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Post Removal Site Control Plan

For

Mouat Industries National Priority List Site

Columbus, Stillwater County, Montana

Revision 1

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List of Acronyms

AMC	Anaconda Minerals Company
ARARs	Applicable or Relevant and Appropriate Requirements
ARCO	Atlantic Richfield Corporation
ARM	Administrative Rules of Montana
bgs	Below Ground Surface
BOR	Bureau of Reclamation
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
CL	Confidence Level
COC	Contaminant of Concern
Cr III	Trivalent Chromium
Cr VI	Hexavalent Chromium
cy	Cubic Yards
EPA	United States Environmental Protection Agency
EE/CA	Engineering Evaluation/Cost Analysis
ft	Feet
ft/day	Feet per day
FMC	FMC Corporation
IC	Institutional Control
MBMG	Montana Bureau of Mines and Geology
MCL	Maximum Contaminant Level
mg/l	Milligrams per Liter
MNA	Monitored Natural Attenuation
Mouat	Mouat Industries
MPWN	Monitoring Plan Well Network
MDEQ	Montana Department of Environmental Quality
MVC	Monte Vista Company
NCP	National Contingency Plan
ND	Non-detect
NTCRA	Non-Time Critical Removal Action

NPL	National Priority List
Order	Administrative Order
Plan	Post Removal Site Control Plan
POC	Point of Compliance
PRP	Potentially Responsible Party
RPD	Relative Percent Difference
Site	Mouat Industries NPL Site
SOP	Standard Operating Procedure
TCLP	Toxicity Characteristic Leaching Procedure
Timberweld	Timberweld Manufacturing Company
Town	Town of Columbus
SOD	Superfund Overlay District
UAO	Unilateral Administrative Order
UCL	Upper Confidence Limit
µg/L	Microgram Per Liter
WQB	Water Quality Bureau

1.0 INTRODUCTION

This Post Removal Site Control Plan (Plan) was developed to comply with the June 21, 1996 Non-Time Critical Removal Action (NTCRA) at the Mouat Industries NPL Site Action Memorandum (EPA, 1996a) and the amendment to this Action Memorandum dated July 11, 2008 (EPA, 2008b). This Plan is being revised to update activities that have occurred since the original plan was written and to modify the groundwater monitoring network. All response actions identified in Administrative Order for Removal Action (Docket No.CERCLA-VIII-92-05) and Administrative Order for Conduct of a NTCRA at the Mouat Industries National Priorities List (NPL) Site (Docket No. CERCLA-VIII-96-22) as well as the Action Memorandums dated September 5, 1991 and June 21, 1996 have been successfully performed. Full scale soil excavation and treatment of approximately 33, 400 cubic yards (cy) of chromium containing soils have been completed. Treatment consisted of soil screening, chromium reduction and soil fixation of 14,000 cy of soils and off-Site disposal of approximately 19,400 cy of soils exhibiting chromium above cleanup standards (FMC, 1995). The selected post removal Site remedy for groundwater was natural attenuation with groundwater monitoring and Institutional Controls (ICs) (EPA, 1996a). ICs have been maintained at the Site since 1995 and will continue to be in effect for the Site.

This Plan identifies background, down-gradient, and source area monitoring points, sampling frequency and duration; as well as analytical and statistical methods that will be employed to review collected data. Four wells down-gradient of the source area have also been identified as the Point of Compliance (POC) for groundwater. Under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the groundwater POC is generally at the waste management unit boundary as noted in the preamble to the National Oil and Hazardous Substances Pollution Contingency Plan (NCP): "The United States Environmental Protection Agency (EPA) believes that groundwater remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area, when the waste is left in place." (55 FR 8753). As such, the POC for groundwater is at the boundary of the block disposal area.

This Plan also establishes trigger value levels for chromium (Cr) concentrations in groundwater that, if realized, may require additional monitoring of groundwater. Statistical procedures have also been developed in the Plan that will modify or maintain sampling frequency. A section of this Plan discusses ICs and establishes measures to ensure that the Agencies are periodically reviewing ICs. The monitoring effort and periodic review of ICs are not considered part of the response actions identified in previous Action Memorandums, but are intended to fulfill the Post Removal Site Control of the treated block placement area as specified in the July 11, 2008 Action Memorandum Amendment (EPA, 2008b). To date EPA has funded and EPA and Montana Department of Environmental Quality (MDEQ) have implemented these requirements.

Previous Site activities and recent investigations have indicated that EPA's three objectives for Site remediation for groundwater treatment, as identified in the 1996 Action Memorandum, are currently satisfied. This Plan ensures that these objectives will continue to be met in the future. The three objectives are to: 1) restore groundwater quality; 2) prevent migration; and 3) prevent exposure through administrative controls. The objectives must be satisfied in a hierarchal manner. The objectives and how they pertain to the Site follow:

1. Restore Groundwater: Groundwater chromium concentrations have met performance standards established for the Site in a reasonable amount of time.
2. Prevent Migration: Site geology and hydrogeologic conditions in the subsurface below the Site allowed for natural attenuation of chromium, the contaminant of concern (COC). The primary natural attenuation processes in groundwater at the Mouat Site include adsorption and precipitation, dispersion, and chemical alteration. Each of these processes is described in the Engineering Evaluation/Cost Analysis (Baker, 1996).
3. Prevent Exposure through Administrative Controls: Institutional Controls have been implemented at the Site and are being maintained by the Town of Columbus. In addition, a warranty deed for Timberweld's property which has been filed with Stillwater County in Columbus, Montana, is expressly subject to the provisions of the SOD requirements. (See Appendix D.)

A Site description is given in Section 2.0 and Section 3.0 provides a summary of events. Section 4.0 discusses the groundwater monitoring while Section 5.0 discusses ICs.

2.0 SITE DESCRIPTION

2.1 Site Location and Layout

The Mouat Industries NPL Site (Site) is located on Clough Avenue, Columbus, Stillwater County, Montana. The Site CERCLIS ID number is MTD021997689. The Site is located in the flood-plain of the Yellowstone River and is less than 0.6 miles north of the present river channel in the SW ¼ of the NW ¼ of Section 27, T2S, R20E. The Site is approximately 4.5 acres. Clough Avenue and a railroad line are to the north of the Site and East 1st Avenue South and the Columbus Airport are to the south. The Site is adjacent to a parcel of open land that is owned by the Town of Columbus to the east and the Timberweld manufacturing facility is to the west. Land use at the Site is designated as light and heavy industrial (Figure 1).

The Town of Columbus (Town) had a population of 1,893 at the 2010 census. Residential areas lie within 0.5 miles of the Site. The portion of the Site to the east is owned by the Town while Timberweld Manufacturing (Timberweld) owns the portion of the Site to the west. The Town's portion of the Site currently has its Public Works facility and a parking lot over a portion of the site and the town recontoured the vegetated portion of the Site in 2013 after completion of the Public Works Facility. Timberweld manufactures laminated beams and arches and supplies complete roof systems for a variety of structures including clubhouses, retail centers, banks, fine homes and churches around the United States and uses its portion of the Site as an open storage area for its products.

2.2 Site Geology

The land surface at the Site slopes gently to the southeast towards the Yellowstone River. Site stratigraphy consists of alluvial deposits of the Quaternary period underlain by "nearly flat lying shale beds of the Upper Cretaceous Period" (Baker, 1996). Coarse gravel and sand, derived from igneous and sedimentary sources, overlay fine-grained sediments and localized fill deposits. Studies conducted by Baker Environmental (Baker, 1992; Baker, 1993) and the Bureau of

Figure 1 Mouat Industries NPL Site -- Post Removal Site Control Plan

Reclamation (BOR) (BOR, 1994) provide Site-specific geological data. Based on the Baker and BOR data, bedrock at the Site ranges from 13.5 to more than 30 feet below ground surface (bgs).

These studies also indicate that alluvium consists of "brown to gray, moderately dense to very dense gravels, and consist of clean, poorly sorted, and well-rounded gravel, containing some fine to course sand, a trace of some cobbles and boulders, and a trace of silt" (Baker, 1996). Fine grained sediments, consisting of alluvial clay, silt and find sand horizons overly the gravels. The Baker and BOR studies found this fine-grained sediment horizon to range from 0 to 10 feet in thickness.

The shallow Site geology consists of up to three-feet of imported gravel overlying fine grained sand and clay to a depth of 11-feet. This is underlain by 10- to 25-feet of sand, gravel and cobbles which, in turn, is underlain by shale bedrock. The shale is relatively impermeable and acts as a barrier against the vertical migration of shallow groundwater.

Groundwater is present at a depth of between six- and thirteen-feet bgs. The aquifer is generally unconfined, but may be confined in places where shallow clay and silt are present. Baker reported the saturated thickness of the sand and gravel formation to be 7.5 to 27 feet (Baker, 1992). The interface between the alluvial sand and gravel and the clay/shale bedrock defines the aquifer base. The hydraulic gradient and flow direction do not exhibit significant temporal variability. The hydraulic gradient across the Site averages 0.003 foot per foot with flow towards the southeast. Slug tests conducted by the BOR estimated an average hydraulic conductivity of .038 centimeters per second, or 107 feet per day (ft/day) (BOR, 1994). Average horizontal groundwater velocity is estimated at 1.29 ft/day (Baker, 1996).

3.0 SITE SUMMARY

3.1 Site Background

The Town has owned the eastern portion of the Site since 1933. In 1960, the Town acquired the western portion of the Site which was later sold to Timberweld. Aerial photos of Columbus indicate industrialization of the area occurred between 1954 and 1957 (Baker, 1996). A chromium processing plant was constructed on the Site by Mouat Industries (Mouat). Under a Five Year lease agreement with the Town, Mouat operated the plant beginning in 1957. In 1962, the lease was extended through August 1967. Mouat's operation processed chromite ore mined from the rights owned by Mouat Industries in the Stillwater Mining Complex in south-central Montana and stockpiled at a site near Nye. The ore was then transported to the Columbus plant as needed. The chromium ore as it was mined from the Stillwater Complex was in a trivalent (Cr+ 3) oxidation state. It remained in this state until processed at the Columbus plant.

At the plant, the chromite ore was ground in a ball mill and concentrated. The concentrate was mized with Soda Ash and water making a slurry. This material was dried and then discharged into a rotary kiln. Chromite reacts at 850^0 - 1050^0 Celsius with soda ash and oxygen to form sodium chromate.

The sodium chromate solution contains sodium aluminate and sodium silicate which must be removed. Sulfuric acid is then added and the sodium aluminate and sodium silicate are precipitated out leaving excess sodium sulfate in the solution. By the addition of sulfuric acid, the sodium chromate is coverted to sodium dichromate. The sodium dichromate can be removed by centrifugation, and the solution evaporated down to any desired concentration which was needed by The Atomic Energy Work at the Hanford Project, Richland, Washington, as a corrosion inhibitor. The process also generated sodium sulfate process wastes containing sodium chromate and sodium dichromate salts. These hexavalent chromium (Cr VI) containing compounds leached from the sodium sulfate waste piles into underlying soils and eventually into the Site groundwater. The chromium processing plant was built and operated from 1957 to 1962. Chromium wastes were created during this time, but not after 1962.

Mouat allowed FMC Corporation (FMC) to operate the plant from September 1961 to April 1962. The companies believed it would allow FMC to accumulate experience, giving it a basis for deciding whether to enter into a joint venture agreement to operate the plant. FMC Corporation assumed the responsibility of operating the plant during this time period and 31 tons of sodium dichromate were produced from 228 tons ofchromite concentrate.

In May 1963, the Monte Vista Company (MVC) purchased the plant and equipment, and received an assignment of Mouat's lease for a portion of the Site. As mentioned above, Mouat's lease expired in 1967. Once this lease ended, MVC executed a five year lease directly with the Town. This lease was effective from January 1, 1969 until December 31, 1973.

In 1968, Mouat assigned its interest in the agreements it had with MVC to the Anaconda Minerals Company (AMC). AMC was involved with the Site until 1973 and during this time AMC took actions to address concerns the Town had about the Site. In 1969, AMC removed approximately 468 tons of stockpiled chromium salts from the Site yard. A portion of these salts were drummed and placed in the manufacturing building. The remainder was simply placed on the building's floor. The Site was then graded and gravel was laid over a portion of the yard.

In 1973, AMC performed sampling activities at the Site, identifying chromium in soils, surface water, and groundwater. Drainage ditches were also constructed around the manufacturing building to route storm water flow away from the building and yard. In an attempt to address visible chromium salts, sulfuric acid and ferrous sulfate was applied to the soil and mixed into a portion of the yard west and south of the building. The acid addition was done with the intent of reducing the Cr VI to the more stable trivalent chromium (Cr III). AMC removed tons of the drummed and stockpiled material from the manufacturing building to an off-Site location in Butte, Montana. In 1974, MVC removed equipment from the Site and demolished the processing building. AMC merged into the Atlantic Richfield Company (ARCO) in 1981.

Timberweld entered into a lease with the Town for additional space on the Site in 1975 to expand existing operations. During the same year, Timberweld employees discovered what was later found to be chromium precipitate coming up onto the property. Unsure of the source of this

material, Timberweld covered both the leased and owned portions of its property with a foot of gravel, in an effort to protect their wood products from the precipitate.

In 1977, HKM Associates, under a grant funded by EPA for the Mid-Yellowstone Area wide Planning Organization, conducted groundwater sampling, confirming the presence of Cr VI in groundwater (HKM, 1977). The HKM Associates report indicated that a Cr VI plume was migrating southeast of the Site, and could degrade the water quality of the Yellowstone River.

Various entities also conducted multimedia sampling during the late 1970s and 1980s including the EPA, which conducted a Preliminary Assessment/Site Inspection from 1979 to 1980. These studies lead EPA to send a letter to the Town in 1984 stating that the analytical numbers from the monitoring wells sampled exceeded the recommended drinking water standards for chromium and recommended that the contaminated groundwater not be used for human and animal consumption. Hexavalent chromium is a hazardous substance as defined by CERCLA Sec, 101(14), and designated as such under 40 CFR 117 and 40 CFR 302. EPA proposed the facility for the NPL in 1984, 29 FR 40320 (Oct. 15, 1984). The Site received a Hazard Ranking System score of 31.66. The listing was final in 1986, 51 FR 21054 (June 10, 1986).

3.2 Response Actions

The contaminated surface and subsurface soils at the Site were addressed through two removal actions while two other Action Memorandums addressed Site controls and groundwater. In 1990, after evidence of chromium contamination reappeared at the surface of the gravel-covered area at the Timberweld facility, EPA initiated a removal action to (1) secure the Site and to mitigate the threat of direct contact to hazardous materials by Timberweld's workers and nearby individuals, and (2) provide run-on, run-off drainage control for the Site (EPA, 1991a). Approximately 1,400 feet of 6-foot industrial chain link fencing with two 20-foot wide gates with locks were installed around the Site to restrict public access to chromium-containing soils and secured a portion of the area of Timberweld's storage yard. The Town performed all Site drainage controls. Due to the potential for direct contact with the high levels of chromium, EPA fenced the Site using time-

critical removal authority and used Superfund Trust Fund money. The response action was completed April 14, 1990, at a cost of $28,650.

In 1991, after additional soil and groundwater samples indicated elevated levels of chromium, it was determined that there was still a threat to public health posed by the Site through exposure to CrVI contaminated soils, surface water and groundwater through direct contact, inhalation and ingestion pathways. The threats met the removal criteria specified in the NCP at 40 CFR Section 300.415(b)(2)(i), (ii), (iv), (v), and an additional removal action was necessary (EPA, 1991a). After efforts to negotiate an Administrative Order on Consent with the Potentially Responsible Parties (PRPs) failed, EPA issued a Administrative Order (Order) Docket No. CERCLA-VIII-92-05 on November 12, 1991 to FMC Corporation, MVC, Mouat, Timberweld, and the Town requiring the excavation and treatment of approximately 20,000 cy of chromium-contaminated soil (EPA, 1991b). EPA specified removal performance standards within the Order as follows:

> Soil inside the EPA perimeter fence for which total chromium concentration in the extract Toxicity Characteristic Leaching Procedure (TCLP) was greater than 0.5 milligrams per liter (mg/L) was to be excavated to elevation 3564 or to the clay-gravel interface, whichever was lower. Soil outside the EPA fence perimeter for which TCLP chromium was greater than 0.1 mg/L was to be excavated to elevation 3564 or to the clay-gravel interface, whichever was lower.

Since this was a time critical removal action, an engineering evaluation/cost analysis (EE/CA) and a thorough Applicable or Relevant and Appropriate Requirements (ARARs) analysis were not required and were not completed. A human health risk assessment was also not completed (EPA, 1996a).

EPA issued an Action Memorandum selecting on-Site treatment as the primary removal alternative with off-Site disposal of soils as a back-up (EPA, 1991a). FMC responded to the Order and undertook the required response action. After preliminary work, including sampling and preparation of work plans, full-scale treatment of contaminated soils began on June 28, 1993. Performance standards for treated soils were established as follows:

- The TCLP chromium was to be equal to or less than 0.5 mg/L;

- The total chromium in any extract obtained by the Multiple Extraction Procedure was to be equal to or less than 5.0 mg/L;
- The unconfined compressive strength of each block was to be equal to or greater than 50 pounds per square inch; and
- The permeability of treated soil was to be equal to or less than that of the background soils.

FMC began construction of the soil treatment plant in 1993. The treatment process included soil screening, chemical addition for chromium reduction, and Portland cement addition for soil fixation. The treated soils were formed into 5' x 5' x 6' blocks for curing, testing, and placement. Approximately 14,000 cy of chromium-containing soil were treated, creating approximately 7,000 blocks. The treatment process rendered the contaminants as a less toxic and immobile Cr III. Non-treated, relatively clean soil was also used as fill.

In late 1993 and early 1994, local government officials and members of the community became concerned when they realized there were yet another 9000 blocks to be created and disposed at the Site, which would create a mound at least 20 feet high. In response to the Town's concern about final Site configuration and future land use considerations, EPA directed FMC to change the response action to the off-Site disposal alternative, described in the Action Memorandum. FMC complied with this change and submitted an Addendum to the Response Action Work Plan on June 17, 1994. Off-Site disposal of the remaining contaminated soils began on July 7, 1994 (FMC, 1994). The addendum as approved called for excavation of all soils, inside or outside the fence, with chromium leachate above 0.1 mg/l as determined by the TCLP.

The soils excavated in 1994 by FMC, for which the TCLP chromium exceeded the clean-up standard were removed from the Site by rail for disposal at appropriately permitted off-Site disposal facilities. Soil that tested as hazardous (TCLP chromium greater than or equal to 0.5 mg/L of leachable chromium) was sent to the USPCI hazardous waste treatment and disposal facility at Grassy Mountain, Utah. Soil that tested as non-hazardous (TCLP chromium less than 0.5 mg/L of leachable chromium) was sent to the East Carbon

Development Corporation nonhazardous waste disposal facility at East Carbon, Utah. Off-Site disposal of the remaining affected soils began on July 7, 1994 and was completed by October 1, 1994. Approximately 19,400 cy of chromium-containing soil were disposed of off-Site. Upon completion of contaminated soil excavation and transport off-Site, treated soil blocks formed in 1993 and untreated soil with chromium concentrations below action levels were placed in the excavation area. The blocks and non-treated soil were covered with two feet of clean fill and graded to a slight slope to facilitate run-off. A portion of the excavated and filled area was vegetated and the remainder of it was covered in gravel.

The response actions were successful in restoring the Site surface and subsurface soils to concentrations at or below the cleanup standard of less than 0.5 mg/L TCLP chromium. For waste left on-Site, each block of treated soil was sampled and analyzed for compliance with this standard. Analytical results show that all blocks met the cleanup standard in the TCLP extract. The maximum chromium concentration in any TCLP extract was 0.47 mg/L and most values were less than 0.1 mg/L. EPA's oversight contractor, the Bureau of Reclamation, also reported that

> "... all EPA split samples for 28-day cure treated soils... met performance criteria... for TCLP extractable total chromium, total chromium in (the more aggressive) multiple extraction testing, and unconfined compressive strength. Moreover, the close correspondence between EPA and FMC split samples indicates that FMC data base was appropriate for guiding remedial Site operations..." (EPA, 1996a).

Quarterly groundwater monitoring was initiated in June 1992 and continued through August 1995. Total Cr concentrations were above the MCL and Montana Water Quality Bureau (WQB) WQB-7 water quality standard of 100 micrograms per liter (µg/L) at five of the 16 wells monitored in June 1992. In August 1995, 25 wells were monitored, and eight of these wells displayed total Cr concentrations greater than 100 µg/L. That same year, EPA initiated investigations to address groundwater problems remaining after the soil removal. Also, surface waters on the golf course exceeded water quality standards for Cr VI, and Cr III had been found in the ditch bottom sediments on the golf course.

EPA released a final EE/CA in 1996. Monitored natural attenuation (MNA) was chosen as the most appropriate removal action to clean up groundwater at Mouat based on an evaluation of: (1) criteria provided for in the EE/CA guidance document (EPA 1993), namely effectiveness, implementability, and cost, and (2) criteria provided for in the NCP CFR 300.430(e)(9)(iii). An Action Memorandum to implement the recommendations of the EE/CA, with revisions required by EPA and MDEQ was signed on June 21, 1996 (EPA, 1996b). Table 3 of the Action Memorandum presents a summary of the comparative analysis for each of the three alternatives (No Action, Pump and Treat, and Natural Attenuation) with respect to the EE/CA criteria, and Table 4 of the same document presents the same with respect to the NCP criteria (EPA, 1996a). Review of these two tables demonstrates that the selected alternative best met the above two sets of criteria.

Data from leaching tests of the treated soil blocks coupled with the geochemistry of the Site groundwater, supported natural attenuation. The groundwater within the alluvial aquifer is supplied by infiltration of precipitation and thus is of an oxidizing nature and the pH of the groundwater is neutral to slightly basic. The neutral to basic pH (<8) and oxidizing state of the groundwater combine to create a geochemical environment that is conducive for the formation of chromium oxide, Cr_2O_3, which is a stable, solid form of CrIII that has a very low solubility. Consequently, there was no reason to believe that chromium would be released to the aquifer beyond the treated blocks under the range of conditions expected for this Site (EPA, 1996a). The 1996 Action Memorandum also specified that EPA monitor a set of four wells annually (RMIS-4S, RMIS-5, MIS-15, and MIS-16) located immediately along this down-gradient perimeter (EPA, 1996a). The 1996 Action Memorandum Amendment specified that POCs would be established (EPA, 2008b). Point of Compliance is discussed in Section 4.3 of this Plan.
On July 22, 1996, EPA issued a Unilateral Administrative Order (UAO) Docket No. CERCLA-VIII-96-22 to all PRPs noticed in the 1991 Order and ARCO (EPA, 1996c). Effective August 11, 1996, the UAO required implementation of a Non-Time Critical Removal Action (NTCRA). EPA selected ARCO as the primary PRP to conduct the removal action. Also in 1996, the groundwater monitoring network was reduced to twelve network wells. This groundwater monitoring program was designed to track groundwater levels as well as groundwater quality. The purpose of this

program was to monitor natural attenuation of chromium and evaluate contaminant migration. The results of groundwater sampling are documented in the *Final Closure Report, Mouat Industries NPL Site* (ARCO, 2004).

Timberweld and the Town complied with the UAO by establishing and implementing ICs at the Site. The Town established ICs over land use and groundwater use through a zoning ordinance (Chapter 17.76), which was approved by the Town in March 1995 creating the Superfund Overlay District (SOD). The intent of SOD is to protect public health, safety and welfare while allowing appropriate use of lands within the district. The ordinance establishing the SOD became enforceable in April 1995. Requirements of the SOD are enforced by the zoning authority of Columbus. The SOD covers the entire Site and area above the chromium plume with a reasonable buffer zone. Limitations apply to groundwater use and related activities within the SOD. Land use restrictions are applicable specifically to the block placement area and surrounding buffer areas.

Performance standards for groundwater were established in the 1996 Action Memorandum and compliance with these standards was based on the following requirements (EPA, 1996a):

1. Demonstrate that the MCL for chromium in groundwater (100 µg/L total chromium) and the Circular WQB-7 standards for chromium in groundwater (100 µg/L total chromium) are not exceeded for three consecutive years in selected monitoring wells (Monitoring Plan Well Network (MPWN)).

2. Demonstrate that all remaining wells not included in the MPWN but within the Superfund Overlay District do not exceed the MCL for chromium in groundwater and the Circular WQB-7 standards for chromium in groundwater as determined by a single sample event taken after Item 1 above is satisfied.

Semi-annual groundwater monitoring under the UAO for Conduct of a Non-Time Critical Removal Action at the Mouat Industries NPL Site began in November 1996. Total Cr concentrations began to be detected below the MCL and WQB-7 standard starting in December 1999. After three consecutive years of meeting the first performance standard, the October 2002 sampling event

finalized the demonstration that the MCL for chromium in groundwater and the WQB-7 standards for chromium in groundwater had not been exceeded for a period of three consecutive years. In order to assess compliance with the second standard set in the 1996 Action Memorandum, a single sample event was conducted at the non-MPWN stations in December 2003. Chromium concentrations at the non-MPWN stations were below the MCL and WQB-7 standards, marking compliance with the second groundwater performance standard. A final performance standard pertaining to surface water quality required a review of chromium levels in surface water upon achievement of groundwater performance standards. Sampling and analysis demonstrated that this performance standard was also achieved.

EPA requested that MDEQ consider deletion of the Site from the NPL in 2005. MDEQ had concerns about the effectiveness of the soil treatment process, the long-term stability of the treated soil cement blocks, and the possibility that the remaining Cr VI could regenerate a groundwater plume in the future (MDEQ, 2005). MDEQ was also concerned that groundwater samples from the existing monitoring wells may not be representative due to the long, deep screen interval. Thus MDEQ contracted with the Montana Bureau of Mines and Geology (MBMG) in 2007 to conduct an investigation of the treated soil in the block placement area and install new wells (with shorter screen intervals) in the source area and between the four down-gradient wells (RMIS-4S, RMIS-5, MIS-15, and MIS-16).

Sixty one (61) soil /treated soil samples were also collected by MBMG from twenty three (23) borings and six (6) new monitoring wells were installed and sampled. Results of the investigation showed that the treatment process was effective in converting Cr VI to Cr III. Only one of the three source area wells had groundwater with dissolved Cr above the MCL. However, the chromium is quickly dispersed, diluted, and/or attenuated in the highly transmissive aquifer as evidenced by the chromium concentrations in the four nearest down-gradient wells (and the new wells in between these) which all showed chromium levels less than half of the MCL (MBMG, 2007).

3.3 Applicable or Relevant and Appropriate Requirements (ARARs)

EPA released a final EE/CA in 1996 which included an ARARs analysis which is included as Appendix B of this Plan. As stated earlier, soils were cleaned up using time-critical removal authority and a thorough ARARs analysis was not required nor completed. The ARARs established in the 1996 Action Memorandum that are of greatest significance are:

- Federal drinking water MCLs for chromium;
- State water quality standards for chromium; and
- Class II landfill construction and monitoring requirements.

A review of the Site ARARs determined that the treated Cr soil blocks on Site are considered to constitute a Class II landfill under Montana solid waste regulations. EPA determined in the 1996 Action Memorandum that this ARAR could not be met because the action had already been completed. Therefore, the following language was added to this Action Memorandum (EPA, 1996a):

> "The treated soil blocks are considered to constitute a Class II landfill under Montana solid waste regulations. Consequently, ARARs include requirements to maintain minimum separation between landfill wastes and state waters, to demonstrate that landfill leachate will not adversely affect state waters or to provide for a landfill liner and leachate collection system, to provide for an adequate cover to minimize infiltration as part of landfill closure, and related requirements. The treated soil blocks have been partially emplaced below the local groundwater table, with no liner, and cover consists of gravel and revegetated soil and probably does not meet minimum permeability requirements. Consequently, an ARAR waiver is necessary.
>
> EPA evaluated, leachate data from the treated soil blocks and confirmatory soil analyses, along with appropriate geochemical considerations regarding the treated soil blocks and Site groundwater. EPA then determined that the subsurface emplacement of treated soil blocks at the Site constitute a Class II landfill under the Montana solid waste regulations. Equivalent compliance with these solid waste requirements would have to be met

through use of another method or approach which included establishing a program of appropriate ICs, monitoring, and maintenance as part of this removal action.

Accordingly, EPA invokes the ARAR waiver provision provided by CERCLA Sec. 121 (d) (4) (D) and C.F.R. 300.430 (f) (1) (ii) (C) (4). In determining that this ARAR waiver may properly be invoked in this limited context, EPA has considered that the purpose behind this solid waste regulation is to ensure that the leaching of chromium from the treated soil blocks does not further contaminate underlying groundwater or surface water bodies receiving groundwater discharge so that human health or the environment are not adversely affected. The ICs and long-term monitoring to be instituted and/or continued under this removal action can attain these specific goals at an equivalent level of performance."

3.4 First Five Year Review

The EPA Region 8 conducted the first Five-Year Review of the response actions implemented previously at the Site between October 2007 and March 2008 (EPA, 2008a). The purpose of the Five-Year Review was to determine whether the Site response actions were protective of human health and the environment. Response actions conducted at the Site resulted in waste being left in place. Response actions were conducted as removal actions rather than remedial actions. Therefore, a Five-Year Review is not required but is being conducted as a matter of EPA policy, because the removal actions left hazardous substances, pollutants, or contaminants on Site above levels that allow for unlimited use and unrestricted exposure. The triggering action for this review was the completion of the Preliminary Closeout Report in September 1996 (EPA, 1996b).

No major concerns were identified during this review. However, portions of the perimeter fence were observed to be in need of repair. In addition, the recent relaxation of groundwater use restrictions across the entire SOD was judged to be in need of revision. Groundwater use restrictions were still needed within the treated block placement areas. This revision was

completed by the Town in March 2008 and was identified as a necessary remedy element in the July 11, 2008 Action Memorandum Amendment recommended in the Five-Year Review.

The Five Year Review protectiveness summary included the following language (EPA, 2008a):

> "Removal actions as implemented are currently protective of human health and the environment. Protectiveness is achieved through the meeting of ground and surface water performance standards at the wells down-gradient of the source area. Additional protection is achieved through groundwater and land use restrictions. Response actions are complete and all performance standards have been met at the wells immediately down-gradient of the block placement area. Therefore, deletion of the Site from the NPL may be appropriate. Removal action implementation currently consists of enforcement of ICs and fence maintenance. The opportunities for optimization include:
>
> Development of Post Removal Site Control Plan that defines the location of any wells to be monitored as well as sampling frequency and duration. This Plan should also include a provision for evaluating the protectiveness of the removal actions should land use change."

3.5 Partial Deletion of the Surface and Subsurface Remedy Components

As a result of the first Five Year Review, the Environmental Protection Agency (EPA) Region 8 published a direct final Notice of Partial Deletion of the surface and subsurface soil components of the Site from the National Priorities List (NPL). This direct final partial deletion was published by EPA with the concurrence of the State of Montana, through the MDEQ because EPA determined that all appropriate response actions at these identified parcels under CERCLA, other than five year reviews and operation and maintenance, have been completed. However, this partial deletion does not preclude future actions under Superfund.

This partial deletion only pertains to the surface and subsurface soils component. The groundwater component remains on the NPL and was not considered for deletion as part of this action. The direct final partial deletion became effective May 26, 2009.

3.6 Structural Capacity and Institutional Controls Reassessment

In August of 2008, the Montana DEQ issued a task order to the Montana Bureau of Mines and Geology, a department of Montana Tech of the University of Montana, to investigate the structural capacity of the ground and reassess the institutional controls.

Five standard penetration test holes were driven on location, and soil samples extracted and analyzed. The blocks of remediated wastes were easily identifiable within the boreholes. Low penetration test blow counts within the blocks were also conducted and showed that the block material has very little load bearing capacity. Geophysical investigations of the site confirmed the existence of the waste blocks within the Site boundaries, and partial block deposition boundaries were estimated.

Based on the investigation, several changes to institutional controls of the Site were also recommended, allowing for broader uses. Town Ordinance *No. 556 AN ORDINANCE OF THE TOWN COUNCIL OF THE TOWN OF COLUMBUS, MONTANA, AMENDING SUBSECTIONS F, G AND H OF SECTION 17.76.030 OF THE COLUMBUS MUNICIPAL CODE* was adopted by the Columbus Town Council on second reading during its March 15, 2010, regular meeting for the purpose of amending the institutional controls pertaining to the block placement area within the Mouat Industries Superfund Site Overlay District as recommended by the Agencies. The Ordinance became effective April 15, 2010. These modifications are discussed further in Section 5.2 of this plan.

The final report recommended against using the block material to carry structural loads. Rather, piers or deep footings placed below the blocks should be used to support buildings or other heavy loads at the site. While shallow spread footings may be able to distribute the load

sufficiently to allow building on top of the blocks, any such design should be preceded by a thorough geotechnical investigation and submittal of detailed site and construction plans, prepared by an architect or engineer, for review and approval by the Town of Columbus.

In 2012, The Town of Columbus completed construction of its new public works building on top of a portion of the waste repository located on the eastern half of the site. EPA and MDEQ were provided with a complete set of plans and the contract documents/specifications for the building.

A photo of the new public works facility

3.7 Second Five Year Review

The EPA Region 8 conducted the second Five-Year Review between August 2012 and April 2013 (EPA, 2013). The triggering action for this review was the completion of the first Five Year Review Report (EPA, 2008a).

It was determined during the review that the repository soil and gravel covers have not been maintained to prevent degradation. Block areas with a vegetated soil cover were being utilized as an equipment and vehicular storage area and soil and gravel are stockpiled on the cover. In addition, damage from vehicles and other means was evident and unrepaired. The Town of

Columbus agreed to recontour the cover to facilitate storm water runoff and maintenance of the cap as well as store surplus equipment, vehicles, soil, and gravel in areas that are not on the vegetated cap.

It was also noted that several wells used to monitor the completed response action have not been abandoned. Some of these wells are damaged and may act as surface water conduits to groundwater. The Five Year Review recommended abandonment of wells that will no longer be sampled.

It was also recommended that this Plan be modified to clearly outline scheduled inspection and maintenance responsibilities for the vegetative cover, gravel and asphalt caps. Subsequent discussions between EPA, MDEQ and the Town are anticipated to ensure that roles and responsibilities are delineated at which time this Plan will be revised.

The Five Year Review protectiveness summary included the following language (EPA, 2013):

> "The response actions implemented at OU1 currently protect human health and the environment because all caps are still intact, which is protective of human health and the environment in the short-term. Even though the Town has conducted some recent activities that are inconsistent with the ICs, these actions do not impact short-term protectiveness because the blocks excavated were replaced on Town property within the Block placement area and this issue is easily remedied. However, in order for the response actions to be protective in the long-term, the following actions need to be taken (the Post Removal Site Control Plan needs to be modified; and the EPA and DEQ need to ensure that the town operates, maintains, and enforces the zoning ordinance that implements the ICs for the Site) to ensure protectiveness."

Future Five-Year Reviews will be required since waste is left in place above levels that allow for unlimited use and unrestricted exposure. The next Five-Year Review is scheduled to be completed in 2018. Additional Five-Year Reviews are anticipated in 2023, 2028, 2033, and

beyond as long as waste is left in place and the Site does not allow for unlimited use and unrestricted exposure.

3.8 Annual Groundwater Monitoring

Conclusions from the 2008 groundwater monitoring report were as follows. The DEQ Circular 7 drinking water standard for Cr is 100 µg/L; while the highest observed dissolved Cr concentration was 229 µg/l with a corresponding total recoverable Cr concentration of 235 µg /L. The MCL was exceeded in three monitoring wells within the repository/source area of the Site; while no exceedences were noted in any of the downgradient wells. Based upon the results between the two 2008 sample periods it appears that Cr concentrations in the groundwater system are dependent upon local groundwater levels and climatic conditions. This indicates that the residual Cr in soil is leaching to the groundwater but the plume is being dispersed by the highly transmissive aquifer and/or geochemically attenuated. It is also possible that sampling occurred at a time when the plume had not fully reached the downgradient wells, or had already passed by. Chromium concentrations increased in all but one of the downgradient wells between low-water and high-water level conditions (MBMG, 2008).

During 2008 it was planned to collect groundwater samples at this Site once; however, when performing the May sampling it was determined that water levels were 1-1.5-ft below the previous year spring levels and several of the wells would not have enough water to sample. Therefore, samples were collected from seven wells in May and eleven wells in June. Sample concentrations increased in a majority of the wells from the May to June sample events; while the highest concentrations of both dissolved Cr (229 µg/L) and total recoverable Cr (235 µg/L) were observed in the source areas during the June sampling event. Only one of the four source area wells (RMIS-2) was sampled during both sampling events; however, Cr concentrations increased over 30 fold in this well. This increase in concentration followed an almost 1.5-ft water-level rise and almost 4.5-inches of precipitation. Concentrations increased in a majority of the down-gradient wells between sample events; however, the magnitude of the increases was much less than those observed in the repository area of the Site. The MCL for chromium of 100

µg /L was exceeded in three samples collected during the June sample event, those being wells MO-25, MO-26 and RMIS-2, which are all located in the source area. The next highest concentrations were between 20 and 30 µg/L in two of the down-gradient wells (MBMG, 2008).

Conclusions from the 2009 groundwater monitoring report were as follows. The concentrations of Cr from wells within the repository this year were much lower than those observed in samples collected in June 2008 with the highest concentration of 101 µg/L dissolved Cr, which was the only sample from any of the wells to exceed the 100 µg/L performance standard. All samples collected from the down-gradient wells had Cr concentrations below100 ug/L. However, one down-gradient well (MO-11) shows a trend of increasing Cr concentrations for the last three years with the highest down-gradient concentration of 42 µg/L dissolved Cr and 42.6 µg/L total recoverable Cr.

Chromium concentrations in the other down-gradient wells do not show a consistent trend for the last three years and concentrations from this year were similar to those from previous years. However, based on the last three years of data it appears that it would be advisable in the future to select sample times that coincide with somewhat elevated water levels to ensure that the data collected represent the maximum potential contamination of the aquifer. This approach will ensure that exceedences of the MCL are unlikely to be missed or occur down gradient of the sampling sites (MBMG, 2009).

Conclusions from the 2010 groundwater monitoring report were as follows. The Cr concentrations in samples from the wells down-gradient of the repository site, including the compliance wells, were well below the action limit of 100 µg/L with all dissolved and total recoverable Cr concentrations below 25 µg/L. However, one compliance well (MIS-15) could not be found during the June sampling and had been buried during a fencing project on the airport property. The Cr concentrations in samples from the wells within the repository were relatively high with total recoverable Cr concentrations ranging from 23.5 to 283 µg/L and dissolved Cr concentrations ranging from 4.33 to 306 µg/L. The high sample was from well MO-25. The value of 306 µg/L Cr from MO-25 exceeds the source area well trigger value specified in the Post Removal Site Control Plan. No other trigger values were exceeded (MBMG, 2010). In

accordance with the Post Removal Site Control Plan the source area and downgradient well were re-sampled in January 2011 and are presented in the 2011 annual report.

Conclusions from the 2011 groundwater monitoring report were as follows. The 2011 report included results from the January 2011, June 2011, and November 2011 sampling events. Trigger values were exceeded in samples collected during the January 2011 and June 2011 sampling events. The January 2011 sampling was conducted because a chromium concentration of 306 µg/L was detected in a sample from well MO-25 collected during the June 2010 sampling, which exceeded the trigger value for source area wells . The January 2011 sampling also resulted in an exceedance of the downgradient trigger value. A chromium concentration of 52.5 µg/L was detected in the total recoverable sample from MO-11. The trigger value for downgradient wells is ½ the MCL or 50 µg/L chromium. The exceedance of this trigger necessitated semi-annual sampling for at least two sampling events (June and November).

The June 2011 sampling event resulted in exceedances of the trigger in 3 of the source area wells and one downgradient well. The block-area wells MO-25, MO-26, and RMIS-2 had dissolved chromium concentrations of 518, 1500, and 805 µg/L (respectively) and total recoverable chromium concentrations of 561, 1520, and 773 µg/L (respectively). The downgradient well MIS-16 had dissolved and total recoverable chromium concentrations of 71 and 71 µg/L, respectively. The spring and summer of 2011 were exceptionally wet for Columbus, MT. This unusual recharge provided for more than normal flushing of the block area and is likely the cause for the very high concentrations and the trigger exceedances observed during the June 2011 sampling. There were no trigger exceedances in the samples collected during the November 2011 event. Assuming no exceedances in the next sample event scheduled for the June 2012 timeframe, annual sampling is planned to resume in 2013 (MBMG, 2012).

The 2012 groundwater samples were collected on three separate trips July 31st, August 1st/2nd, August 14th/15th, and September 18th. All of the site monitoring wells were sampled as part of the Five Year Review. Conclusions from the 2012 groundwater monitoring report were as follows. The trigger values were not exceeded in any of the routinely monitored wells. The highest chromium concentrations were observed in the samples from MO-25 (79.49 µg/L

dissolved and 82.76 µg/L total recoverable), which is a block area well. The highest chromium concentrations in a downgradient well were observed in the samples from RMIS-5 (16.82 µg/L dissolved and 18.64 µg/L total recoverable). The chromium concentrations in the additional upgradient well were very similar to other upgradient well (RMIS-1).

The two additional block-area wells were just to the north (W-9) or east (W-10) of the block area and the chromium concentrations in these wells are lower than most of the other block-area wells. Four of the additional downgradient wells had chromium concentrations that were similar to or greater than the chromium concentrations in the routinely monitored wells. The nested well pair MIS-11A and MIS-11B had the highest chromium concentrations (26.05 to 35.75 µg/L). Wells MIS-14 and RMIS-8 had chromium concentrations that ranged from 15.44 to 20.21 µg/L. Wells MIS-11A, MIS-11B and RMIS-8 are located along the southern boundary of the airport property approximately 700 feet downgradient from the block area. However, well MIS-14 is more than 2,000 feet downgradient from the block area.

The elevated chromium concentrations in the more distal downgradient wells may be part of the higher than normal chromium concentrations that occurred during the unusual recharge events in 2011. Without long term monitoring of these wells it is not possible to determine if the chromium concentrations observed during the 2012 sampling were an artifact of the unusual recharge in 2011 or are typical concentrations for these wells.

Wells MIS-11A, MIS-11B, MIS-14 and RMIS-8 will be sampled on an annual basis until the next five-year review in 2018 to assess chromium concentration trends in these more distal wells. This is also the basis for Revision 1 of the Post Removal Site Control Plan.

4.0 GROUNDWATER MONITORING

This Plan is intended to ensure there are no negative impacts on human health and the environment through exposure to groundwater contaminated with chromium. It is also intended to fulfill the post-closure monitoring of the treated block placement area as specified on page 19 of the 1996 Action Memorandum. This language included provisions to monitor the four wells nearest the block area (RMIS-4S, RMIS-5, MIS-15 and MIS-16) on an annual basis for a period of 30 years (EPA, 1996a). This monitoring began in 1996 and was temporarily suspended in 2002. Monitoring resumed in 2007.

Monitoring wells were chosen based on the general direction of groundwater flow. The groundwater monitoring network consists of one well up-gradient (RMIS-1) of the block placement area, four wells within or adjacent to the block placement area (MO-09, MO-26, MO-25, and RMIS-2) and six wells immediately down-gradient of the block placement area (MO-10, MO-11, MIS-15, MIS-16, RMIS-4S, and RMIS-5) and four wells on the southside of the airport (MIS-11A, MIS-11B, MIS-14 and RMIS-8). Table 1 contains information on the 15 wells including well name, elevation, location, casing size and type, as well as total depth and screen interval in feet (ft) and Figure 2 shows the location of the wells. Appendix C contains the well log reports where this information was obtained. Table 2 contains the monitoring objectives for each network of wells that will be monitored while Table 3 contains the sampling frequency for each well network

In addition to the 15 wells being sampled, four Quality Assurance/Quality Control samples will also be collected in the field – two duplicates and two field blanks. Sampling procedures including sample acquisition methods, locations and ID numbers, sampling objectives, quality assurance/quality control samples as well as shipping and handling arrangements are discussed in the Quality Assurance Project Plan included as Appendix A of this Plan. All historical data collected on the 15 wells through 2012 is contained in Montana's Ground Water Information Center, which is contained within the Montana Bureau of Mines. (www.mbmggwic.mtech.edu)

Table 1
Groundwater Wells to be Sampled

Well Name	Elevation (ft)	Location	Casing Size and Type	Total Depth (ft)	Screen Interval (ft)
RMIS-1	3575.40	Up-gradient	2-in PVC	18.3	8-18
MO-09	3579.73	West block area	2-in PVC	13	8-13
MO-25	3580.77	East block area	2-in PVC	13	8-13
MO-26	3580.97	Center block area	2-in PVC	14	9-14
RMIS-2	3571.18	Between East & Center block area	2-in PVC	14.5	4.2-14.2
MO-10	3575.33	Down-gradient	2-in PVC	10	5-10
MO-11	3574.62	Down-gradient	2-in PVC	11	6-11
MIS-15	3575.28	Down-gradient	2-in PVC	25.6	9-25.6
MIS-16	3574.36	Down-gradient	2-in PVC	26	5.5-25.6
RMIS-4S	3574.91	Down-gradient	2-in PVC	15.6	5.3-15.3
RMIS-5	3574.21	Down-gradient	2-in PVC	14.9	4.6-14.6
MIS-11A	3572.4	Down-gradient	2-in PVC	18	7.4-17.4
MIS-11B	3572.4	Down-gradient	2-in PVC	28	17.1-27.1
MIS-14	3565.6	Down-gradient	2-in PVC	21.4	6.2-16.2
RMIS-8	3570.7	Down-gradient	2-in PVC	17.9	7.6-17.6

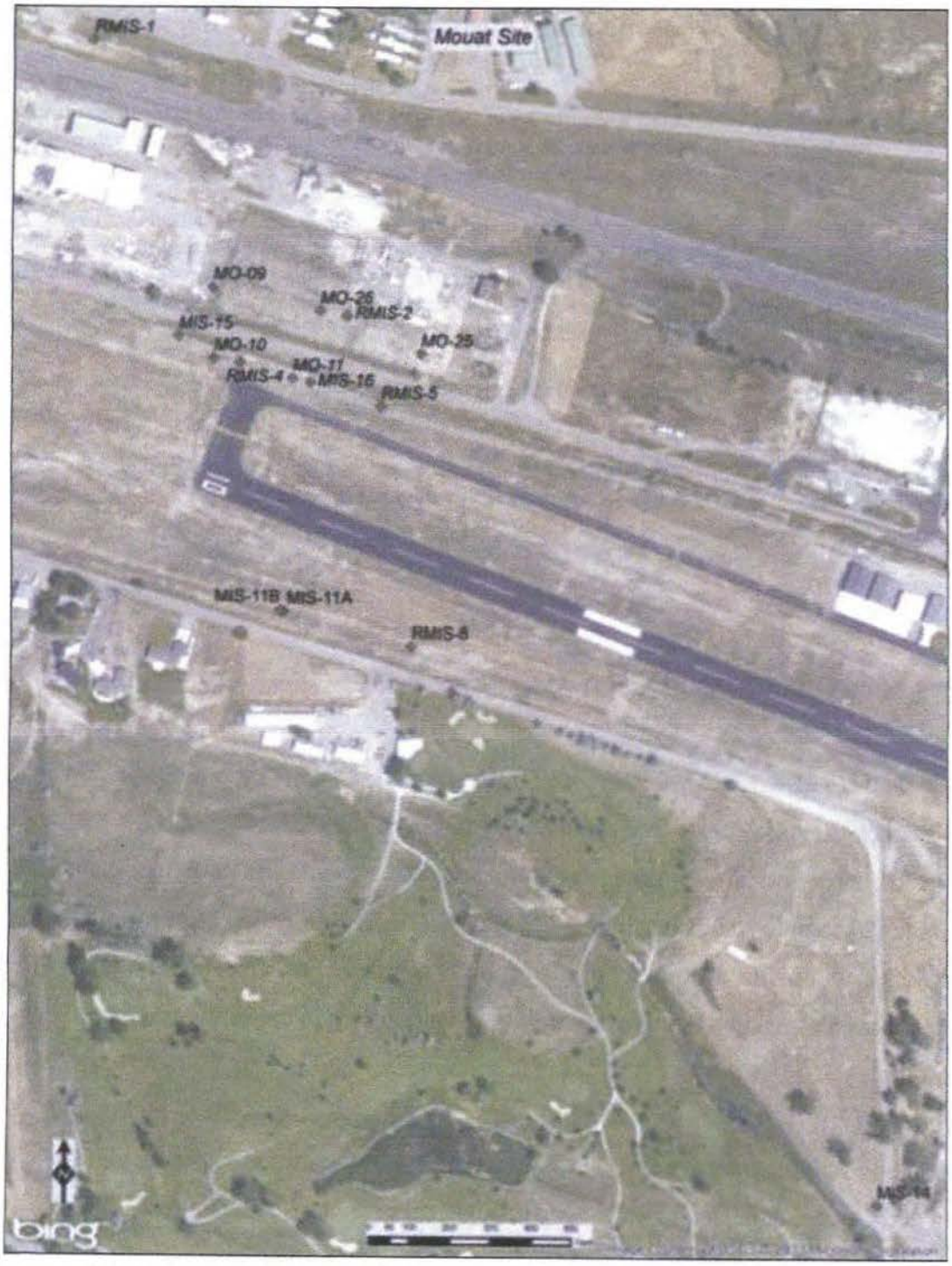


Figure 2. Map showing the sampling well locations for the Mouat Site.

Table 2
Monitoring Objectives

Well Name	Designation	Objective
RMIS-1	Background Well	Monitor the quality of the groundwater that is unaffected by impacts in the block placement source area and the relevant points of compliance in the down-gradient attenuated plume.
MO-09, MO-25, MO-26, RMIS-2	Block Area Wells	Monitor the water quality impacts from the treated soil cement blocks as the blocks degrade over time and determine if the remaining Cr VI will regenerate a groundwater plume in the future. Source area wells will also serve as the Site's sentinel wells to identify changes in groundwater conditions before observed in down-gradient POC wells.
MIS-15, MIS-16, RMIS-4S, RMIS-5	Points of Compliance	Ensure detection of groundwater contamination in the uppermost aquifer.
MO-10, MO-11, MIS-11A, MIS-11B, MIS-14 RMIS-8	Additional wells	Ensure that the POC wells are representative of aquifer conditions and to compare concentrations with the POC wells

4.1 Background Groundwater Quality Monitoring Well

There are two wells (RMIS-1 and MO-01) located up-gradient of the block placement area that can be used as background wells. However, RMIS-1 has been selected as the background well because it was the background well for all previous monitoring events and sufficient historical data is available (27 sample results between 1992 and 2002). The objective of sampling the background well is to monitor the quality of the groundwater that is unaffected by impacts in the block placement source area and the relevant points of compliance in the down-gradient attenuated plume.

RMIS-1 has a long screen interval and should be less affected by seasonal water-level changes and changes in the water table due to prolonged drought conditions. Sufficient historical data are also available to perform a statistical evaluation of the upper confidence limit of background concentration and trends analysis to demonstrate the presence or absence of trends that may impact the interpretation of results from the affected areas. Current and anticipated future land use that is up-gradient of the Site do not have the potential to release a Cr plume. Therefore, EPA and MDEQ agree that the background well will be sampled once every Five Years as part

of the data collection effort for the Five Year Review. However, a trigger value has been established for the background well that would increase sampling frequency if Cr concentrations increase. This is discussed in Section 4.7.2.

4.2 Block Area Groundwater Quality Monitoring Wells

The treated soil blocks are considered to constitute a Class II landfill under Montana solid waste regulations. Consequently, ARARs include requirements to maintain minimum separation between landfill wastes and state waters; to demonstrate that landfill leachate will not adversely affect state waters or to provide for a landfill liner and leachate collection system; to provide for an adequate cover to minimize infiltration as part of landfill closure; and related requirements. The treated soil blocks have been partially emplaced below the local groundwater table, with no liner, and cover consists of gravel and revegetated soil which probably does not meet minimum permeability requirements. Consequently, an ARAR waiver was necessary pursuant to CERCLA Sec. 121 (d) (4) (D) and C.F.R. 300.430 (f) (1) (ii) (C) (4).

This Plan identifies four monitoring wells (MO-09, MO-26, MO-25, and RMIS-2) that are located adjacent to and within the block placement area that will be monitored. The objective of sampling the source area wells is to monitor the water quality impacts from the treated soil cement blocks as the blocks degrade over time and determine if the remaining Cr VI will regenerate a groundwater plume in the future. Source area wells will also serve as the Site's sentinel wells to identify changes in groundwater conditions before observed in down-gradient POC wells.

These wells will be monitored annually until 2018 which is when the 3rd Five Year Review is due. If the trends analysis that is performed on each individual well for the 3rd Five Year Review demonstrates that Cr concentrations are stable or are decreasing, then sampling will be reduced to biennially. If the trends analysis demonstrates no trend or an increasing trend at the 95% confidence level (CL) , then sampling will continue annually until a future Five Year review trend analysis demonstrates stability or a decreasing trend and/or Site conditions allow for

unlimited use and unrestricted exposure. An increasing trend in a well in the block placement area will not automatically be a concern to EPA and MDEQ as groundwater levels underneath the block placement area fluctuate seasonally and come in direct contact with the blocks and contaminated backfill soil. This was demonstrated in the 2008 and 2011 sampling events.

A trigger value has been established for the source area well network that will increase sampling frequency if Cr concentrations exceed this trigger. This is discussed in Section 4.7.1.

4.3 Down-gradient Groundwater Quality Monitoring Wells

The ten wells (RMIS-4S, RMIS-5, RMIS-8, MIS-11A, MIS-11B, MIS-14, MIS-15, MO10, MO11 and MIS-16) that are located down-gradient of the source area will also be monitored as part of the monitoring well network. These wells have been broken into POC wells and the additional well network and are discussed below.

4.3.1 Point of Compliance Wells

The four wells (RMIS-4S, RMIS-5, MIS-15, and MIS-16) located immediately along this down-gradient perimeter were identified in the 1996 Action Memorandum as the post-closure monitoring wells and have been chosen as the Site's POC monitoring (EPA, 1996a). This was further clarified in the amendment to this Action Memorandum (EPA, 2008b). These wells were chosen as the POC because it is technically infeasible to place the wells at the unit boundary and each well has long screen intervals and thus are more likely to intercept groundwater if the water table drops due to seasonal changes or prolonged drought conditions. Also, these wells have historic water quality data to perform a trends analysis. Wells in the POC group have sampling data from 1992 to the present. This data is contained in Montana's Ground Water Information Center. The objective of monitoring these wells is to ensure detection of groundwater contamination in the uppermost aquifer.

For attainment of a Site specific standard in groundwater, the POC is normally the property boundary that existed at the time the contamination was discovered and is established in the groundwater as near the source as technically, hydrogeologically, and geographically feasible. Site-specific cleanup standards are usually attained at and beyond this POC. Under CERCLA, the groundwater POC is generally at the waste management unit boundary as noted in the preamble to the NCP: "EPA believes that groundwater remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area, when the waste is left in place." As such, the Point of Compliance for groundwater is at the boundary of the block disposal area. Similarly, The Administrative Rules of Montana specify that a down-gradient monitoring system must be installed at the relevant POC that ensures detection of groundwater contamination in the uppermost aquifer. When physical obstacles preclude installation of groundwater monitoring wells at the relevant POC at existing units, the down-gradient monitoring system may be installed at the closest practicable distance hydraulically down-gradient from the relevant POC specified by the MDEQ (ARM, 1997).

EPA and MDEQ have determined that the monitoring POC beyond the property boundary is appropriate at this Site because the following situations are demonstrated:

- The Site is a small parcel of land with limited space for on-Site monitoring wells;
- It is not physically possible to monitor groundwater quality at the property boundary because of the existence of a deep ditch and a paved road;
- The down-gradient property is the municipal airport. This property was owned by the Town at the time the contamination was discovered; and
- The use of the groundwater on the down-gradient property can be controlled to prevent unacceptable exposure through re-establishment of the original Superfund Overlay District should annual monitoring and statistical evaluation of groundwater data demonstrate an increase in concentration levels.

The POC wells will be monitored annually until 2018 which is when the 3rd Five Year Review is due. Concentrations at the POC wells will be compared against the MCL for chromium (100

µg/L) as well as the background concentration for the Site (95% Upper Confidence Limit (UCL) for data from RMIS-1). Intermittent detections of chromium can result in a false increasing trend when most samples are non-detect (ND) as in the background well. POC sample results should be compared to background concentration patterns (i.e. mostly non-detect with occasional detections below a certain concentration).

If the trend analysis that is performed for the 3rd Five Year Review demonstrates that Cr concentrations are stable, decreasing, or ND, then sampling will be reduced to biennially. If POC wells show intermittent detections of chromium but detected concentrations are below the 95% UCL for background concentration, sampling will be reduced to biennially. If chromium concentrations are intermittently above the 95% UCL for background and the trends analysis demonstrates no trend, or an increase at the 95% trend CL, then sampling will continue annually until a future Five Year review trends analysis demonstrates stability or a decreasing trend and/or Site conditions allow for unlimited use and unrestricted exposure. An increasing trend in a POC well will not automatically be a concern to EPA and MDEQ if concentrations remain below the MCL as some fluctuation is expected as the blocks degrade over time. This was demonstrated in the 2008 sampling event discussed in Section 3.8. However, trigger values have been established that will increase sampling frequency of the POC wells if Cr concentrations exceed this trigger. This is discussed in Sections 4.7.1, 4.7.3 and 4.7.4.

4.3.2 Additional Well Network

In addition to the four down-gradient POC wells, the two wells that were installed by MBMG in 2007 (MO10, MO11) will also be sampled. MO10 and MO11 are constructed differently than POC wells in that they have shorter well screens that straddle only the upper portion of the alluvial aquifer. It was also determnined during the 2nd Five Year Review that chromium concentration above laboratory detection limits were detected in wells further downgradient of the POC wells. As a result, the Agencies agreed to sample RMIS-8, MIS-11A, MIS-11B, MIS-14. The monitoring objectives for these wells are to ensure that the POC wells are representative of aquifer conditions and to compare concentrations with the POC wells.

These wells will be monitored annually until 2018 which is when the 3rd Five Year Review is due. If the difference in concentrations within the additional well network is within 25% of the concentrations in the POC wells and the trend analysis that is performed for the 3rd Five Year Review demonstrates that Cr concentrations are stable or are decreasing, then sampling of these six wells will be eliminated. If statistical evaluation of sample results indicate a greater than 25% relative percent difference (RPD) with POC wells or if trend analysis demonstrates no trend or an increase at the 95% CL, then sampling will continue annually until future Five Year review trends analysis demonstrates stability or a decreasing trend and/or Site conditions allow for unlimited use and unrestricted exposure. An increasing trend in the additional well network will not automatically be a concern to EPA and MDEQ if concentrations remain below the MCL as some fluctuation is expected as the blocks degrade over time. However, trigger values have been established that will increase sampling frequency of these wells if Cr concentrations exceed this trigger. This is discussed in Sections 4.7.1, 4.7.3 and 4.7.4.

4.4 Groundwater Sampling

Groundwater samples will be collected with a stainless steel or Teflon bailer, or polyvinyl chloride submersible pump or a peristaltic pump equipped with tygon tubing following MBMG Standard Operation Procedure SOP-SS-1 (Appendix A). All wells will be purged prior to sampling; however, static water elevation will be taken prior to purging the well using an electric water-level tape. The purging procedures include pumping or bailing standing stagnant water from each well prior to sampling to get a more representative sample of the in-situ groundwater quality. Well purging will be considered finished when at least 3 bore volumes are removed and/or field parameters are considered stable. When evacuating low-yield wells (wells that are not capable of yielding 3 bore volumes) the well will be evacuated down to the pump; allowed to recover and purged; and then allowed to recover sufficiently prior to sampling. The field parameters that will be collected include pH, specific conductivity, redox potential, and temperature.

4.5 Chemical Analysis

Aqueous samples will be submitted to the MBMG Analytical Laboratory located in Butte, Montana for chromium (dissolved and total recoverable) analysis. Chromium analyses will follow the methods listed below:

- Total chromium with EPA methods 200.7/200.8, and
- EPA method for dissolved chromium analyses, 6010/6020

Chromium is classified as a hazardous substance under CERCLA Sec. 101(14) and all wastes generated will be treated as such. Further discussion of the sampling protocol is discussed in the Quality Assurance Project Plan that accompanies this Plan (Appendix A).

4.6 Statistical Evaluation

Analytical results from the monitoring of chromium compounds will undergo a single well evaluation every five years using a Mann-Kendall statistical evaluation as long as sampling is necessary. A description of the anticipated approach to the Mann-Kendall and background concentration evaluations are provided in Appendix C. The first comprehensive statistical evaluation of the monitoring wells will be performed during the next Five-Year Review, which is scheduled for 2018. Additional Five-Year Reviews are anticipated in 2023, 2028, 2033 and beyond as long as waste is left in place and the Site does not allow for unlimited use and unrestricted exposure.

Annual monitoring will continue until 2018 when the 3rd Five Year Review is due. If any wells in the source and down-gradient well networks have no trend or an increasing trend above the 95% CL when compared with previous sampling events, then annual monitoring will continue until the next Five Year Review. If analysis of this data demonstrates stability or a decreasing trend at the 95% CL, then monitoring will be decreased depending on the well network as shown in Table 3.

4.7 Trigger Values

This Plan establishes trigger values such that if any background, block area and/or down-gradient well demonstrates an increase in Cr concentration above this trigger and the increase is not due to a laboratory discrepancy or any other variable (i.e., fieldwork) that could influence an anomaly, then additional monitoring and/or corrective action will be required. Trigger values have been established for the following:

1) A Cr concentration that is greater than three times the MCL in the block area wells;

2) A Cr concentration greater than 25% of the MCL in the background well;

3) A Cr concentration that is greater than ½ the MCL in down-gradient wells; and

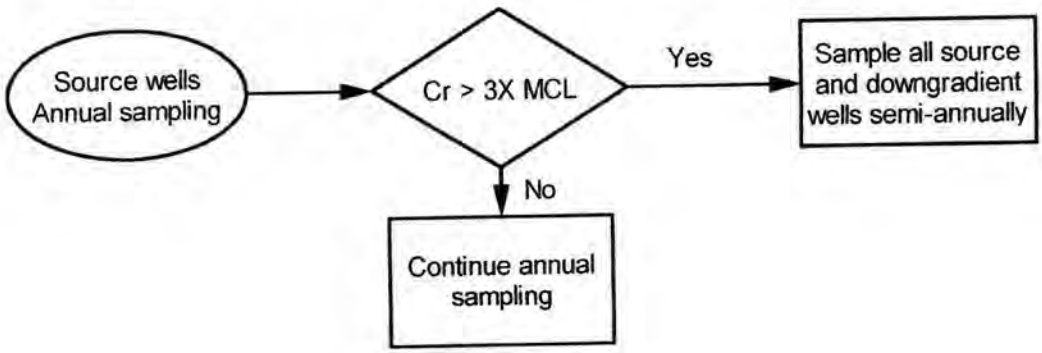
4) Cr concentrations that exceed the MCL in down-gradient wells.

Table 3
Sampling Frequency of Groundwater Wells

Well Name	Designation	Sample Frequency
RMIS-1	Background Well	Once every Five Years. Use historic record to determine a 95% UCL for chromium concentrations. Monitor during next scheduled sampling event if Cr concentrations are greater than 25% of the MCL.
MO-09, MO-25, MO-26, RMIS-2	Block Area Wells	Annually until 2018. Reduce sampling to biennial if stable or a decreasing trend. Continue annual sampling if no trend or increasing at 95% CL . Monitor well(s) semi-annually if Cr concentrations are three times the MCL.
MO-10, MO-11, MIS-11A, MIS-11B, MIS-14 RMIS-8	Additional Wells	Annually until 2018. Eliminate sampling if stable or a decreasing trend and there is less than 25% difference in concentrations when compared with the POC wells. Continue sampling if no trend or increasing at 95% CL or if there is greater than 25% difference in concentrations when compared to the POC wells. Monitor semi-annually if Cr concentrations are greater than ½ the MCL or if Cr concentration in any block area well is three times the MCL. Resample as soon as the field team can remobilize if any down-gradient well is above the MCL.
MIS-15, MIS-16, RMIS-4S, RMIS-5	Points of Compliance	Annually until 2018. Reduce sampling to biennially if ND,stable or a decreasing trend or with intermittent concentrations detected below the 95%UCL for background concentrations. Continue annual sampling if no trend or increasing at 95% CL. Monitor semi-annually if Cr concentrations are greater than ½ the MCL or if Cr concentration in any block area well is three times the MCL. Resample as soon as the field team can remobilize if any down-gradient well is above the MCL.

4.7.1 Chromium Concentrations greater than three times the MCL in the Block Area Wells

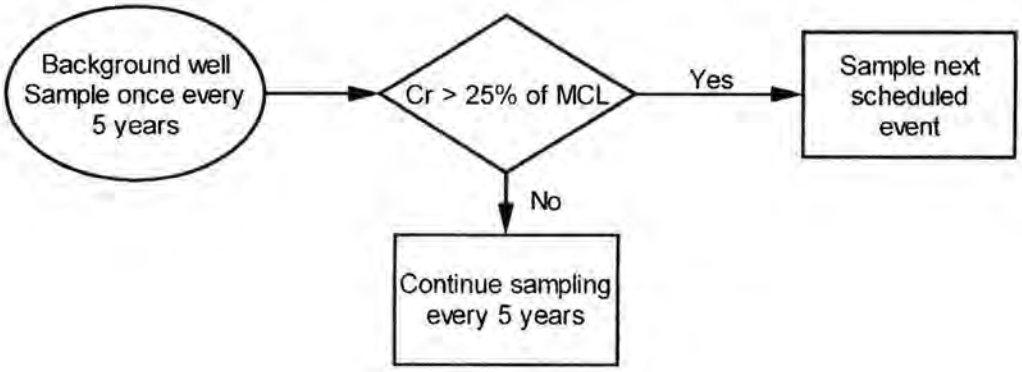
If Cr concentrations are three times the MCL (300 µg/L) and concentrations are not attributed to a laboratory discrepancy or any other variable (i.e., fieldwork) that could influence an anomaly, then all block (source) area and down-gradient wells will be sampled semi-annually as long as concentrations in the block (source) area well(s) continue to be three times the MCL.



If the Cr concentration continues to be three times the MCL, then corrective actions specified in Section 4.7.4 will be implemented.

4.7.2 Chromium Concentrations greater than 25% of the MCL in the Background Well

If Cr concentrations are greater than 25% of the MCL (25 µg/L) and concentrations are not attributed to a laboratory discrepancy or any other variable (i.e., fieldwork) that could influence an anomaly, then the well will be sampled during the next sampling event as long as concentrations continue to be within this range.

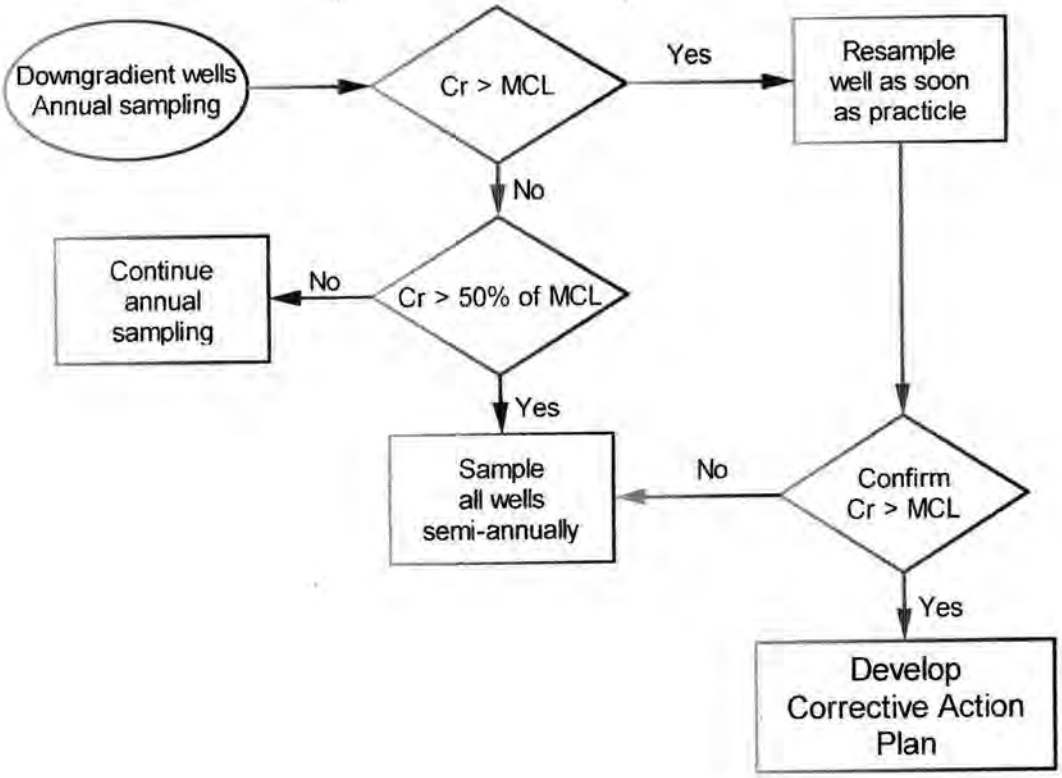


If the Cr concentrations are greater than the MCL, then corrective actions specified in Section 4.7.4 will be implemented.

4.7.3 Chromium Concentrations greater than ½ the MCL in Down-gradient Wells

If concentrations in any down-gradient well are greater than ½ the MCL (50 µg/L) and concentrations are not attributed to a laboratory discrepancy or any other variable (i.e., fieldwork) that could influence an anomaly, then all the down-gradient wells will be resampled semiannually. Semiannual sampling will continue until two successive samples are below ½ the MCL (50 µg/L).

If the Cr concentration in any of the down-gradient wells is greater than the MCL, then corrective actions specified in Section 4.7.4 will be implemented.



4.7.4 Chromium Concentrations Greater Than the MCL in the Background and/or Down-gradient Wells

If concentrations in the background well and/or any of the down-gradient wells exceed the MCL and concentrations are not attributed to a laboratory discrepancy or any other variable (i.e., fieldwork) that could influence an anomaly, then all the down-gradient wells will be resampled as soon as the field team can remobilize. If analysis of these data verifies an increase in concentrations above the MCL, then a corrective action measure will be implemented. The corrective action will likely include additional investigation into the exceedences as the initial action as well as expanded groundwater sampling. EPA and MDEQ will evaluate the information to determine the need for additional corrective actions beyond this initial action. If corrective actions beyond additional investigations and/or increased sampling frequency are necessary, a contingency plan will be developed that establishes the corrective actions to be undertaken. Additional corrective actions may include but are not limited to:

additional monitoring; installation of additional wells; re-imposing the groundwater restrictions that were in the original SOD and/or removal and off-Site disposal of the contamination in the block placement area.

5.0 INSTITUTIONAL CONTROLS

Institutional Controls over land use and groundwater use have been established and maintained by the Town as part of its response actions as a responsible party under Superfund. A zoning ordinance (Chapter 17.76) was approved by Town Council in March 1995 and created the Superfund Overlay District. The intent of the SOD is to protect public health, safety and welfare while allowing appropriate use of lands within the SOD. This intent is accomplished by:

1. Assuring that land use in the SOD is compatible with protecting, and providing for permanent preservation and maintenance of response actions pursuant to the Superfund law, including soil caps, treated concrete blocks, and other remedial structures;

2. Requiring that any development in the block placement area (treated soil repository) of the SOD be preceded by submittal of detailed Site and construction plans, prepared by an architect or engineer, for review and approval by the Town, EPA, and MDEQ as an IC in the context of federal Superfund law;

3. Requiring submittal of as built drawings with certification from an architect or engineer that Site development and construction in the block placement area (treated soil repository) was completed in compliance with zoning title and federal Superfund law;

4. Limiting well use and prohibiting drilling of wells (except for monitoring) within the SOD; and

5. Placing a notice to purchasers on any deed, contract for sale, or other instrument of conveyance before any lot or parcel in the SOD is conveyed (Ordinance 321 (2004); Ordinance 298 (1997)).

The SOD became enforceable in April 1995 - thirty days following the establishment of the ordinance. The Town is required to enforce these institutional controls under the Unilateral Administrative Order (UAO) issued by EPA on July 22, 1996. Requirements of the SOD are

enforced by the zoning authority of the Town and cannot be amended, suspended, or otherwise rendered ineffective without the prior written approval of EPA and MDEQ. (See Section 2.1 of the Response Action Work Plan attached to the UAO). The SOD requirements for groundwater and land use are summarized below and the entire Ordinance and amendments are attached to this Post Removal Site Control Plan as Appendix D.

The Town is past owner of the block placement area and surrounding buffer zone and at present is a partial owner. Columbus is a small town and has a correspondingly small budget. The agreement by the Town to provide access to the Site and to enforce ICs satisfies their portion of any response costs. This includes the maintenance of a perimeter fence if the fence continues to be deemed necessary by EPA and MDEQ, vegetative cap on the block placement area and existing monitoring wells. The Town is required to and will continue to enforce the SOD zoning restrictions as part of its agreement to comply with the UAO until unlimited use and unrestricted exposure can be allowed at the Site or the UAO is otherwise modified. A deed conveying title to the portion of the property owned by Timberweld that is located within the block placement area is subject to the SOD ordinance.

5.1 Groundwater Use Restrictions

Groundwater use restrictions originally applied to the entire SOD (Figure 2). Those restrictions are discussed in Chapter 17.76.040 of the SOD and include:

1. Prohibiting new wells or other groundwater extraction systems;

2. Prohibiting groundwater use from existing wells or other groundwater extraction systems (except for lawn irrigation use, use of the existing golf course pond, and groundwater monitoring); and

3. Prohibiting excavation below the groundwater table within the SOD other than for temporary excavation necessary for placement of footings and utilities. A permit must be obtained from the Town for any such excavation.

Compliance with performance standards established in the 1996 Action Memorandum triggered the relaxation of groundwater use restrictions within the SOD in accordance with provisions of the 1996 response action. Groundwater use restrictions within the SOD were lifted in 2004 through the establishment of a Sunset provision (Chapter 17.76.050). Ordinance No. 321 of the Town Council of the Town of Columbus, Montana of the Columbus Municipal Code became effective 30 days after passage and approval of this ordinance. The relaxation of groundwater use restrictions was completed through a May 20, 2005 letter from Ronald Bertram of EPA to Douglas Howard of the Town of Columbus approving the lifting of groundwater use restrictions in accordance with the 1996 UAO (Appendix E). At that time, it was assumed that groundwater use restriction remained in place within the treated block placement area since the Town can continue to enforce the SOD groundwater restrictions, solely on its own authority, even after EPA has granted approval to lift the restrictions.

Relaxation of groundwater use restrictions across the SOD were judged in need of revision as part of the first Five Year Review. It was recommended that a groundwater use restriction should continue to be maintained within the treated block placement areas through an amendment to Subsection D of Section 17.76.010 and Section 17.76.040 of the Columbus Municipal Code. Town Council approved the first reading of the proposed groundwater restriction amendment to the SOD at their February 19, 2008 meeting. The second reading was done on March 3, 2008 and Ordinance No. 328 of the Town Council of the Town of Columbus, Montana, amending Subsection D of Section 17.76.010 and Section 17.76.040 of the Columbus Municipal Code took effect thirty days following.

This revision to groundwater restrictions was identified as a necessary remedy element in order to ensure that the actual or threatened releases of hazardous substances from this Site do not occur. Chapter 17.76.040 was amended through Ordinance 328 to include provisions that limit groundwater use in the block placement area that:

1. Prohibit new wells or other groundwater extraction systems other than for monitoring;

2. Prohibit groundwater use from existing wells or other groundwater extraction systems (except for groundwater monitoring); and

3. Prohibit excavation below the groundwater table other than for temporary excavation necessary for placement of footings and utilities. A permit must be obtained from the Town for any such excavation.

Additional layers of groundwater protectiveness are ensured through Chapter 15.08 (Water Well Regulations) of the Columbus Municipal Code and Section 17.36.328 of Montana's Administrative Rule that prohibits wells within 500 feet of an existing public water supply. Chapter 15.08 establishes permissible residential, commercial and industrial use of water wells; requires inspection of all water wells before the well is placed in operation; as well as requires permits for installation and annual renewal for water wells. It also established procedures for water wells that were already in existence prior to the establishment of this Chapter. Montana's Administrative Rule applies only to new subdivisions and there are exceptions to the rule.

5.2 Land Use Restrictions

In addition to current groundwater restrictions, land-use restrictions have been incorporated into Chapter 17.76.020 and 17.76.030 of the SOD. The Site and adjacent areas are zoned as commercial/industrial. The Town of Columbus Master Plan indicates that the area will continue to function as a commercial/industrial zone.

Current land use consists of the following:

- Timberweld occupies land along the west edge of the Site. Timberweld uses part of the area for storage and the remainder for normal business activities. Several commercial businesses are located to the west of Timberweld.

- Immediately south of the Site is the Town's municipal airport runway. The large open area in which the runway is located consists of mowed "prairie hay". The Town's municipal golf course adjoins the airport to the south.

- East of the Site is part of the Stillwater Mining Industrial Complex that uses a three stage leach and metal recovery process to selectively extract nickel, iron, copper and other valuable metals from a Platinum Group Metal bearing granulated matte from the smelter. These activities result in a higher grade Platinum Group Metal filter cake being produced.

- Private residences are located to the north and west, up-gradient of the Site.

Chapter 17.76.020 includes additional application requirements for uses and development within the SOD. The following requirements apply:

- Require the property owner to maintain the Site cover, drainage facilities, and fences; and
- Establish specifications for construction on the block placement area; and
- Limit vehicle loads on the graveled portions of the block placement area.

Chapter 17.76.030 establishes performance standards for the block placement areas. The following standards apply to the block placement area of the SOD:

- Prohibit excavation into block placement area; and
- Prohibit any use of the soil-covered block placement area unless those areas are paved or covered with gravel.

Montana Tech completed an evaluation of the geotechnical and structural capacities of the Site in 2009. Based on the investigation, several changes to institutional controls of the Site were also

recommended, allowing for broader uses were incorporated into Town Ordinance 556 effective April 10, 2010:

1) Subsection F of Section 17.76.030 of the Columbus Municipal Code is hereby amended to read as follows:

"F. If a building is constructed within the block placement area, excavation required for this construction and trenching for utilities is allowed. Excavated waste may be placed back into the foundation excavation and compacted as backfill to support the foundation and /or disposed of according to state of Montana approved methods. Any building or structure, including the related utilities, must meet all applicable requirements of the Montana State Building Code and the Town of Columbus zoning code. Load limits for buildings or structures will not exceed six thousand (6,000) pounds per square foot as long as waste is left in place"

2) Subsection G of Section 17.76.030 of the Columbus Municipal Code is hereby amended to read as follows:

"G. Asphalt paving can be substituted for the upper most four inches of gravel cover. In this case, the asphalt will be placed in three courses— a minimum two-inch gravel base course, a four-inch asphalt base course, and a two-inch surface wearing course."

3) Subsection H of Section 17.76.030 of the Columbus Municipal Code is hereby amended to read as follows:

"H. Maintenance of fences around the soil cover areas as well as locked gates are no longer deemed necessary. However, the property owner must maintain the vegetated soil cover or gravel cover on the site."

Institutional Controls have been functioning for more than a decade, but their efficacies need to be tweaked based on findings from the second Five Year Review. This Plan will be revised to

clearly outline regularly scheduled inspections by EPA and MDEQ and maintenance responsibilities by the Town of Columbus for the vegetative cover, gravel and asphalt caps. These actions will be written to assure compliance with institutional controls.

5.3 Deed Restrictions

A deed conveying title to the portion of the property owned by Timberweld that is located within the block placement area was placed in the record in 2006 as required by Ordinance 321 adopted in 2004. This property is more particularly described as Industrial Sites Addition to the Town of Columbus, Montana Block 2 : Lots 1 and 2 as shown in Plat No. 179163. The following language was added to the Timberweld's warranty deed as an additional layer of protectiveness:

"This conveyance is subject to the provisions of Chapter 17.76, SOD Superfund Overlay District, of the Columbus Municipal Code"

Timberweld's title is attached to this Post Removal Site Control Plan as Appendix D.

The Town of Columbus owns the remaining portion of the block placement area. As long as the Town retains ownership of the land, this conveyance will not be added to the deed. Should the Town convey title to another entity, this language will be added to the deed as long as Site conditions do not allow for unlimited use and unrestricted exposure.

5.4 Periodic Review

As part of the future work to be performed at the Site, the Town agrees to provide access to the Site and to enforce ICs. This Plan will be revised to provide for regularly scheduled MDEQ and EPA inspections of the vegetative and gravel cap. The Agencies also agree to meet with the Town at least once every five years to discuss the Site land use and groundwater use restrictions. These inspections and meetings are designed to provide better understanding of the issues

associated with these restrictions as well as notify the Agencies of any upcoming land use changes that may require a more comprehensive review.

To ensure compliance with the federal Superfund law as provided in the SOD, the Town also agrees to notify EPA and MDEQ of any proposed land use change and/or development of the Site that would affect the block placement area or remedial structures such as vegetative caps, drainage facilities, or fences. Such notification will be given in writing sufficiently in advance of any action by the Town to approve such changes to allow EPA and MDEQ to determine whether the proposed changes could adversely affect the maintenance or protectiveness of the Superfund remedial measures at the Site. Such notice will include any information required in the ordinance, such as detailed site and construction plans, and other information necessary to determine the potential impact of the proposed changes on the Superfund remedial measures.

Previous response actions conducted at the Site resulted in waste being left in place. Further, these actions result in Site conditions that do not allow for unlimited use and unrestricted exposure. Such conditions require the implementation of a Five-Year Review. The second Five-Year Review was completed in 2013. The next Five-Year Review is expected to be completed in 2018. ICs will be reviewed during each Five-Year Review.

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APPENDIX A

QUALITY ASSURANCE PROJECT PLAN

August 2013

Quality Assurance Project Plan
For
MOUAT INDUSTRIES SUPERFUND SITE

By
Montana Bureau of Mines and Geology
August 2013

Prepared for:
Montana Department of Environmental Quality
Helena, MT

Prepared by:
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Approvals:

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Montana Bureau of Mines and Geology — 8/16/13 date

Gary Icopini, Project Manager and
Quality Assurance Manager
Montana Bureau of Mines and Geology — 8/16/13 date

Daryl Reed, Project Officer
Montana Department of Environmental Quality — 8/21/13 date

Roger Hoogerheide, Project Manager
and Delegated Quality Assurance Approval Official
US Environmental Protection Agency — 8/21/13 date

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A3. Distribution List

This Quality Assurance Project Plan is distributed to the following parties:

Ted Duaime, Montana Bureau of Mines and Geology (MBMG)
Gary Icopini, MBMG
Steve McGrath, MBMG
Nick Tucci, MBMG
Mark Wolfram, MBMG
Daryl Reed, Montana Department of Environmental Quality (DEQ)
Roger Hoogerheide, US Environmental Protection Agency (EPA)

A4. Project Organization

Name	Project Title	Responsibility
Ted Duaime, Gary Icopini MBMG	Project Mangers	- Overall responsibility for the MBMG participation in Mouat Superfund Site Cr-mobility assessment. - Assist in QAPP development - Design protocol for selecting sampling sites - Prepare final report for review and approval - Submit final report to EPA and ensure report is publicly accessible
Gary Icopini MBMG	Field Team Leader	- Participation in site selection and supervision of field sampling - Assist in QAPP development - Design protocol for selecting sampling sites - Oversee inventory and sampling activities - Assist in the preparation of final report for review and approval
Ted Duaime Gary Icopini Nick Tucci, Mark Wolfram, MBMG	Field Sampling Crew	- Conduct field sampling and assist in preparation of final report. - Assist in QAPP development - Design protocol for selecting sampling sites - Oversee inventory and sampling activities - Assist in the preparation of final report for review and approval
Gary Icopini MBMG	QA Officer	- Assist with development of the QAPP - Responsible for ensuring that procedures in field and laboratory are performed in accordance with this QAPP - Responsible for maintaining the official approved QAPP - Makes arrangements with the laboratory according to QAPP - Ensure correct procedures are used, holding times are met and laboratory provides complete documentation.

Daryl Reed DEQ	DEQ Project Officer	- Act in an advisory capacity during QAPP preparation - Ensure QAPP is properly prepared and approved
Steve McGrath MBMG	Laboratory Manager	- Responsible for reporting analytical data and ensuring the laboratory follows analytical methodology QA/QC procedures - Calculate and report precision and accuracy results for QC samples that are not blind to the laboratory
Roger Hoogerheide	EPA Project Manager	- Act in an advisory capacity during QAPP preparation - Ensure QAPP is properly prepared and approved

See also MBMG organizational chart (below).

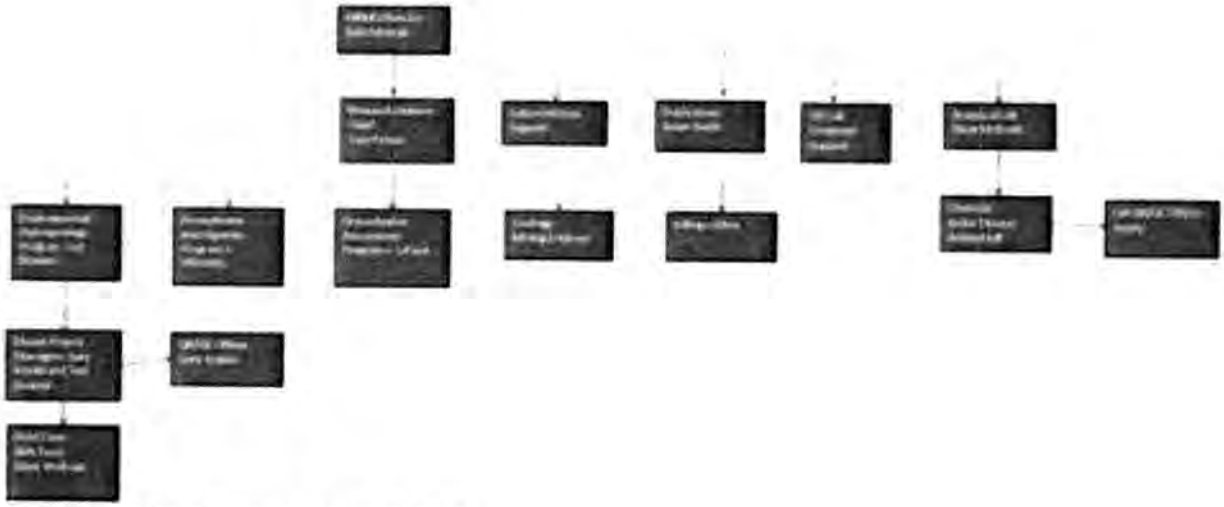

Figure 1. MBMG organizational chart.

A5. Problem Definition/Background

Preface

This quality assurance project plan (QAPP) has been prepared for use by all participants in the MBMG Mouat Industries Superfund Site sampling program. The purpose of this QAPP is to insure that appropriate and applicable means are instituted during data collection and sample analysis. The resulting data should be known and defensible. A Sampling and Analysis Plan (SAP) has been written for the site, which references this QAPP.

Background

Industrial activities from 1957 to approximately 1973 lead to the release of Cr(VI) to the soils and groundwater at the Mouat Industries Site located in Columbus, Montana. A significant amount of the visible surface contamination was removed in the 1970's. However, persistent Cr(VI) groundwater contamination led the Environmental Protection Agency (EPA) to place the Mouat Industries Site on the National Priority List (NPL) in 1986. From 1993 through 1995 FMC conducted full scale excavation and treatment activities. These activities included immobilization of Cr(VI) contaminated soils by both reduction of Cr(VI) to Cr(III) with reduced

forms of iron and sulfur and by solidification in cement blocks. These cement blocks were then buried in on-site repositories (FMC, 1995).

Atlantic Richfield conducted groundwater monitoring from 1996 through 2003 on 12 monitoring wells. The monitoring documented the natural attenuation of the groundwater chromium plume. The Cr(VI) concentrations in the groundwater down gradient of the site decreased from more than 200 to less than 50 µg/L. This indicates that under current conditions the treated soil and blocks are leaching less hexavalent chromium than before the removal action.

The adverse health effects resulting from exposure to hexavalent chromium can cause unacceptable human health risks. Concern about potential exposure to hexavalent chromium hazards in groundwater require EPA and DEQ to develop a sampling and assessment program to evaluate the presence and stability of hexavalent and total chromium in the blocks and groundwater, identify an appropriate long term monitoring program, and assist DEQ in determining the appropriateness of delisting the Mouat site from the NPL. Groundwater sampling will characterize the extent and likelihood of a hexavalent chromium groundwater plume developing, and enable DEQ to determine an adequate scope of the long term sampling and an appropriate delisting recommendation.

Project Definition

The decision statement is to determine if mean concentrations of dissolved chromium and total chromium in groundwater exceed DEQ Circular 7 standards at or beyond the Point of Compliance established at the Site in the Post Removal Site Control Plan.

Project Decision Criteria

For groundwater, the DEQ will use DEQ Circular 7 groundwater standard that stated that if dissolved chromium and/or total chromium median concentrations are above the DEQ Circular 7 groundwater standard for chromium (100 µg/L), potential development of a hexavalent chromium groundwater plume may be likely. This is also the cleanup standard established in the 1996 Action memorandum issued for the Site.

Project Decision Makers and Principle Customers

The planning team consists of DEQ, MBMG as the technical consultant, and EPA; however, the agencies will seek input from stakeholders in the investigation outcome including the principal responsible parties (FMC Corporation and Town of Columbus). DEQ and EPA are the decision makers.

A6. Project Description

Project Description

This project will evaluate the presence of dissolved chromium and total chromium in groundwater. Ground-water monitoring has shown that currently the blocks are not apparently leaching and developing a hexavalent chromium plume that exceeds drinking water standards beyond the Point of Compliance.

Groundwater migration from the site towards the river resulted in elevated levels of hexavalent chromium prior to the removal actions performed at the Site. Continued potential sources of hexavalent chromium to groundwater are the buried stabilized blocks that are below the high seasonal groundwater table. DEQ will evaluate the levels of hexavalent chromium and other metals in groundwater and the blocks, and other water quality parameter indicators of block stability.

Expected Measurements

DEQ will assess the potential for hexavalent chromium plume development potential through analyzing groundwater for dissolved chromium and total chromium, and other indicator parameters such as field measurements collected during sampling and transducers placed in strategic wells to monitor continuous water elevations.

Quality Control

Two field duplicates will be collected during each sampling round. A field duplicate is a sample that is collected from the same location and time period (sequentially) as original sample that is sent to the same laboratory as separate samples. A field duplicate is collected for the purpose of assessing the consistency of the overall sampling and analytical system. Chromium concentrations in the field duplicate water samples should have a relative percent difference of 20% or less.

One equipment blank consisting of a deionized water sample that is brought to the field in sealed containers, transferred to sample bottles in the field via a pump used to collect samples, and then transported to the laboratory with the sample containers. The equipment blank should be collected after the pump has been decontaminated. Equipment blank results are used to evaluate the artificial introduction of contaminants during the sample collection and handling processes.

Work Schedule and Required Reports

Services provided under this Task Order will begin upon the Effective Date of this Task Order and continue through its expiration date. Sampling will be conducted during the summer months after the groundwater elevations peak. Sampling will require one to two sampling personnel approximately one week to prepare and collect samples from the 14 wells on the annual sampling list. The Draft SAP is due 15 working days after receipt of draft Data Quality Objectives from DEQ, and the Final SAP due 5 working days after Contractor's receipt of DEQ and EPA comments. The Field Summary Report is due 15 working days after demobilization. The Draft Data Summary, Analysis, and Interpretation Report (DSAIR) is due 20 working days after receipt of all laboratory data and the Final DSAIR is due within 10 working days of receipt of DEQ and EPA comments.

Time and Resource Constraints

MBMG has identified the project team and determined resources, budget, personnel, and schedule. The field work is expected to be completed after groundwater elevations peak, which typically occur during late Spring or early Summer. Constraints for collecting data are limited to daylight hours and weather, road closures.

It is anticipated that monitoring will continue in the future but the exact locations and frequency of data collection will be periodically evaluated based on comparisons to historical data; the availability of resources; and the performance monitoring requirements implemented as part of any future five year review.

A7. Quality Objectives and Criteria

The Data Quality Objectives (DQOs) for this project are to insure that groundwater samples are representative of site conditions and to obtain analytical results that meet data

quality objectives. DQOs were prepared using EPA guidance for the data quality objectives process (EPA 2006). The EPA guidance presents the DQOs as a seven-step process:

Step 1: State the Problem.

This project monitors the groundwater to determine if concentrations of dissolved and total chromium exceed DEQ Circular 7 standards (100 µg/L) at or beyond the Point of Compliance. Additionally, groundwater concentrations are monitored in accordance with the other action limits defined in the Post Removal Site Control Plan (2009).

Step 2: Identify the Decision.

DEQ selected the concentrations of dissolved chromium and total chromium concentrations as the appropriate parameter to assess groundwater quality and annual samples are collected from monitoring wells to obtain these data. The 2009 Post Removal Site Control Plan for the site describes the various site actions based upon chromium concentrations in groundwater within the block area, as well as downgradient and upgradient of the site. Based on the action levels in Post Removal Site Control Plan, chromium concentrations greater than 300 µg/L in a block area well, greater than 50 µg/L in a downgradient well, or greater than 25 µg/L in the background well triggers semi-annual sampling. Reproducible chromium concentrations greater than 100 µg/L in a downgradient well triggers the development of a corrective action plan.

Step 3: Identify the Inputs to the Decision.

Total recoverable and dissolved chromium concentrations are required for the decision making process.

Step 4: Define the Study Boundaries.

Samples will be collected annually after the high groundwater peak in the summer from 4 wells within the block area and 10 downgradient wells (figure 2). A sample will be collected from the background well once every five years. If routine sampling results in concentrations that exceed the contingency triggers outlined in Step 2 (300, 50, or 25 µg/L), semi-annual sampling will continue until two consecutive samples are below the contingency triggers. If sampling results in chromium concentrations ≥ 100 µg/L in a point of compliance well, resamples will be collected as soon as practical. If chromium concentrations ≥ 100 µg/L are confirmed, a corrective action plan will be developed.

The spatial boundaries of the study area are the buried block location area, the area immediately downgradient and one well up gradient from the site. Figure 2 in the SAP identifies the location of wells that will be sampled.

Step 5: Develop a Decision Rule.

The action levels are outlined in Step 2 and were based on historical data for the site. Additionally, during the 2018 Five Year Review a Mann-Kendall statistical evaluation will be conducted to assess concentration trends and optimize the sampling design.

Step 6: Specify Tolerable Limits on Decision Errors.

Accuracy measures how close the results are to a true or expected value and can be determined by comparing analysis of a standard or reference sample to its actual value. Table 1 lists the precision, accuracy, and measurement range for the pH, temperature, and specific conductance (SC) meters that will be used during the project.

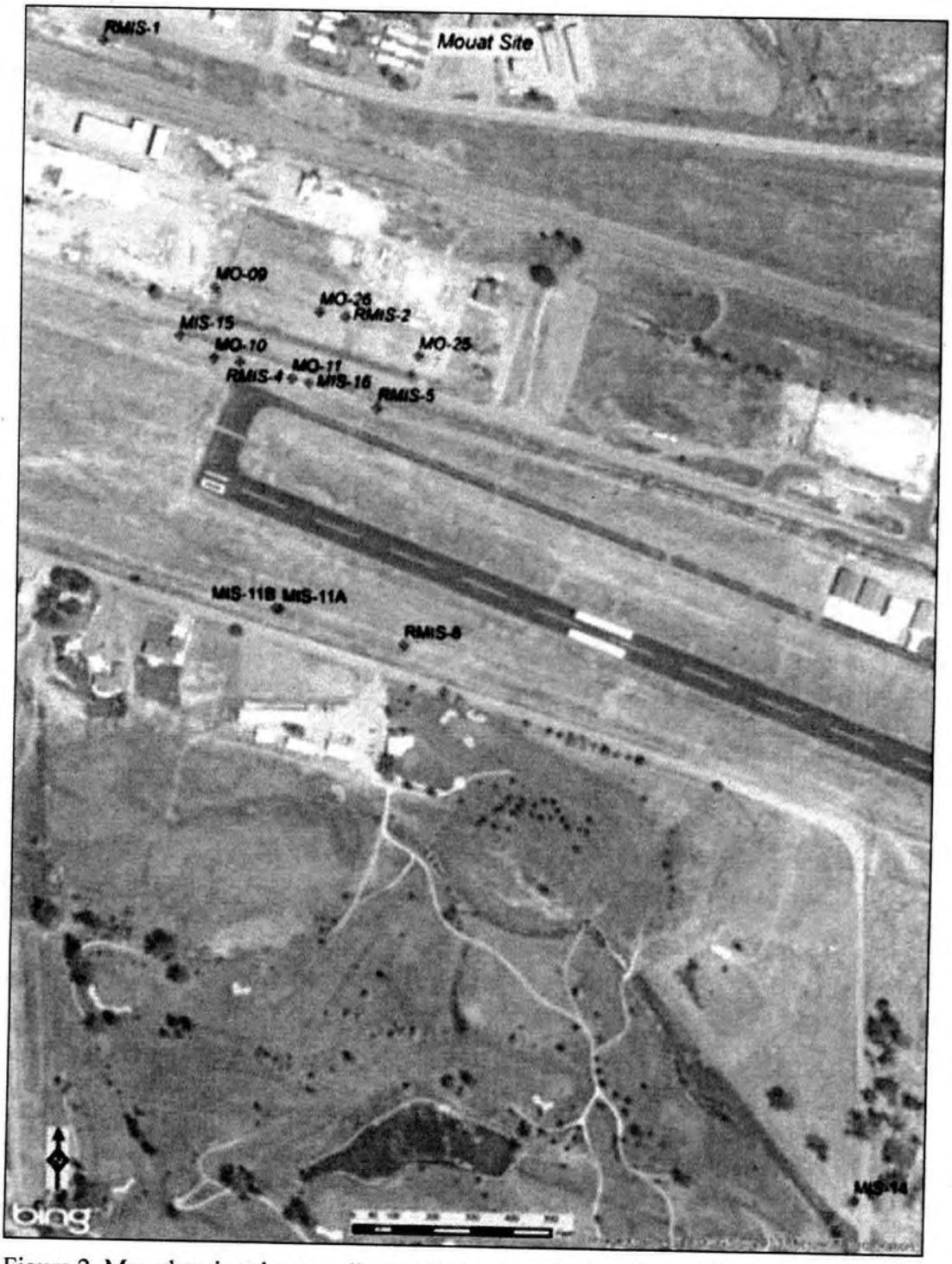

Figure 2. Map showing the sampling well locations for the Mouat Site.

Precision is the agreement of a set of results among themselves and is a measure of the ability to reproduce a result. Field duplicates will be the primary method of assessing precision for this project. Chromium concentrations in the field duplicate samples should have a relative percent difference of 20% or less for values that are ≥ 5 times the Contract Required Quantitation Limit (CRQL). For this project the laboratory quantitation (CRQL) and detection limits for chromium are 0.5 µg/L and 0.1 µg/L, respectively. Table 1 lists the objectives for accuracy and precision critical laboratory measurements.

Table 1. Data quality objectives for accuracy and precision.

Matrix	Units	Accuracy	Precision
Groundwater	µg /l	20%	20%

For samples submitted to the MBMG Analytical Laboratory, analysis of samples, quality assurance/quality control (QA/QC) steps (such as the use of laboratory controls, matrix spikes/ matrix spike duplicates [MS/MSD], blanks, etc.) will be used to determine precision and accuracy. These will conducted in accordance with EPA methods 200.7/200.8 and MBMG Analytical Laboratory SOPs which are included in Appendix B.

To insure representative duplicates and samples, field parameters will also be measured during collection of groundwater samples. Samples will be collected when field measurements stabilize about the mean of three consecutive readings recorded over a period of at least 6 minutes (temperature ≤±0.5°C; pH ≤±0.1; Eh ≤±20 mV; specific conductance ≤±5%). Field measurements will be recorded in a notebook.

Table 2. Accuracy and range of field water-quality instruments.

Matrix	Parameter	Accuracy	Range
Water	SC	± 1%	0 to 200 mS
Water	temperature	± 0.5%	-10.0 to 110.0° C
Water	pH	0.01±1 digit	0-14 pH

Representativeness is the extent to which measurements actually represent the true environmental condition or population at the time a sample was collected. Representativeness of the data will depend on sample collection, preservation and analysis in accordance with SOPS and with procedures included in this QAPP.

Completeness is the comparison between the amount of valid data, versus how much is needed insure the data is statistically valid.

Comparability is the extent to which data can be compared between sample locations or periods of time within a project, or between projects. For this project, comparability will be addressed through the use of common and accepted sampling and analytical techniques and by reporting data in standard units. Since 2007 chromium concentrations in the block area, downgradient, and background wells have ranged from 1 to 1500 µg/L, 1 to 72 µg/L, and 0.3 to 3 µg/L, respectively.

Step 7: Optimize the Design.

During the 2018 Five Year Review a Mann-Kendall statistical evaluation will be conducted to assess concentration trends and optimize the sampling design.

A8. Special Training/Certification

All field personnel will have completed OSHA 40 hour training and have completed an 8 hour refresher course to maintain current status. The training certifications are stored at MBMG's offices in Butte, Montana. Field personnel from the MBMG who are already trained in standard sampling protocols and use of field equipment will be collecting the water-quality samples.

A9. Documents and Records

An electronic copy of this document will be provided to all of the parties listed in Section A3. Non-MBMG employees will be sent copies via email. This document will be maintained on the MBMG secure server in a location accessible to project personnel. MBMG project personnel shall be given printouts of the most recent QAPP prior to work on the project and directed to the location of the QAPP on the MBMG server.

Records will provide documentation of all activities conducted in the field. Field operation records will include field sampling records, chain of custody records, QC sample records, general field procedures, and corrective action reports. Field sampling records will include documentation of the names of individuals collecting samples, sample site, date, maps and diagrams, equipment and methods used and field observations.

Field notebooks will be used to record depth to water, site conditions, and field parameters. This information will be entered into MBMG Groundwater Information Center (GWIC) database.

Site inventory sheets will be used for all wells not previously sampled by the MBMG and archived in digital form within the MBMG GWIC database. The Site Inventory Sheet or field notebook will be used to record information on site location, well completion details, static water levels, purging parameters to insure that the well has been adequately purged before sampling, and pumping water level, if applicable. Original Site Inventory Sheets will be maintained by MBMG and stored as a permanent part of the project file.

Water samples collected in the field and transported to the lab for analysis will require chain of custody records and QC sample records. Chain of custody records will provide documentation for the progression of samples from the time they are collected in the field to their transport to the lab for analysis. QC records will provide documentation on the integrity of the sample, including preservation, calibration, and standardization. QC records will include an equipment blank and field duplicate samples.

B. DATA GENERATION AND ACQUISITION

B1. Sampling Process Design

Aqueous samples will be collected from 15 monitoring wells (Figure 2). Monitoring wells were chosen based on the general direction of groundwater flow. The groundwater monitoring network consists of one well up-gradient (RMIS-1; sampled once every five years) of the block placement area, four wells within or adjacent to the block placement area (MO-09, MO-26, MO-25, and RMIS-2), six wells immediately down-gradient of the block placement area (MO-10, MO-11, MIS-15, MIS-16, RMIS-4S, and RMIS-5) and four wells on the south side of

the airport (MIS-11A, MIS-11B, MIS-14 and RMIS-8). Table 3 contains information on the 15 wells including well name, elevation, location, casing size and type, as well as total depth and screen interval in feet (ft). Appendix C contains the well log reports where this information was obtained. Table 2 contains the monitoring objectives for each network of wells that will be monitored, while Table 4 contains the sampling frequency for each well network

In addition to the 15 wells being sampled, three Quality Assurance/Quality Control samples will also be collected in the field – two duplicates and one equipment blank. Sampling procedures including sample acquisition methods, locations and ID numbers, sampling objectives, quality assurance/quality control samples as well as shipping and handling arrangements are discussed in the Sampling and Analysis Plan. All historical data collected on the 15 wells through 2012 is contained in Montana's Ground Water Information Center, which is contained within the Montana Bureau of Mines. (www.mbmggwic.mtech.edu)

All wells have Global Positioning System (GPS) locations and will be located using hand-held GPS units when sampling. Also, all wells have been labeled on the well or well cap and labels will be reapplied as necessary. Representatives of both DEQ and EPA will be notified of any well that is not accessible for sampling. If the well has been buried, a surveyor may need to relocate the well.

The annual field work is expected to be completed after groundwater elevations peak, which typically occur during late Spring or early Summer. The dissolved and total recoverable chromium concentrations are the critical data for the project. Secondary data includes pH, SC, temperature, redox, and dissolved oxygen.

The historical and current dissolved and total recoverable chromium concentrations are critical data for the sampling process design. Field data is considered informational data.

Table 3. Groundwater Wells to be Sampled

Well Name	Elevation (ft)	Location	Casing Size and Type	Total Depth (ft)	Screen Interval (ft)
RMIS-1	3575.40	Up-gradient	2-in PVC	18.3	8-18
MO-09	3579.73	West block area	2-in PVC	13	8-13
MO-25	3580.77	East block area	2-in PVC	13	8-13
MO-26	3580.97	Center block area	2-in PVC	14	9-14
RMIS-2	3571.18	Between East & Center block area	2-in PVC	14.5	4.2-14.2
MO-10	3575.33	Down-gradient	2-in PVC	10	5-10
MO-11	3574.62	Down-gradient	2-in PVC	11	6-11
MIS-15	3575.28	Down-gradient	2-in PVC	25.6	9-25.6
MIS-16	3574.36	Down-gradient	2-in PVC	26	5.5-25.6
RMIS-4S	3574.91	Down-gradient	2-in PVC	15.6	5.3-15.3
RMIS-5	3574.21	Down-gradient	2-in PVC	14.9	4.6-14.6
MIS-11A	3572.4	Down-gradient	2-in PVC	18	7.4-17.4
MIS-11B	3572.4	Down-gradient	2-in PVC	28	17.1-27.1
MIS-14	3565.6	Down-gradient	2-in PVC	21.4	6.2-16.2
RMIS-8		Down-gradient	2-in PVC	17.9	7.6-17.6

Table 4. Monitoring Objectives

Well Name	Designation	Objective
RMIS-1	Background Well	Monitor the quality of the groundwater that is unaffected by impacts in the block placement source area and the relevant points of compliance in the down-gradient attenuated plume. Sampled once every five years.
MO-09, MO-25, MO-26, RMIS-2	Block Area Wells	Monitor the water quality impacts from the treated soil cement blocks as the blocks degrade over time and determine if the remaining Cr VI will regenerate a groundwater plume in the future. Source area wells will also serve as the Site's sentinel wells to identify changes in groundwater conditions before observed in down-gradient POC wells.
MIS-15, MIS-16, RMIS-4S, RMIS-5	Points of Compliance	Ensure detection of groundwater contamination in the uppermost aquifer.
MO-10, MO-11, MIS-11A, MIS-11B, MIS-14 RMIS-8	Additional wells	Ensure that the POC wells are representative of aquifer conditions and to compare concentrations with the POC wells

B2. Sampling Methods

MBMG will use established sampling methods for ground-water collection that have been defined in the Clark Fork River NPL Site SOPs (CLRSSI, 1992). Groundwater sampling follows GW-1 with some MBMG modifications. Field log book data entries will follow G-4. Sample handling will follow G-7 with MBMG modifications. All SOPs are contained in Appendix A.

The water levels in wells RMIS-1, RMIS-2, RMIS-5, MIS-15, and MIS-16 will be monitored continuously with Solinst Leveloggers. A Solinst Barologger will be installed in RMIS-2 to allow for the barometric correction of Levelogger data. The loggers will be permanently installed using stainless-steel wires or direct read cables. During site visits the data from the Leveloggers will be downloaded to portable data storage devise and returned to the MBMG offices for processing. Solinst software will be used to process the Levelogger data and correct for barometric pressure fluctuations in accordance with the manufacture's guidelines. The Levelogger data from RMIS-2 will be sent electronically via a telemetry station to the MBMG offices daily. Telemetry transmission failures will result in email notifications to MBMG personnel, so that communication can be reestablished. RMIS-2 will be used to track water level elevations and determine the annual groundwater peak elevation.

Field water-quality parameters will be measured using a Hach Datasonde, which is a multiparameter field instrument including temperature, pH, SC, redox, and dissolved oxygen. The Datasonde will be calibrated in the office prior to each sampling trip in accordance with the manufacture's calibration procedures (http://www.hachhydromet.com/web/ott_hach.nsf/id /pa_home_e.html). Instrument calibration will be documented in the instrument calibration log book, which resides in the MBMG laboratory. The Datasonde calibration will be checked periodically while in the field. Field measurements will be made using a flow-through cell whereby the pump discharge is directed into a closed cell containing the Datasonde electrodes.

Sample containers will be filled following MBMG laboratory guidelines for container labeling, preserving, filling priority, and filtration. In general, all sample containers will be

triple-rinsed with well water prior to filling. The triple rinse is performed with filtered well water for samples that require field filtration. A rinse is considered filling the container at least 1/3 full, swirling and emptying. Three 500 mL polypropylene sample bottles will be collected filled for each sample for total recoverable chromium, dissolved chromium, and general laboratory analyses. Both the total recoverable and dissolved containers will be acidified to below pH 2 with nitric acid at the time of collection. After all sample bottles for each well are filled, the samples are logged into the field notes, and then stored in a cooler with ice until turned over to the MBMG laboratory.

The samples requiring filtration will be filtered directly from the pump discharge line with a disposable 0.45µm acrylic copolymer membrane filter or other suitable media type. When a sample is collected with a bailer, a hand or electric peristaltic pump will be used to filter the sample from the bailer. Sampling pumps and tubing will be decontaminated between wells following the procedures defined in the SOP for this project (Appendix A), which include detergent, tap water, acid and deionized water rinses.

Problems that arise during sampling will be addressed by the field sampling personnel in consultation with the project managers. All sampling personnel have cellular telephones and will use them to contact one of the project managers. The project managers are responsible for deciding on the corrective action necessary to rectify the problem. Problems with the laboratory analysis will be reported to project managers and the laboratory personnel in coordination with the project managers will decide on the necessary corrective action. Problems that cause significant delays or deviations from the sampling plan will be reported in the DEQ or EPA project officers at the time. In general, problems that require corrective action will be reported in either the sampling activity summary report and/or the annual report.

Table 5. List of sampling equipment and consumables

Equipment List	Consumables
Datasonde, surveyor, flow cell	pH buffers, SC standard, Zobell solution
Water level probe	Decon. bottles, paper towels
Tsunami pump and controller	Tubing, decon. tube, decon. solutions (DI water, acid), filters
Peristaltic pump	Tubing, bucket, decon. solutions (DI water, acid), filters
Leveloader and cables	None

B3. Sample Handling and Custody

Sample bottles will be labeled with a waterproof marker. The label will include a site name, GWIC well number, date and time sampled, sampler's initials, and preservative (Appendix A). The sample will be identified by the GWIC well number and duplicate samples will be distinguished by addition of the word "duplicate" after the GWIC number. Chain of custody forms will be filled out by the sampling personnel and the samples will remain in the sampler's custody until they are delivered to the laboratory. Inorganic samples will be stored in a cooler on ice until delivered to the laboratory. Field water-quality data will be entered into the digital sample login page for the MBMG Analytical Laboratory. Laboratory personnel will sign chain of custody forms upon receiving the samples at the laboratory (Appendix A). At the time

the samples are logged into the laboratory they will receive a unique laboratory identification number that will be used by the laboratory personnel to track and report data for the sample. The maximum holding times for total recoverable and dissolved chromium analyses is 6 months.

B4. Analytical Methods

The SOPs for the MBMG Analytical Laboratory are provided in Appendix B. MBMG will use the following methods to conduct laboratory activities; dissolved and total recoverable chromium with EPA methods 200.7/200.8, (MBMG). The MBMG SOPs for the implementation of these methods are provided in Appendix B and includes descriptions of the instrumentation needed and performance criteria. Problems with the laboratory analysis will be reported to project managers and the laboratory personnel in coordination with the project managers will decide on the necessary corrective action. The laboratory turnaround times for chromium analyses shall not exceed 3 months.

The MBMG containerizes laboratory wastes and disposes of the laboratory wastes in accordance with the Chemical Hygiene Plan for Montana Tech Laboratories (Montana Tech, 2010). Inorganic wastes are processed by In-lab Chemical Management Procedures consisting of neutralization and addition of metal precipitants. The liquid is decanted and analyzed prior to disposal in the sanitary sewer. Solids are reposited in an approved metal solid waste holding landfill. Organic liquids are held in approved drums in a storage facility, which are removed annually by a waste-disposal company.

B5. Quality Control

Two field duplicates will be collected during each sampling round. A field duplicate is a sample that is collected from the same location and time period (sequentially) as original sample that is sent to the same laboratory as separate samples. A field duplicate is collected for the purpose of assessing the consistency of the overall sampling and analytical system. Chromium concentrations in the field duplicate water samples should have a relative percent difference of 20% or less. The formula for calculating the Relative Percent Difference is RPD = 100* Absolute Value$(X_1-X_2)/((X_1+X_2)/2)$ where X_1 and X_2 are the two measurements being compared.

One equipment blank consisting of a deionized water sample that is brought to the field in sealed containers, transferred to a sample bottle in the field via a pump or bailer used to collect samples, and then transported to the laboratory with the other sample containers. The equipment blank should be collected after the pump has been decontaminated. Equipment blank results are used to evaluate the artificial introduction of contaminants during the sample collection and handling processes. The chromium concentrations in the blanks should be less than the reporting limit of 0.5 µg/L.

A RPD greater than 20% or chromium concentration greater than 0.5 µg/L in a blank sample shall constitute an exceedance of the control limits. When the control limits are exceeded, the samples will be reanalyzed. If the reanalysis also results in an exceedance, the laboratory and field procedures will be reevaluated by the project managers in consultation with DEQ and EPA project officers to determine an appropriate corrective action. The quality control data, control limit exceedances, and corrective actions will be reported in the annual reports.

B6. Instrument/Equipment Test, Inspection, and Maintenance

Prior to each sampling event, field instruments and equipment are inspected and maintenance records checked to ensure instruments are in good working condition. Reagents are replaced according to manufacturer's recommendations. Batteries and power packs are replaced as needed. The Field Manager maintains a maintenance log book to track scheduled maintenance on all equipment. Copies of owner manuals for instruments and equipment are maintained in the MBMG field laboratory.

Spare or replacement parts for all field measurement instruments and equipment are available directly through the manufacturers, or may be acquired from known, reliable retailers. Replacement equipment and parts will be acquired, if needed, in a timely manner to reduce or eliminate work delays. Replacement parts which are subject to frequent failure or which cannot be acquired from outside sources in a timely manner will be maintained in-house.

The MBMG project manager is responsible for ensuring that all instruments and equipment used by field personnel meet the project quality standards through testing, inspection, and maintenance. Field personnel are responsible for inspecting all field equipment for damage prior to use.

Any instruments or equipment found to be deficient of project quality standards will be replaced, repaired, or re-cleaned. Any replaced, repaired, or re-cleaned instruments or equipment will be subject to the same testing and rigors described above, including documentation, to determine if additional corrective action is required. Field equipment found to be in need of repair or replacement will be clearly labeled and removed from service until such repair or replacement can be made.

Laboratory instrument testing, inspection, and maintenance procedures are discussed in the laboratory SOPs (Appendix B).

B7. Instrument Calibration and Frequency

Field water-quality parameters will be measured using a Hach Datasonde, which is a multiparameter field instrument including temperature, pH, SC, temperature, redox, and dissolved oxygen. The Datasonde will be calibrated in the office prior to each sampling trip in accordance with the manufacture's calibration procedures (http://www.hachhydromet.com/web/ott_hach.nsf/id /pa_home_e.html). Instrument calibration will be documented in the instrument calibration log book, which resides in the MBMG laboratory. Calibration will be re-checked at the end of each sampling event.

B8. Inspection and Acceptance of Supplies and Consumables

The field team leader will monitor supplies and consumables and be responsible for reordering, stocking and preparing all equipment and consumables for fieldwork. The field personnel are responsible for assembling all the equipment and consumables necessary for a sampling trip. The equipment and consumables are listed in Table 5.

B9. Non-direct Measurements

Non-direct measurements were used to prepare for project implementation. These

measurements include previous annual reports developed by MBMG for the 2010, 2011, and 2012 sampling seasons, as well as historic Site data. These data were used to generate additional sampling locations, identify additional chemicals of concern, or to identify additional data gaps. Past sampling experiences at Mouat provide relevant information on expected field conditions and groundwater quality. Considering that these events largely coincide both geospatially and seasonally with the 2013 sampling efforts, the same general resources and facilities used in previous investigations will be used to support the 2013 sampling event. Acceptance criteria for these data sources are outlined in the applicable SAPs. All non-direct measurements were used as qualified in previous reports, with any data identified as unusable omitted from consideration during development of this SAP.

B10. Data Management

Field notebooks will be used to record all the field data following CFRSSI SOP G-4 (Appendix A). Field notebooks will be inspected and initialed by the field technician before leaving the site. At the end of the field work, field notebooks will be submitted to the Quality Assurance manager for review. The Quality Assurance Manager will consult with team members if significant errors or omissions are found.

Field water-quality data will be entered into the digital sample login page for the MBMG Analytical Laboratory when the samples are submitted to the laboratory. These data will be linked with the laboratory data when the laboratory data is released and will be permanently stored in the MBMG GWIC database. The laboratory data is generated in a digital format that is imported to a Laboratory Information Management System (LIMS; LISA.lims, Systat Software Inc.), which is linked directly with the MBMG GWIC database. The GWIC database is maintained on a secure server with off-site backup. The data will be retrievable over the internet from the GWIC site (http://mbmggwic.mtech.edu/). Luke Buckley is the GWIC database manager and he is responsible for maintaining the database. Field notebooks and print outs of the water-quality data will be maintained by the project managers.

C. ASSESSMENT AND OVERSIGHT

C1. Assessment and Response Actions

Review of field activities is the joint responsibility of the Project Manager, Field Sampling Leader, and Quality Assurance Officer. One of these individuals will review site inventory data and field notebooks. Assessment of field activities may occur at any time and without prior notice, and will be documented in the field notebook as well as the sampling activities report. Only authorized individuals may conduct the assessments and it is their role to issue any corrective action or response action to the situation. Minor problems will be addressed on site prior to resuming work. Significant problems may result in a stop work order issued by DEQ until the project officer or designee can resolve the problem.

An independent audit of the MBMG Laboratory is conducted on an annual basis by the Montana Department of Environmental Quality.

C2. Reports to Management

Services provided under this Task Order will begin upon the Effective Date of this Task Order and continue through its expiration date. The Draft SAP is due 15 working days after receipt of draft Data Quality Objectives from DEQ, and the Final SAP due 5 working days after Contractor's receipt of DEQ and EPA comments. The Field Summary Report is due 15 working days after demobilization. The Draft Data Summary, Analysis, and Interpretation Report (DSAIR) is due 20 working days after receipt of all lab data and the Final DSAIR is due within 10 working days of receipt of DEQ and EPA comments. The MBMG project managers are responsible for writing these reports.

D. DATA VALIDATION AND USABILITY

D1. Data Review, Verification and Validation

All data obtained in this project will be reviewed by QA Officer to verify that the data meet QAPP standards for comparability, completeness, accuracy, and precision.

Data will be validated if they meet the following criteria:

- Site Inventory sheets and/or field notebooks are complete
- Site Inventory and laboratory data are validated
- Actual sample locations and collection procedures match the proposed sample locations and collection procedures.
- Sample handling procedures documented on chain-of-custody forms, the field activity report, and case narratives match the proposed sampling handling procedures (e.g., samples were adequately preserved and holding times were not exceeded).
- Field QC was conducted and meets the acceptance criteria.
- If any of the QA samples (calibration or recalibration, a blank, a known, a spike and a duplicate) fall outside of the established acceptance criteria, all of the results from the group or batch will be affected.
- If the calibration or recalibration falls outside acceptance criteria, data for that batch should be rejected, the system recalibrated and samples reanalyzed.

Any deviations from the QAPP are to be reported in the final report and field notebook.

If the data fail to meet the criteria, they will be flagged by the project manager as estimated. Any flagged data will be discussed with the project team to determine if the data will be rejected.

D2. Validation and Verification Methods

Analytical data will be validated for 10% of the results by either the MBMG Laboratory QA Officer or by a designated MBMG Quality Assurance officer outside of the field team. The validation will include reviewing 10% of the samples for 100% of the analytical analysis performed and reported according to the EPA guidelines (U.S. EPA, 2010). The following elements will be reviewed for compliance as part of the abbreviated data validation:

- Holding times
- Calibration
- Blanks
- Spikes
- Duplicates
- LCSs
- Reporting limits
- Analyte identification
- Analyte quantification
- Comparison of instrumental results to electronic data deliverable

D3. Reconciliation with User Requirements

If necessary, the analytical data will be qualified in order to convey the outcome of the data validation process to the end users to help them determine how the data may be applied in subsequent interpretations. The following definitions provide brief explanations of the national qualifiers assigned to results in the data review process (Table 6). If additional qualifiers are needed, then a complete explanation of those other qualifiers will be included in the data review.

Table 6. Laboratory qualifiers and definitions.

U	The analyte was analyzed for, but was not detected above the level of the reported sample Quantitation limit.
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.
J+	The result is an estimated quantity, but the results may be biased high.
J-	The result is an estimated quantity, but the results may be biased low.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting QC criteria. The analyte may or may not be present in the sample.
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise

If data quality indicators do not meet the projects specifications, data may be discarded and resampling may occur. The cause of the failure to meet laboratory and field quality objectives will be evaluated. If the cause is found to be equipment failure, calibration, or maintenance, these techniques will be reassessed and improved. If the problem is found to be sampling team error, team members will be retrained. Any limitations on data use will be detailed in both interim and final reports, and other documentation as needed.

D4. Reconciliation with DQOs

Information obtained from the field investigation will be evaluated through the data quality assessment (DQA) process to determine if the data are of adequate quality and quantity to support their intended use. The DQA process consists of five steps, as summarized below (USEPA, 2006):

1) Review the project's objectives and sampling design: Review the objectives defined during

the systematic planning to assure that they are still applicable. If objectives have not been deployed, specify them before evaluating the data for the projects objectives. Review the sampling design and data collection documentation for consistency with the project objectives observing any potential discrepancies.

2) Conduct a preliminary data review: Review QA reports (when possible) for the validation of data, calculate basic statistics, and generate graphs of the data. Use this information to learn about the structures of the data and identify patterns, relationships, or potential anomalies.

3) Select the statistical method: Select the appropriate procedures for summarizing and analyzing the data based on the review of the performance and acceptance criteria associated with the project objectives, the sampling design, and the preliminary data review. Identify the key underlying assumptions associated with the statistical tests.

4) Verify the assumptions of the statistical method: Evaluate whether the underlying assumptions hold, or whether departures are acceptable, given the actual data and other information about the study.

5) Draw conclusion from the data: Perform the calculations necessary to draw reasonable conclusions from the data. If the design is to be used again, evaluate the performance of the sampling design.

Uncertainty of validated data will be evaluated by DEQ, in consultation with the EPA, to determine if the DQOs were met. In the event that the DQOs were not met, they will be reviewed to determine if they are achievable and may be revised if necessary, and the data may be further evaluated to determine the impact to the project. Data usability and limitations will be evaluated and determined by DEQ.

E. REFERENCES

Clark Fork River Superfund Site Investigations (CLRSSI), Standard Operating Procedures, Atlantic Richfield, September 1992.

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Appendix A. Field Sampling Standard Operating Procedures

STANDARD OPERATING PROCEDURE GW-1

GROUND WATER SAMPLING FOR INORGANICS
SOP GW-1

CFRSSI SOP
September, 1992
Revision 1

STANDARD OPERATING PROCEDURE GW-1

GROUND WATER SAMPLING FOR INORGANICS
SOP GW-1

WELL SAMPLING SEQUENCE

The sampling sequence within a specific site will begin with the well containing the lowest anticipated analyte concentration. Successive samples will be obtained from wells anticipated to have increasing analyte concentration. If the relative degree of suspected concentrations cannot be reasonably assumed, wells will be sampled in order of increasing proximity to the suspected analyte source, preferably from the perimeter towards the center of the site.

WELL PURGING AND SAMPLING

The deep monitoring wells will be purged and then sampled with a submersible pump. The pumping rate will be adjusted to allow a uniform rate of discharge during the purging. The adjustment valve will then be opened up to allow the pump to discharge without back-pressure to minimize oxygenating the water during sampling. Where practical, the shallow wells or wells with a low yield will be purged and sampled using other types of pumps (i.e., bladder, peristaltic or similar pumps). The purge water will be handled in accordance with the site-specific SAP.

Monitoring wells will be purged until a minimum of three well casing volumes have been removed and the water quality characteristics (pH, temperature, and conductivity) have stabilized. Stabilization is achieved when the pH readings stabilize to within 0.1 and temperature and conductivity readings stabilize to within 10 percent over a casing volume.

Before purging each well, determine and record the depth from top of the well casing to top of the water level in the well to the nearest 0.1 foot. Procedures for measuring the depth to water level are presented in SOP GW-5.

The following equations can be used to calculate the three well volumes. The first equation gives the results in cubic feet (V_1), and the second equation gives the results in gallons (V_2):

1. $V_1 = 0.017 * (d*d) * W$
2. $V_2 = 0.13 * (d*d) * W$

Where:

d = the well casing diameter in inches; and

W = the depth of water in the well casing measured in feet, calculated by subtracting the measured depth to water in the well from the total well casing length reported on the well installation details, or by manually measuring the well's total depth. Procedures for measuring the total well depth are presented in SOP GW-5

Example: Monitoring well diameter = 4-inch diameter
Water level = 25.5 feet (below ground surface)
Well bottom = 36.0 feet (below ground surface)

Therefore, the well has 10.5 feet of water.

Using equation 1: $V_1 = 0.017\ (4"*4")\ 10.5'$
$V_1 = 2.86$ cubic feet

Or using equation 2: $V_2 = 0.13\ (4"^2 - 4")\ 10.5'$

$V_2 = 21.8$ gallons

Therefore, 2.86 cubic feet or 21.8 gallons would be the minimum three well casing volumes that need to be purged from this well.

For further details on water level measurements and well casing volume calculations, refer to SOP GW-5.

Appropriate pumping rates determined during development of the well should be used to remove the calculated purge volume. If a well is evacuated during the purge, it will be allowed to recharge until the water level has recovered to 80 percent of the static level or for a period not exceeding 24 hours before sampling. If it has not recovered sufficiently to allow sampling after 24 hours, this well will be noted as "dry" during this sampling event.

To determine if the water in a well originates from the surrounding hydrogeologic formations, the purged water will be sampled every 15 minutes for temperature, pH, and conductivity. Wells will be sampled after pH, conductivity, and temperature have stabilized and within three hours after purging.

The collected ground water samples will be placed in the appropriate types of containers specified in SOP HG-4.

Inorganic analyses will require both filtered and unfiltered water samples. These samples will be prepared using either a Geotech high-capacity barrel filter or a vacuum pump equipped with a 0.45 μm field filter. Refer to SOP SW-5 for guidance on field sample filtration procedures.

The filter flasks will be either glass, stainless steel, or polypropylene. Refer to SOP HG-4 for guidance on appropriate flask material to be used with each sample parameter. Both the filtered and unfiltered samples will be placed in appropriate sample containers.

After all samples have been collected, shut off the sampling pump and withdraw it from the well. Lay down the pump and tubing on the plastic sheeting. Pour clean tap water from a carboy into the end of the discharge tube and work it down to the inside of the pump. Repeat this process and then rinse the tubing and inside of the pump with distilled water. Wash off the outside of the pump and the tubing with a high-pressure spray of clean tap water.

Next disassemble the filtration apparatus and discard the filter. Spray the apparatus thoroughly with dilute nitric acid, making certain that the bed of the pre-filter is completely clean. Finally, rinse the apparatus with distilled water. The rinseate will be handled in accordance with the site-specific SAP.

MBMG Standard Operating Procedures for Collection of Groundwater Samples

A. Well Purging

The wells will be purged using a stainless steel or PVC submersible pump or a PVC, stainless steel, or Teflon bailer. Purging procedures include pumping or bailing standing stagnant water from each well prior to sampling to get a more representative sample of the in-situ ground-water quality. Well purging will be considered finished when at least 3 bore volumes are removed and field parameters (pH, temperature, Eh, and conductivity) have stabilized about the mean of three consecutive readings recorded at 5 minute intervals (temperature $\leq\pm0.5°C$; pH $\leq\pm0.1$; Eh $\leq\pm20$ mV specific conductance $\leq\pm5\%$). When evacuating low-yield wells (wells that are not capable of yielding 3 bore volumes) the well will be evacuated down to the pump, allowed to recover and purged, and then allowed to recover sufficiently prior to sampling. Field parameters on bailed wells will be collected using the instrument's storage cup.

B. Sample Collection

After well purging is completed, water samples will be collected directly from from the discharge hose. A PVC valve and polyethylene tubing may be used to split the flow from the discharging pump to allow collecting samples at an appropriate rate so as to fill the sample containers without excessive turbulence and splashing. For samples collected from a bailer, the water will be transferred to a clean bucket and filtered with a peristaltic pump using clean tubing.

Labeling

Sample bottles will be labeled with a waterproof marker. Sample labels will include; sample identifier, time, preservative, date, sample type and sampler's initials.

Container filling and preservation

Sample containers will be filled following MBMG or NAL laboratory guidelines for container labeling, preserving, filling priority, and filtration. In general, all sample containers will be triple-rinsed with well water prior to filling. The triple rinse is performed with filtered well water for samples that require field filtering. A rinse is considered filling the container at least 1/2 full, swirling and emptying. A nitric-acid preservative is added to the dissolved-metals container to obtain a pH of 2 or less. After all sample bottles for each well are filled, the samples are logged into the field notes, and then stored in a cooler with ice until turned over to MBMG or NAL laboratory.

Filtration

The sample will be filtered directly from the pump discharge line with a disposable 0.45μm acrylic copolymer membrane filter or other suitable media type. When a sample is collected with a bailer, a hand or electric peristaltic pump will be used to filter the sample from the bailer.

C. Sample Handling and Custody

Samples are stored in a cooler with ice while in the field until turned over to the MBMG or NAL laboratory. The following procedure will be followed when turning samples over to the laboratory.

1) Field water-quality data will be entered into the digital sample login page for the MBMG Analytical Laboratory.

2) Sample bottles will be removed from field coolers and aligned in order. Labels will be checked at this time.

3) Chain of Custody record will be filled out to track sample possession from the time of collection to analysis. The time, date and signature of the individual turning over the samples is required, as well as the individual receiving the samples. An example of this form is in appendix A.

D. Equipment Decontamination

Equipment that comes in contact with sample media will be decontaminated in order to avoid cross contamination and preserve sample integrity. Decontamination procedures between sampling events will consist of:

1) Wash equipment with non-phosphate soap
2) Tap water rinse
3) A 1:10 nitric acid rinse
4) Final rise with deionized water

E. Field Quality Assurance Quality Control

Quality assurance procedures include the above-listed methods of sample handing, labeling, documentation, decontamination, and chain of custody following protocols listed in the QAPP. Two field duplicates will be collected during each sampling trip. A field duplicate is a sample that is collected from the same location and time period as original sample that is sent to the same laboratory as separate samples. Field duplicates are collected for the purpose of assessing the consistency of the overall sampling and analytical system. Field duplicate samples should have a relative percent difference of 20% or less.

One equipment blank will be collected for each sampling trip. An equipment blank consists of a deionized water sample that is brought to the field in sealed containers, transferred to sample bottles in the field via a pump used to collect samples, and then transported to the laboratory with the sample containers. The equipment blank should be collected after the pump has been decontaminated. Equipment blank results are used to evaluate the artificial introduction of contaminants during the sample collection and handling processes.

STANDARD OPERATING PROCEDURE G-4

FIELD LOGBOOK/PHOTOGRAPHS
SOP G-4

STANDARD OPERATING PROCEDURE G-4

FIELD LOGBOOK/PHOTOGRAPHS
SOP G-4

FIELD LOGBOOK

A separate field logbook will be used for each field task. Each logbook shall have a unique document control number. The logbooks will be bound and have consecutively numbered pages. The information recorded in these logbooks shall be written in indelible ink. The author will initial and date entries at the end of each day, and a line shall be drawn through the remainder of the page. All corrections will consist of a single line-out deletion in indelible ink, followed by the author's initials and the date. No bound field logbooks will be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document. These bound logbooks, at a minimum, shall include the following entries:

1. A purpose and description of the proposed field task,

2. Time and date fieldwork started,

3. Location and description of the work area, including sketches if possible, map references and photographs, and sketches of well construction details, soils, pits, etc.,

4. Names and titles of field personnel,

5. Name, address, and phone number of any field contacts,

6. Meteorological conditions at the beginning of fieldwork and any ensuing changes in these conditions,

7. Details of the fieldwork performed and field data sheets used (including document control numbers), with special attention to any deviations from the task-specific Sampling and Analysis Plan (SAP) or Standard Operating Procedures (SOPs),

8. All field measurements made,

9. Any field laboratory analytical results, and

10. Personnel and equipment decontamination procedures.

For any field sampling work, at a minimum, the following entries should be made:

1. Sample location and number,

2. Sample type (eg, ground water) and amount collected,

3. Date and time of sample collection,

4. Split samples taken by other parties. Note the type of sample, sample location, time/date, name of person, person's company, any other pertinent information,

5. Sampling method, particularly any deviations from the SOP,

6. Suspected waste composition, including an estimate of the hazard level as being low or medium,

7. Documentation or reference of preparation procedures for reagents or supplies that will become an integral part of the sample (eg, filters and preserving reagents), and

8. Sample preservation, handling, packaging, labeling, shipping information (eg., weight), the shipping agent, and the laboratory where the samples will be sent.

After each day of fieldwork, all the bound logbooks will be locked up in a location accessible to the Quality Assurance Manager, such as the field office filing cabinet.

PHOTOGRAPHS

Photographs will be taken of field activities using a camera-lens system with a perspective similar to the naked eye. Photographs should include a measured scale in the picture, when practical. Telephoto or wide-angle shots will not be used, since they cannot be used in enforcement meetings. The following items shall be recorded in the bound field logbook for each photograph taken:

1. The photographer's name, the date, the time of the photograph, and the general direction faced,

2. A brief description of the subject and the fieldwork portrayed in the picture, and

3. Sequential number of the photograph and the roll number on which it is contained.

The slides or prints and associated negatives shall be placed in task files in the field office after the film is developed. Any supporting documentation from the bound field logbooks shall be photocopied and placed in the task files to accompany the particular slides or prints.

Figure G-4-1 provides a suggested photograph label format for attaching to photographs, or for a photograph logbook.

ARCO-PHOTOGRAPH LABELS

PHOTOGRAPH NUMBER: _____
DATE: _____
TIME: _____
DIRECTION: _____
PHOTOGRAPHER: _____
DESCRIPTION: _____

PHOTOGRAPH NUMBER: _____
DATE: _____
TIME: _____
DIRECTION: _____
PHOTOGRAPHER: _____
DESCRIPTION: _____

STANDARD OPERATING PROCEDURE G-7

SAMPLE CUSTODY
SOP G-7

STANDARD OPERATING PROCEDURE G-7

SAMPLE CUSTODY
SOP G-7

A stringent, established program of sample chain-of-custody procedures shall be followed during field sample collection and handling activities to account for each sample. Preprinted labels will be used to maintain the highest degree of control in sample handling. The preprinted labels (with spaces provided) will ensure that all necessary information is retained with the sample chain-of-custody records, and shipping manifests will be utilized to maintain control over access to the sample destination after shipment from the sample collection site.

SAMPLE CONTROL FORMS

Figures G-7-1, G-7-2, and G-7-3 show the sample label, the field sample data sheet, and the chain-of-custody record, respectively. The use of each of the forms is discussed below.

Sample Label

Each sample collected at the site shall be identified with a sample label. The following information shall be recorded on the label:

1. Project number,

2. Sample type (grab or composite, media sampled),

3. Sample identification (well number for ground water samples, soil boring number,

2. Sample type (grab or composite, media sampled),

3. Sample identification (well number for ground water samples, soil boring number, sample number, and sample depth for soil samples, etc.),

4. Date and time sample was taken,

5. Sampler's name,

6. Sample tag number (a unique serial number stamped or written on each sample label; duplicates and blanks shall be assigned separate sample numbers),

7. Preservative added, and

8. Remarks, including pertinent field observations.

Field Sample Data Sheet

The field sample data sheet is completed in the field and signed by the individual physically in charge of collecting the sample. The field sample data sheet correlates the assigned sample bottle designation to a specific well or sample location, or to other distinguishing features or attributes (i.e., dummy sample, replicate sample, purge evaluation sample, etc.).

Chain-of-Custody Record

Chain-of-custody records ensure that samples are traceable from the time of collection until introduced as evidence in legal proceedings. A sample is in a person's custody if any of the following criteria are met:

1. The sample is in the person's possession,

2. The sample is in the person's view after being in possession,

3. The sample has been locked up to prevent tampering after it was in the person's possession, and

4. The sample was in the person's possession, then was transferred to a designated secure area.

The chain-of-custody record is completed in the field by the individual physically in charge of the sample collection. Figure G-7-4 provides an example of a completed chain-of-custody form. The chain-of-custody record may be completed concurrently with the field sample data sheet or before shipping samples to the laboratory. The sampler is personally responsible for the care and custody of the sample until it is shipped.

When transferring the sample possession, the individuals relinquishing and receiving the sample will sign, date, and write the time of day on the chain-of-custody record. The chain-of-custody record is enclosed with the sample after it has been signed by the sampler.

The chain-of-custody record also serves as the laboratory request form. As shown on Figure G-7-3, a space is included on the form to list the analyses requested for each set of samples.

DRAWING NUMBER 89-121-A103

Contractor's Name
Contractor's Address

Project No.

Sample Type

Sample No.

Preservative

Remarks

Sampler Date/Time

SITE NAME

Tag No.

SAMPLE LABEL
PREPARED FOR
ARCO
ANACONDA, MONTANA

No.	DATE	ISSUE / REVISION				
4	4-2-92	ISSUED FOR CLARK FORK RIVER SUPERFUND SITE STANDARD OPERATING PROCEDURES	WJI	DEM	RAN	
3	8-8-90	ISSUED FOR CLIENT/AGENCY REVIEW	P.J.H.	H.M.B.	R.A.P.	

DATE: 8-8-90
SCALE: N.T.S.

FIGURE G-7-1

DRAWING NUMBER 89-121-A103

ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement

CHAIN OF CUSTODY RECORD

PROJ NO.	PROJECT NAME					NO. OF CONTAINERS		REMARKS
SAMPLERS (Signature)								
STA NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION			

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

CHAIN-OF-CUSTODY RECORD FORM

FIGURE G-7-3

7-5

Canonie

Field Sample Data

PROJECT No. _____
PAGE _____ OF _____

PROJECT NAME _____ SAMPLED BY _____
STATION No./LOCATION _____ DATE _____

SKETCH ON BACK YES ☐ NO ☐ PHOTOGRAPHS YES ☐ NO ☐ ROLL No./EXPOSURE No. _____

FIELD DATA

TIME _____ AIR TEMP. °F _____ WEATHER _____

WELL DEPTH _____ WATER DEPTH _____ SAMPLE DEPTH _____ SAMPLE METHOD _____

VOL. PURGED _____ SAMPLE TEMP. _____ °C ☐ IN SITU ☐ IN BOTTLE SP. COND. _____ / _____ AT 25° C ☐ IN SITU ☐ IN BOTTL

pH _____ ☐ IN SITU ☐ IN BOTTLE Eh _____ ☐ IN SITU ☐ IN BOTTLE DISSOLVED O_2 _____ ppm ☐ IN SITU ☐ IN BOTTL

BOTTLE ID	LAB ID	VOL	MATERIAL	FILTERED	PRES./VOL.	ANALYSIS REQUESTED

FIELD PARAMETERS:

_____ GALLON pH- _____ EH- _____ TEMP. _____
_____ GALLON pH- _____ EH- _____ TEMP. _____
_____ GALLON pH- _____ EH- _____ TEMP. _____

REMARKS: _____

FIELD EQUIPMENT QUALITY ASSURANCE CHECKLIST

pH METER BUFFER CHECK pH 4 _____ pH 7 _____ pH 10 _____
SP. COND. METER STANDARDS CHECK _____ Eh PROBE _____
PUMP TUBING RINSED _____ CHANGED _____ SAMPLER BLANK _____
FILTRATION BLANK WITH PRES. _____ FILTERS ACID WASHED _____

FIGURE 7-2

ENVIRONMENTAL PROTECTION AGENCY
Office of Enforcement

CHAIN OF CUSTODY RECORD

PROJ. NO. 12-3456 | PROJECT NAME # 0123

SAMPLERS: (Signature) John Samples

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	Total Metals	Cyanide						REMARKS: ITA	REMARKS: Tag #
001	9/26	9:00		X	LOC-ST-010	2	X	X						M61301	S-102501
														"	S-102502
002	9/26	11:00		X	LOC-ST-011	2	X	X						M61302	S-102503
														"	S-102504
003	9/26	14:00		X	LOC-ST-012	2	X	X						M61303	S-102505
														"	S-102506
004	9/26	15:00		X	LOC-ST-013	2	X	X						M61304	S-102507
														"	S-102508
005	9/26	16:00		X	LOC-ST-014	2	X	X						M61305	S-102509
														"	S-102510

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
John Samples	9/26 16:00				
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time	Remarks	
		Mary Sunshine	9/27 10:00	CASE # 1000 Fed. Ex. # 123456789 Custody Seals # 0123 ; 0123	

Distribution: Original Accompanies Shipment; Copy to Coordinator Field Files

COMPLETED CHAIN-OF-CUSTODY RECORD FORM

FIGURE G-7-4

MBMG Standard Operating Procedures for Collection of Groundwater Samples

A. Well Purging

The wells will be purged using a stainless steel or PVC submersible pump or a PVC, stainless steel, or Teflon bailer. Purging procedures include pumping or bailing standing stagnant water from each well prior to sampling to get a more representative sample of the in-situ ground-water quality. Well purging will be considered finished when at least 3 bore volumes are removed and field parameters (pH, temperature, Eh, and conductivity) have stabilized about the mean of three consecutive readings recorded at 5 minute intervals (temperature $\leq\pm0.5°C$; pH $\leq\pm0.1$; Eh $\leq\pm20$ mV specific conductance $\leq\pm5\%$). When evacuating low-yield wells (wells that are not capable of yielding 3 bore volumes) the well will be evacuated down to the pump, allowed to recover and purged, and then allowed to recover sufficiently prior to sampling. Field parameters on bailed wells will be collected using the instrument's storage cup.

B. Sample Collection

After well purging is completed, water samples will be collected directly from from the discharge hose. A PVC valve and polyethylene tubing may be used to split the flow from the discharging pump to allow collecting samples at an appropriate rate so as to fill the sample containers without excessive turbulence and splashing. For samples collected from a bailer, the water will be transferred to a clean bucket and filtered with a peristaltic pump using clean tubing.

Labeling

Sample bottles will be labeled with a waterproof marker. Sample labels will include; sample identifier, time, preservative, date, sample type and sampler's initials.

Container filling and preservation

Sample containers will be filled following MBMG or NAL laboratory guidelines for container labeling, preserving, filling priority, and filtration. In general, all sample containers will be triple-rinsed with well water prior to filling. The triple rinse is performed with filtered well water for samples that require field filtering. A rinse is considered filling the container at least 1/2 full, swirling and emptying. A nitric-acid preservative is added to the dissolved-metals container to obtain a pH of 2 or less. After all sample bottles for each well are filled, the samples are logged into the field notes, and then stored in a cooler with ice until turned over to MBMG or NAL laboratory.

Filtration

The sample will be filtered directly from the pump discharge line with a disposable 0.45μm acrylic copolymer membrane filter or other suitable media type. When a sample is collected with a bailer, a hand or electric peristaltic pump will be used to filter the sample from the bailer.

C. Sample Handling and Custody

Samples are stored in a cooler with ice while in the field until turned over to the MBMG or NAL laboratory. The following procedure will be followed when turning samples over to the laboratory.

1) Field water-quality data will be entered into the digital sample login page for the MBMG Analytical Laboratory.

2) Sample bottles will be removed from field coolers and aligned in order. Labels will be checked at this time.

3) Chain of Custody record will be filled out to track sample possession from the time of collection to analysis. The time, date and signature of the individual turning over the samples is required, as well as the individual receiving the samples. An example of this form is in appendix A.

D. Equipment Decontamination

Equipment that comes in contact with sample media will be decontaminated in order to avoid cross contamination and preserve sample integrity. Decontamination procedures between sampling events will consist of:

a. Wash equipment with non-phosphate soap
b. Tap water rinse
c. A 1:10 nitric acid rinse
d. Final rise with deionized water

E. Field Quality Assurance Quality Control

Quality assurance procedures include the above-listed methods of sample handing, labeling, documentation, decontamination, and chain of custody following protocols listed in the QAPP. Two field duplicates will be collected during each sampling trip. A field duplicate is a sample that is collected from the same location and time period as original sample that is sent to the same laboratory as separate samples. Field duplicates are collected for the purpose of assessing the consistency of the overall sampling and analytical system. Field duplicate samples should have a relative percent difference of 20% or less.

One equipment blank will be collected for each sampling trip. An equipment blank consists of a deionized water sample that is brought to the field in sealed containers, transferred to sample bottles in the field via a pump used to collect samples, and then transported to the laboratory with the sample containers. The equipment blank should be collected after the pump has been decontaminated. Equipment blank results are used to evaluate the artificial introduction of contaminants during the sample collection and handling processes.

Appendix B. Laboratory Standard Operating Procedures

MBMG Analytical SOP 06

Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Mass Spectrometry (ICP-MS)EPA Method 200.8

Revision: 01
Effective Date: 07/01/2013

Reviewed by:

Jacqueline Timmer
Chemist
Date

Steven McGrath
Chemist
Date

Approved by:

Steven McGrath
Acting Director
Date

1.0 Scope and Application:

This procedure covers the use of the Thermo X II inductively coupled plasma-mass spectrometry (ICP-MS) in the determination of low (µg/L) concentrations of elements in natural water, drinking water and waste water according to the US EPA method 200.8. Many of the analytes included in a routine analysis are not specifically covered in the EPA method, but the Quality Assurance protocols of the method are applied to these as well.

Analysis of dissolved constituents requires that samples be filtered through a 0.45 µm or smaller membrane and preserved with acid at 1% v/v prior to analysis. Acid-digestion prior to analysis is required for groundwater, waste water, soils, sludges and sediments for which acid leachable metal concentrations are desired. For determination of total recoverable constituents, unfiltered acid preserved aqueous samples or solids must be digested by US EPA method 200.2 prior to analysis. Instrument detection limits, sensitivities and linear ranges will be affected by the matrices and operating conditions.

The analyst must be familiar with the potential interferences characteristic of plasma mass spectrometry, as discussed below. Also, the analyst must be familiar with the use of internal standards in compensating for matrix effects on the aspiration of the sample into the plasma. The internal standard elements must span the entire mass range from low atomic mass to high atomic mass because each region may be affected differently. The internal standard suite used in the MBMG laboratory consists of the isotopes ^{6}Li, ^{45}Sc, ^{72}Ge, ^{115}In, ^{159}Tb and ^{209}Bi. The internal standard solution is added using a mixing tee when the sample is introduced into the plasma rather than by pipette into each sample test portion. Care must be taken to monitor internal standard responses which may indicate that a background concentration of one or more of the isotopes occurs in the sample. In that case, alternative isotopes may have to be chosen. Also, the internal standard response may drift during analysis and frequent recalibration may be required. In practice, Li is very difficult to use, mainly because of the characteristics of the quadrupole mass filter which discriminates against lower masses. The instrument has difficulty detecting the difference between ^{6}Li and ^{7}Li.

2.0 Interferences:

The most common types of interferences encountered in this method are:

1. Isobaric polyatomic species created in the plasma which may have the same mass to charge ratio (m/z) as the analyte. Commonly these are oxides of elements in the sample. The most troubling example of this type is the $ArCl^{+}$ species which interferes with the determination of ^{75}As.

2. Doubly charged ions may be formed at the same m/z as one of the analytes. An example of this kind of interference would be ^{150}Nd on ^{75}As.

Historically, correction equations have been determined to counter these interferences. Recent developments in instrument technology have eliminated the need for several of these corrections.

The use of collision cell technology in kinetic energy discrimination mode (KED) all but eliminates the need for polyatomic isobaric corrections. MBMG analytical methods utilize both the standard mode and KED mode simultaneously by switching modes during a single determination. Also, a chilled spray chamber is used to reduce the vapor pressure of solvent entering the plasma to minimize the formation of oxide species. Tuning scripts during instrument setup reduce the formation of oxides and doubly charged species. Some correction equations are still utilized, however.

Physical interferences can be encountered in the nebulization process if the dissolved solids loading of the samples is greater than 2000 ppm. The Specific Conductance of the sample is used as a guide to dictate a dilution schedule. Only those dissolved samples having an SC below 1000 μScm^{-1} are analyzed without dilution.

Memory interferences can occur if analysis of concentrated samples precedes analysis of dilute samples through deposition on instrument components. Dilution of samples minimizes the possibility for excessive deposition.

3.0 Analytes:

A list of routine analytes and their principal analytical masses are shown in Table 1. This list exceeds the number of elements included in EPA Method 200.8. The suggested principal masses are listed in the reference method and in various Thermo Elemental Application Notes [1 – 3] for the X II instrument.

Table 1. Analyte list and principal isotopes. Additional monitored isotopes shown.

Element	Symbol	m/z		
Silver	Ag	107	109	
Aluminum	Al	27		
Arsenic	As	75		
Barium	Ba	137	135	
Beryllium	Be	9		
Cadmium	Cd	111	106	114
Cobalt	Co	59		
Chromium	Cr	52		
Copper	Cu	63	65	
Mercury	Hg	202		
Manganese	Mn	55		
Molybdenum	Mo	98		
Nickel	Ni	60	62	
Phosphorous	P	31		
Lead	Pb	206		
	Pb	207		
	Pb	208		
Antimony	Sb	121	123	
Selenium	Se	82	78	
Thorium	Th	232		
Thallium	Tl	205	203	
Uranium	U	238		
Vanadium	V	51		
Zinc	Zn	66	67	68
Calcium	Ca	44		
Iron	Fe	56		
Potassium	K	39		
Magnesium	Mg	25		
Sodium	Na	23		
Lithium	Li	7		
Titanium	Ti	49		
Gallium	Ga	71		
Rubidium	Rb	85		
Strontium	Sr	88		
Zirconium	Zr	90		
Niobium	Nb	93		
Palladium	Pd	105		
Tin	Sn	118		
Antimony	Sb	121		
Cesium	Cs	133		
Barium	Ba	137		
Lanthanum	La	139		
Cerium	Ce	140		
Praseodymium	Pr	141		
Neodymium	Nd	146		
Tungsten	W	182		

4.0 Instrumentation:

The Thermo Series X II instrument is shown schematically in Figure 1. Liquid samples are introduced as a vapor cloud after nebulization into an argon plasma where singly charged ions are formed from the dissolved elements. The cloud of ions exiting the plasma is sampled through the orifice of a cone into the expansion chamber and a fraction of these are skimmed through a smaller skimmer cone into the extraction lens. This extraction lens has a negative voltage applied and directs ions onto the lens stack.

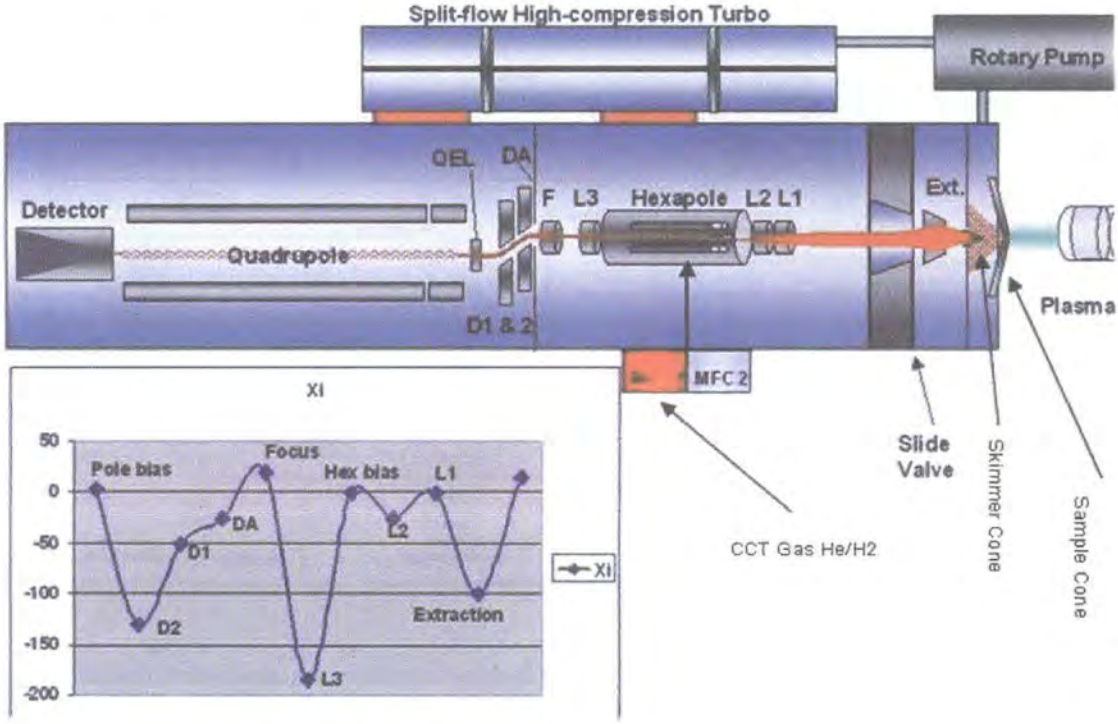

Figure 1 Schematic of X-Series ICPMS System. Typical lens voltages are shown in graph.

The lens pair L1 and L2 focuses the ions into the collision cell, which contains a hexapole electrode operating in RF mode. The rotating field causes the ion stream to spiral, increasing the probability of collisions. CCT gas consisting of 93% He and 7% H2 is admitted to the collision cell when operating in KED mode. L3 has a strongly negative potential to straighten out the ion beam into the focus lens, F. This lens operates at a slightly positive potential to screen out low energy ions. The Analyzer Chamber begins at the Differential Aperture (DA), a small portal which allows a lower pressure to be maintained inside the measuring portion of the instrument. Lenses D1 and D2 move the beam off axis to prevent energetic ions from having a line-of-sight trajectory to the detector, thus resulting in lower off-peak background counts. The Pole bias is the DC potential at which the Quadrupole Mass Filter resides. It is held slightly positive to filter low energy ions from entering the analyzer. The net result of these steps is to provide a narrow distribution of kinetic energy to the ions in the beam so that the quadrupole filtering is efficient. The quadrupole itself is an array of four cylindrical electrodes, two of which have an RF field applied and two of which have a DC potential applied, both of which are ramped in voltage at a

constant proportion during a scan. The combination of these fields presents a stable trajectory configuration for a particular m/z at a particular combination of RF and DC. As the RF/DC potentials are changed during the course of a run, all of the m/z in the analytical range are individually able to pass through the filter and be counted.
Samples are introduced to the plasma using ESI OneFAST™ technology, as shown schematically in Figure 2.

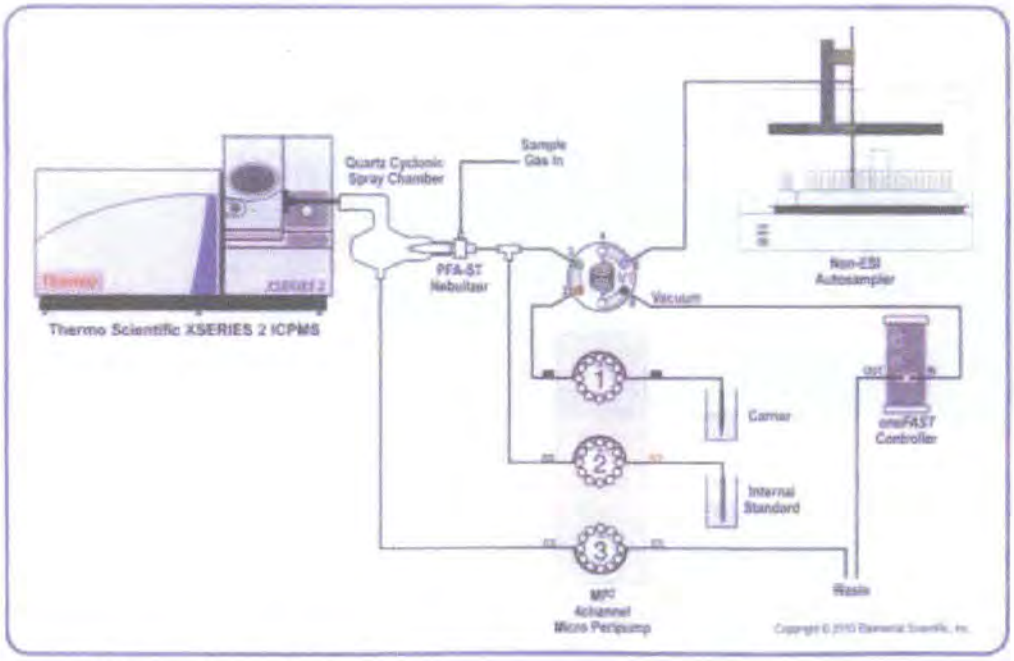

Figure 1 ESI sample introduction system.

The entire sample path is contained in inert fluoropolymer tubing, which permits lower carryover between samples. Even elements such as mercury can be analyzed in this way. A sample loop is switched in and out of the flow path by a software-controlled inert valve. Sample is loaded into the loop through a probe. A carrier solution (1% Nitric Acid) pushes the sample out of the loop and into the nebulizer, which converts the stream into a fine aerosol. The nebulizer sprays the aerosol into a chilled cyclonic spray chamber which removes the larger droplets and cools the aerosol. This cooling minimizes the formation of oxides in the plasma caused by reaction with the solvent vapor. Internal standard is added to samples by pumping and is mixed with the sample in a T prior to the sample entering the nebulizer. The ratio of IS to Sample/Carrier is 1:4. A reservoir of Carrier Solution and one of Internal Standard Solution should be replenished before an analytical run. The spray chamber is emptied by pumping. All streams are pumped by the same 4-channel Micro Peripump. The tubing should be changed after every two analytical runs. Immediately following a run, the peri pump should be opened and the tubing released from the pump.

5.0 Other Equipment:

Calibrated automatic pipetters
5 mL
1 – 5 mL
1 mL
0.5 mL
0.02 – 0.2 mL
0.1 mL
Denver MXX-412 top loading balance
Disposable pipet tips
Acid-washed polypropylene centrifuge tubes
Various HDPE bottles for storage of working standards.
Liquid argon gas supply (99.99%)

6.0 Reagents and Standards

6.01 Reagents

1. Reagent water is 18 megohm water purified in the laboratory and is used for all solutions.
2. Trace Element Grade Nitric Acid diluted to 1% (v/v) and 2% (v/v) for blanks and dilution of standards and samples. It is also used in the digestion procedure for Total Recoverable elements.
3. Ultrapure Hydrochloric Acid is used in the digestion procedure for Total Recoverable elements.

6.02 Standards

1. Calibration Standard Stock Solutions are purchased from recognized vendors. Currently, the lab purchases a QC Standard 7 and a QC Standard 21, commonly available EPA Method standards, along with two other custom standards A and B for ICPMS. Standard A contains 100 µg/mL of Nb, Sn W and Zr in 5% HNO_3 (v/v) and Standard B contains 100 µg/mL of Ce, Cs, Ga, La Nd, P, Pd, Pr, Rb and U in 5% HNO3 (v/v). These are diluted to make a calibration standard concentrate which is further diluted, along with a Th standard to make the calibration standards.
2. Thorium Stock Standard is a single element standard at 1000 µg/mL.
3. Internal Standard Stock solutions can be purchased from several vendors. The elements are in the stock solution at concentrations of 100 µg/mL and must be diluted to 50 ng/mL.
4. CRDL Stock Standard is a QC Standard that evaluates the detection limits of the environmentally important analytes according to EPA Method 6020 CLP M. The same standard is used for ICP-OES and ICP-MS. For MS, the stock 100 µg/mL must be diluted 100 X and then 250µL of the dilution is diluted to 50 mL.
5. ICSA and ICSAB are standards that evaluate matrix interference effects from high concentrations of interfering ions on the response of trace elements. Known concentrations of interferrents such as chloride, iron, calcium, molybdenum are contained in ICSA. The interferrents and the trace elements are contained in ICSAB. Results from ICSA should be below detection limit for trace element analytes, while ICSAB results should show the trace elements at their fortified

concentrations. These two standards verify that interferences such as $^{35}Cl^{16}O^{+}$ on $^{51}V^{+}$ and $^{40}Ar^{35}Cl^{+}$ on $^{75}As^{+}$ are either eliminated or corrected for in the interference equation.

6. Independent Calibration Verification/ Quality Control Standard Set is identical to the Calibration Standard suite, except that it originates with another vendor, a "second source".
7. Calibration Blank is a 1% (v/v) trace metal grade nitric acid solution.
8. Reagent Blank is a 2% (v/v) trace metal grade nitric acid solution and a 1% (v/v) ultra pure hydrochloric acid solution.
9. Rinse Blank is a 2% (v/v) trace metal grade nitric acid solution.

6.0.2.1 Dilutions Required for Calibration Standards

A 100 mL master calibration standard is made from the solutions 7,21,A and B ,mentioned previously, according to the dilutions in Table 2. Dilution should be made in 2% nitric acid to insure the stability of the standard.

Table 2. Master Calibration Standard preparation.

	STOCK STANDARD 2000 ng/mL			
	Volume of Standard: 100 mL. (grams) **Name**	**mL Volume**	100	**Concentration in Stock ng/mL**
A	7	2.00	Bring to 100.0g with 1% HNO3	2000
B	21	2.00		2000
C	A	1.00		1000
D	B	1.00		1000

All dilutions are made by mass, rather than volume. No correction is made for density, as the effect would only be seen in the third decimal place of the final concentration. At 25°C, the density of 1% nitric acid solution is 1.00241 g/mL, while a 10% nitric acid solution is 1.0523. The final mass should be held to less than 1.0% deviation from the nominal value, e.g., 9.90< – < 10.10 for a 10 mL final volume.

The thorium calibration stock standard is made by dilution of the stock standard above by diluting 0.5 mL in 50 mL of 1% (v/v) nitric acid.

The five calibration standards are prepared from this master standard and from the thorium standard according to the dilutions in Table 3. The values shown are for 100 mL of calibration standard. The standards are diluted in 1% (v/v) HNO3. Note that the more common elements are at twice the concentration of the trace elements. Mercury is also shown to be included, but that element is analyzed only when requested.

Table 3. The dilution schedule for the five calibration standards.

STANDARD	Trace Elements and Th	STOCK 2000/1000 ng/mL	Stock Hg 0.05 ng/mL	Stock Th 10,000 ng/mL	Bring to 100.0 g with 1% HNO3	Trace Elements	
ug/L	ug/L	Vol (mL)g	Vol (mL)	Vol (mL)		Ce	Pr
0	0	0.00	0.00	0		Cs	Rb
20	10	1.00	1.00	0.100		Ga	U
100	50	5.00	5.00	0.50		La	Nb
200	100	10.00	10.00	1.00		Nd	Sn
1	0.5	A 100X dilution of 100				P	W
						Pd	Zr

The 100 Mid Range Standard is used as the Continuing Calibration Verification Standard (CCV/IPC) and it is helpful to make larger quantities. If 200 mL of the standard is made, then double the amount of stock shown in the table.

6.0.2.2 Laboratory Control Standards

Standards for monitoring the routine performance of the instrument come from two sources:

- USGS Reference Trace Element Standards
- ERA Quality Control and Performance Evaluation Standards

Typically, standards from both sources are included in analytical runs. These standards are also used as the LCS in the total recoverable digestions.

7.0 Sample Collection, Preservation and Handling

Preservatives for both dissolved and total recoverable samples are supplied by the laboratory in screw capped vials.

7.0.1 Samples for Dissolved Constituents:

Samples for dissolved constituents should be filtered at the time of collection through a 0.45 µm or smaller membrane into a sample bottle provided by the laboratory and preserved with acid at 1% v/v.

7.0.2 Samples for Total Recoverable Constituents:

Samples for total recoverable constituents should NOT be filtered. The sample should be collected in a plastic bottle provided by the laboratory and preserved with acid at 1% v/v. The digestion procedure for total recoverable constituents is covered under EPA Method 200.2. The digestion is carried out in a Modblock™ block digester in disposable 75 mL polypropylene

beakers. The beakers should be allowed to settle for 24 hours before pipetting dilutions for the instrument. If samples have visible sediment, the digestion should be carried out in a DigiPREP™ Digester from SCP Science. The samples can be filtered with a 0.45 µm membrane filter prior to pipetting a test portion.

8.0 Operation of the Instrument for the Performance of an Analysis

8.0.1 Analyzing Samples:

8.0.1.1 Preparation of Samples and Standards:
Both dissolved and total recoverable samples have to be diluted in 1%(v/v) nitric acid prior to analysis on the ICP-MS. The only exception is for dissolved samples having a specific conductance less than 1000 μScm^{-1}. These can be analyzed neat. Two dilutions are analyzed for each sample. A dilution schedule for both total recoverable samples and dissolved samples is given in Table 4. All dilutions are performed on the basis of mass in 10 mL acid washed centrifuge tubes using a top loading balance with 0.01 gram precision. Again the tolerance for final dilution mass is 9.90<mass<10.10.

Table 4 Dilution schedule for dissolved and total recoverable samples

	Dissolved		Total Recoverable	
SC µS cm-1	DFA	DFB	DFA	DFB
<1,000	1	5	2.5	5
1,000<SC<2,500	2.5	10	5	10
2,500<SC<3,500	5	50	5	50
3,500<SC<10,000	10	100	10	100
SC>10,000	50	500	50	500

Calibration standards and other QC check samples should be prepared prior to starting the instrument. The QC standards that must be included in every analysis include:

ICV- (Initial Calibration Verification) made the same as the 100 ng/mL calibration standard, except that the stock solution is sourced from a different vendor.

CCV-(Continuing Calibration Verification) is the mid-level calibration standard.

CRDL- (Contract Required Detection Limit)- a standard in which concentrations are at the level required by EPA for contract laboratories. The included elements are those on the EPA list. The MS CRDL Stock solution is made by diluting the CRDL stock standard 10x and then serially diluting 250µL in 50 mL . The test solution is made by diluting the MS CRDL stock solution 100x.

ICSA- (Interference Check Sample A)- contains ppm levels of common matrix elements such as Fe, Ca and Cl which cause interferences with the determination of analytes. Trace elements should not be detected in this solution if corrections are made. The test solution is made by diluting the stock standard 100x.

ICSAB- (Interference Check Sample AB)- contains the same interferents as above, but with trace elements fortified at low concentrations. The elements should report at their nominal concentrations if interferences are being corrected. The test solution is made by dilution the stock standard 100x.

LFB-(Laboratory Fortified Blank)-is 10 mL of a 1% nitric acid solution fortified with 250 µL of Calibration Stock Standard and 50 µL of Thorium Stock Standard, which provides a 50ng/mL solution of fortified analytes.

LCS-(Laboratory Control Sample)- Both USGS Reference Standards and ERA Quality Control Standards or Performance Evaluation Standards are analyzed. The USGS standards are run without dilution. The ERA samples must be diluted from stock solutions as per instruction.

MD- (Method Duplicate)- another test portion of a sample treated in the same manner as the original and from which a reproducibility of results can be calculated.

LFM-(Laboratory Fortified Matrix)- a sample fortified with 250 µL of Calibration Stock Standard and 50 µL of Thorium Stock Standard, which provides a 50ng/mL solution of fortified analytes.

MDL-(Method Detection Limit)- the test solution is made by a 100X dilution of the 100 µg/L CCV solution into nine 10 mL sample tubes, which are diluted to 10.0 mL. These are included in every analytical run.

8.0.1.2 Optimizing the Instrument Settings for Analysis:

Prior to starting the instrument, the peristaltic pump tubing must be secured in the pump. Inspect the tubing to see if any flat spots have developed and replace the tubing if it exhibits signs of fatigue. It is easier to start the instrument if the Internal Standard and Carrier probes are in a dry test tube. Refer to the ***X-Series ICPMS Starting Guide*** pp 1 – 3 for instructions on starting the instrument. When the plasma is successfully ignited and the nebulizer channel has been established in the plasma, the peristaltic pump will start to turn. At that point, place the probes in a test tube of 1% nitric acid and allow the instrument to warm up. NOTE: Make sure the oneFAST valve is in bypass, as shown in Figure 2. After the instrument has warmed up for thirty minutes, the optimization process can be carried out.

Optimization of signal could be performed manually, but the autotune scripts are easy to use and vary the possible setting through the range of values to find the optimum. These scripts can be edited to achieve particular signal characteristics, if desired. The routine sequence for optimizing the instrument is given in Table 4.

For more information on the autotune procedures, see p 10 in the ***X-Series ICPMS Starting Guide.*** The performance report script is covered on p 30 of the guide. The tuning procedures, the cross calibration and the Method 200.8 Perfromance Report must have successfully passed before an analysis can be conducted.

Table 1 Tuning and calibration procedures required to analyze samples

Tune, Performance Check and Detector Calibration Sequence		
Step	**Procedure**	**Solution**
1	Xt (stage alignment)	Tune A (10 ppb)
2	200.8 Perf Chk	Tune A w/ 10 ppb Mg
3	Detector Cross Cal	Tune D at 50 ppb
4	KED Tune	Tune A w/50 ppm Ca

8.0.1.3 Creating a New Experiment in Plasmalab

The experiment is a file that contains all the information the instrument needs to analyze samples, i.e., the masses to be measured, acquisition parameters, calibration method and list of samples. This file can be created from scratch, from an existing experiment or from a template. A template usually has all the information saved except for the list of samples to be analyzed. Several templates are stored in the system. Always use the most recent version of a template because improvements may have been made in the acquisition parameters over time. Simply fill in the sample table and change any other parameters and save the experiment under a unique name. This can be done prior to starting and optimizing the instrument. The layout of the sample table is discussed in Section 8.0.1.5.2.

Specific information about creating an experiment can be found in the ***X-Series ICPMS Starting Guide*** starting on p 57. When all the information necessary to run the experiment has been entered, save the experiment under a unique name of the form FYXXXYY, where FY are the last two digits of the current Fiscal Year, XXX is the abbreviation for the month and YY is the day of the month. When the experiment is ready to be analyzed, the Queue icon should be selected. A dialog will open and one of the dialog boxes asks what action should be taken upon completion of the experiment. In most cases, one would want the instrument to return to the vacuum condition, but one can choose to have the instrument remain in run mode, as well. Prior to Queuing the experiment, however, the proper configuration of data acquisition must be selected.

8.0.1.4 Configuring Data Acquisition

After tuning the instrument, the correct tune files must be chosen for data acquisition. Under the Setup Tab, choose Configuration, as in Figure 3. Uncheck earlier tune files by clicking on the left hand check mark. Check on the empty box of the Xt tune file most recently used as the first or main acquisition method. Secondly, click on the most recently tuned KED tune file. Be sure to add a 30 second delay for the second acquisition method to allow the CCT gas flow to stabilize.

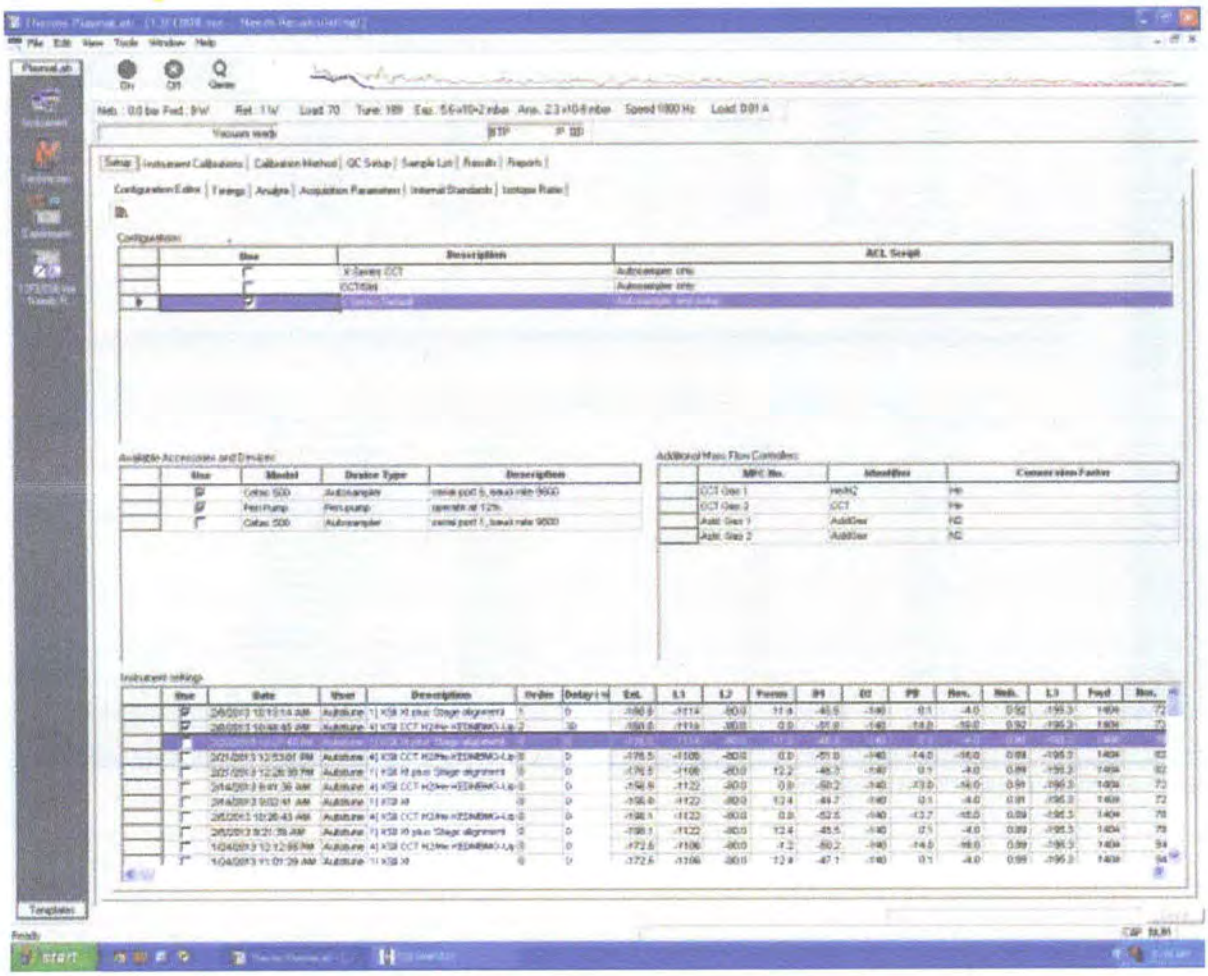

Figure 2 Choosing the correct tune files in Setup

Next, under Acquisition Parameters, individual isotopes are designated for acquiring data under a particular set of tune conditions. Currently 56FE, 75As, 77Arcl and 78Se are run using KED discrimination, as shown in Figure 4.

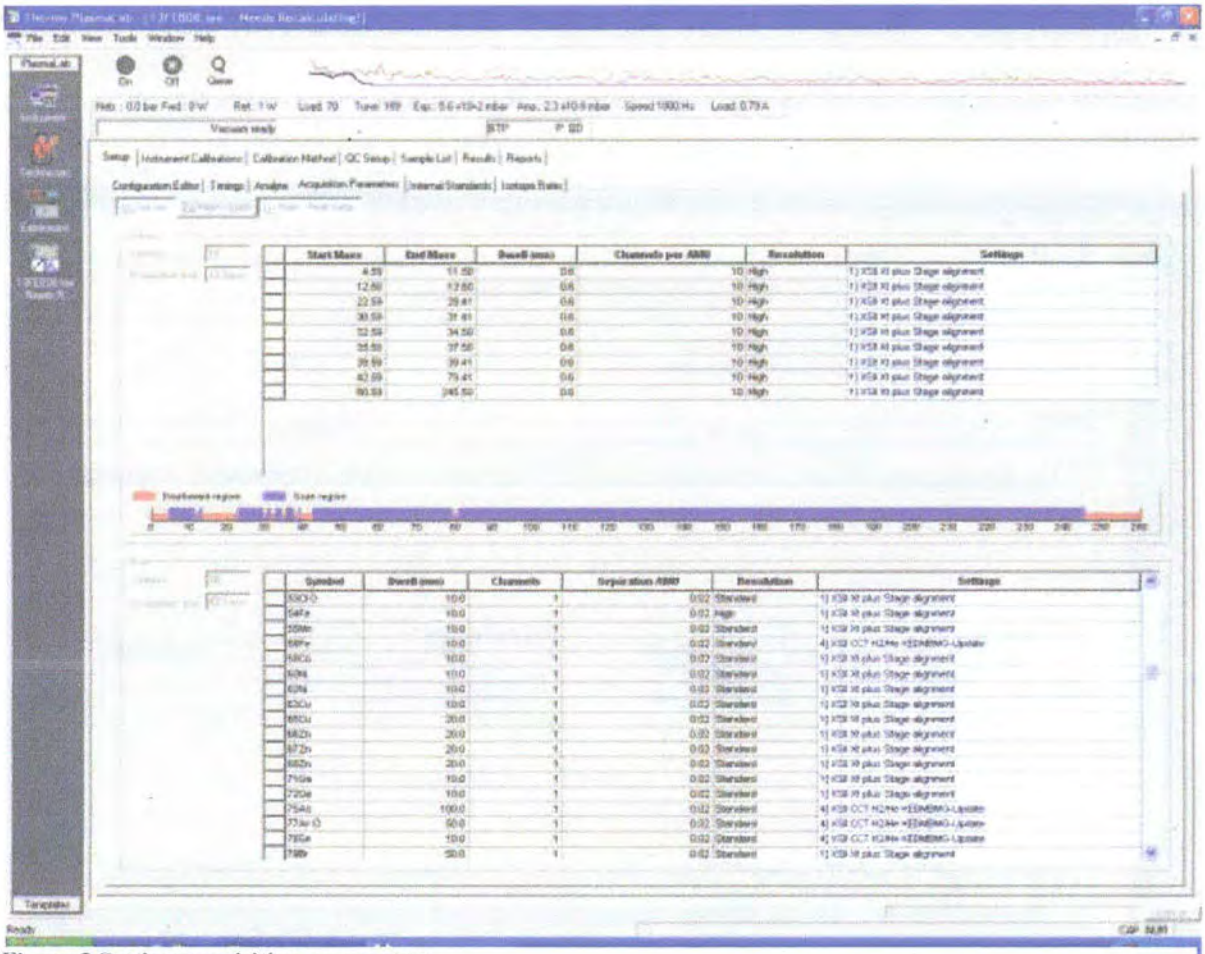

Figure 3 Setting acquisition parameters

8.0.1.5 Configuring the oneFAST™ for Sample Analysis For proper operation, the oneFAST software must control the autosampler. Open the ESI software screen and make sure that the FAST Control Enabled box is checked, as in Figure .

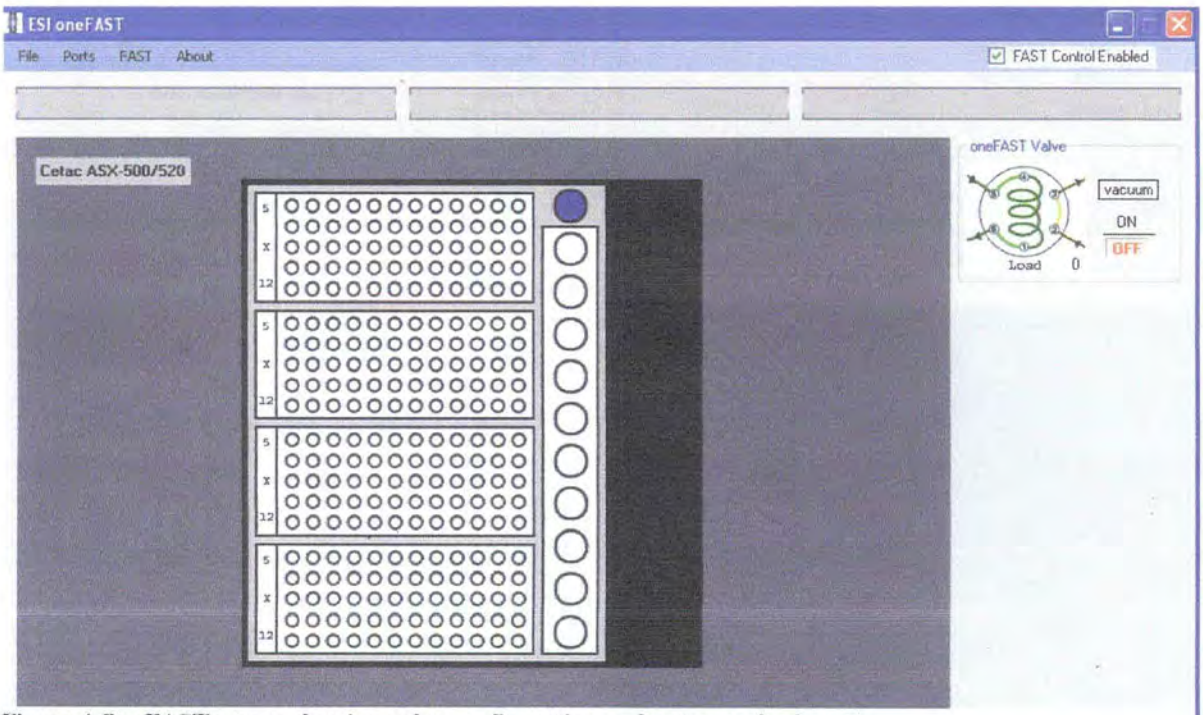

Figure 4 OneFAST screen showing valve configuration and autosampler layout

Under FAST, make sure the proper script file is selected, as seen in Figure 6 . This can be programmed to perform various functions during the analysis. Start with the most recent version of ONEFASTAB and make edits to improve performance of the method as you see the opportunity.

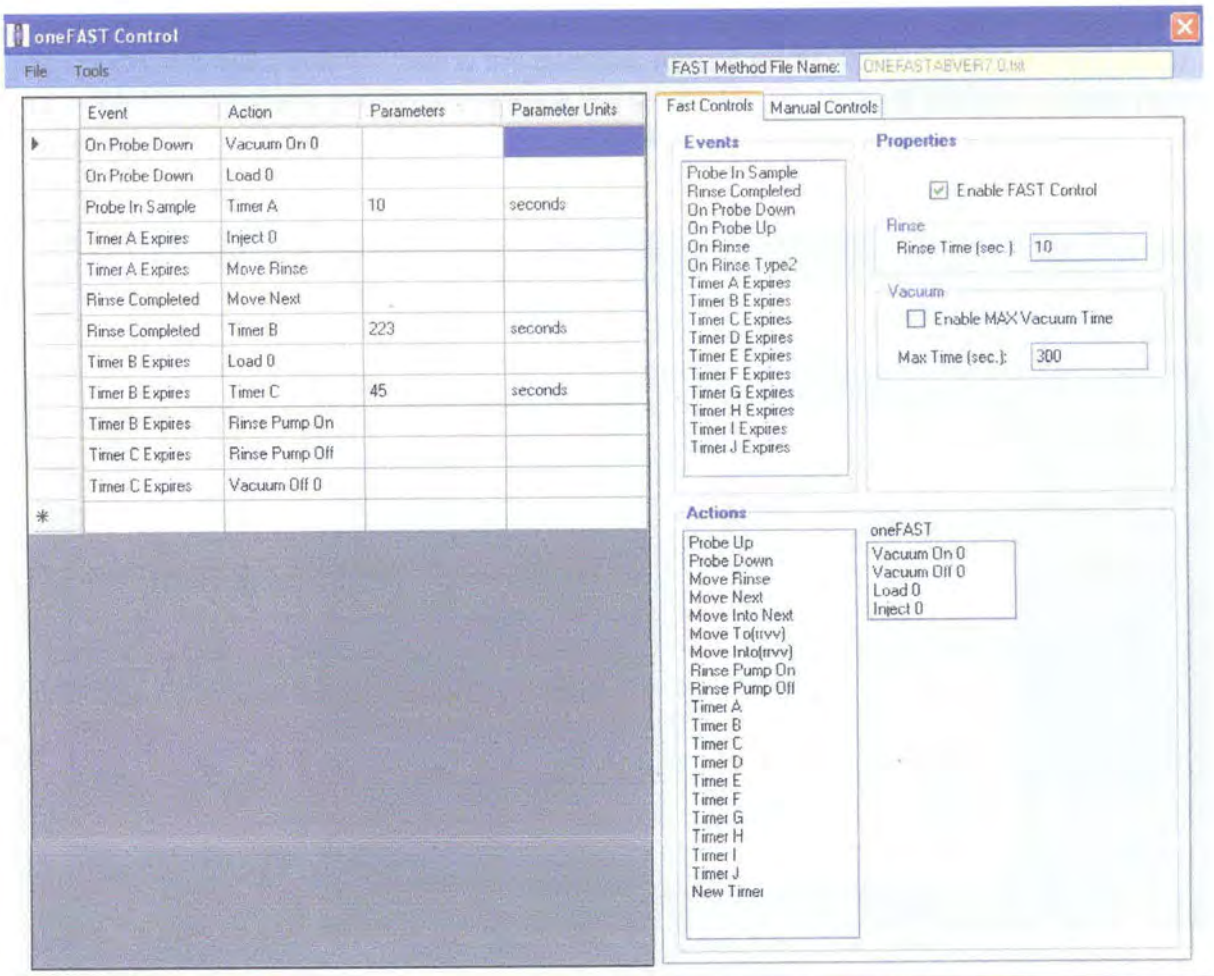

Figure 5 FAST script

8.0.16 Collection of Data

8.0.1.6.1 Demonstration of Initial Capability

Prior to Queuing the experiment, the instrument tune procedures and performance report must have passed. The tune and performance reports should be printed and archived. The experiment can then be loaded and the analysis started. To load the experiment, click on the Queue icon. The first samples run are intended to demonstrate the initial capability of the instrument. These are shown in Table 6.

Table 2 Initial demonstration of analytical capability for an analytical run

Identifier	Name	Purpose	Frequency	Limits
ICV/QCS	Initial Calibration Verification/Quality Control Sample	Checks accuracy of calibration with second source standard	Post initial calibration	90 - 110 % recovery
LRS	Linear Range	Verifies linearity of cross calibration	Post initial calibration	90 - 110%
ICSA	Interference Check Sample A	Verifies that high concentrations of interferrent elements do not produce uncorrected signals for interferred analytes when those analytes are absent.	One per 24 hours	
ICSAB	Interference Check Sample B	Verifies that high concentrations of interferrent elements do not enhance signals of small concentrations of interferred analytes.	One per 24 hours	
LFB	Laboratory Fortified Blank	Checks recovery of analytes from blank	1 per analysis	85 - 115% recovery

8.0.6.1.2 Analysis of Samples

After the samples intended to demonstrate instrument readiness have been analyzed and the results have been verified to be within the control limits, the remaining samples can be analyzed. The autosampler template is laid out according to the sequence:

CCV
CCB
SAMPLE1
SAMPLE2
SAMPLE3
SAMPLE4
SAMPLE5
SAMPLE6
SAMPLE7
SAMPLE8
SAMPLE9
DRIFT
CCV
CCB

The CCV and CCB are continuing calibration verification samples and the DRIFT allows drift compensation during the run.

Results can be viewed while the run is in progress in the Results Tab of the Experiment. Both Numeric and Calibration Data can be viewed. The REFRESH icon must be pressed to see the recently acquired data. After completion of the run, the software will save all the data and they will be visible in Results.

Calibration data can be edited by including or excluding individual responses by clicking on the point in the plots. Refer to pp 73 through 79 in the ***X-Series ICPMS Starting Guide***. Any of these changes can be made after the run is complete. The data can be reprocessed.

8.0.1.6.3 Quality Control

During the analysis, a variety of standards and special samples are analyzed and limits imposed. Additionally, the Internal Standard response is monitored. These standards and their limits are given in Table 7.

Table 3 Summary of Method QC requirements

Identifier	Name	Purpose	Frequency	Limits
CCV	Continuing Calibration Verification	Continuing check of calibration accuracy and drift	Every 10 analyses and at the end of the run	90 - 110%
CCB	Continuing Calibration Blank	Continuing check of blank level	Every 10 analyses and at the end of the run	No specific requirements
LFM	Laboratory Fortified Matrix	Checks recovery of analytes from blank	1 per 10 samples	70 - 130% recovery
LRB	Laboratory Reagent Blank	Monitors reagent contamination	1 per 20 TOREC	No specific requirements
TRI CS	Total Recoverable Laboratory Control Sample	Measures recovery of analytes from sample with certified concentrations of analytes	1 per 20 TOREC	70 - 130% recovery
TRD	Total Recoverable Duplicate Sample	Measures precision of analyte concentrations due to sample preparation and analytical errors	1 per 20 TOREC	20% Relative Per Cent Difference
TRS	Total Recoverable Spike Sample	Measures recovery of analytes from digested sample.	2 per 20 TOREC	70 - 130% recovery
ISTD	Internal Standard Sc Ge In Tb Bi	Corrects for matrix effects	Every analysis	60 - 125% of Calibration Blank response

The last requirement is the most important. For an analysis to qualify as a 200.8 run for drinking water, the ISTD requirement must be strictly met. If the ISTD response is out of control, affected **samples must be reanalyzed.**

For routine MBMG analyses, if any QC requirement is violated, the data reviewer may choose to include the data in the report and qualify the reported concentrations in the Lab Remarks section of the GWIC report (see Section XX).

8.0.1.6. 4 Method Detection Limit Determination

The Method Detection Limit (MDL) is determined at the end of every analytical run. Seven replicate 100X dilutions of mid-range calibration standard are analyzed and the standard deviation calculated. The MDL is calculated as:

$$MDL = 3.14 \times Standard\ Deviation$$

This figure is used to filter data prior to export to the LIMS system. Concentrations less than the MDL are exported as 0.00 values. MDL values are adjusted in the LIMS according to the average MDLs quarterly.

The Method Reporting Limit (MRL) is taken as:

$$MRL = 5 \times MDL$$

Data that appear in GWIC are qualified as "estimated" if the concentration falls between the MRL and the MDL, ad as "undetected" if the concentration falls below the MDL.

8.0.17 Saving Raw Data

The final data report is generated in .XML format under the Reports tab. Click on the refresh icon to generate the report. Make sure Dilution Corrected Concentration is selected as the output choice. Refer to pp 81 – 83 in the ***X-Series ICPMS Starting Guide*** for additional information about data collection and reporting. The report is exported to the LABDATA directory, as shown in Figure 7.

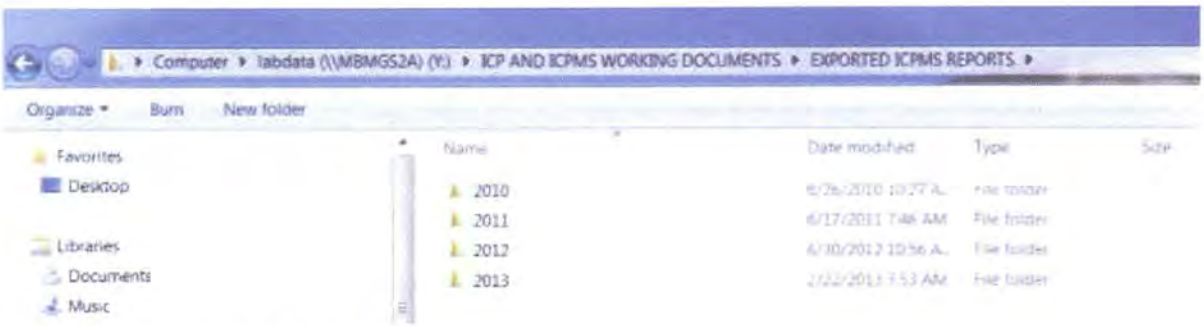

Figure 6 Directory for export of report file

Choose the appropriate FY Directory to store the file.

8.0.1.8 Importing into Excel Spreadsheet and Manipulation of Data

Open the ICP-MS directory, as shown in Figure 8, and open the latest Fiscal Year directory. Open the MSTEMPNEW file. The first worksheet is the location to paste the .xml file from the exported report. Open the report file that had just been exported. Open the .xml file and place the cursor inside the body of the file. Right click to Select All and right click again to Copy. Then Paste the file into the A1 cell of the first worksheet of the template.

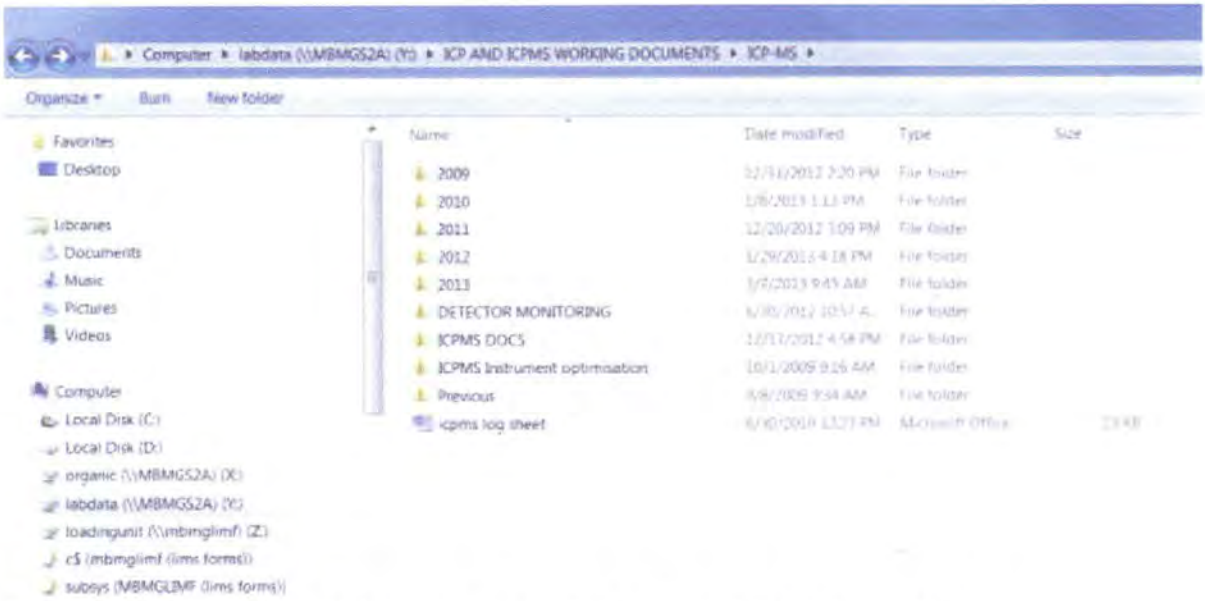

Figure 7 ICP-MS directory which contains the template for importing data from an MS run

The template contains several worksheets necessary to evaluate the quality of the data and to transform the data into a format acceptable for importing in the LIMS software. These are shown in Figure 9.

a. XML FILE – report file is pasted into first worksheet
b. IMPORTED DATA- relevant records are stripped out from the .xml file as formulae
c. PARSE-the sample name in the report is a concatenated string containing the sample name, time, date and dilution factor. The first column of the imported data is copied into the PARSE worksheet as VALUES. Using the data parsing function and selecting underscore _ as the delimiting marker, three columns of data are generated
d. FILE-the sample labels, date and dilution factors are copied into columns 1,2 and 4 of the FILE worksheet. The numeric data from the IMPORTED DATA worksheet are copied and pasted as values into the ILE worksheet
e. DRIFT CORRECTED-using the returned values of the DRIFT samples, an average drift correction factor is calculated for every ten samples. The corrected concentration is given by:

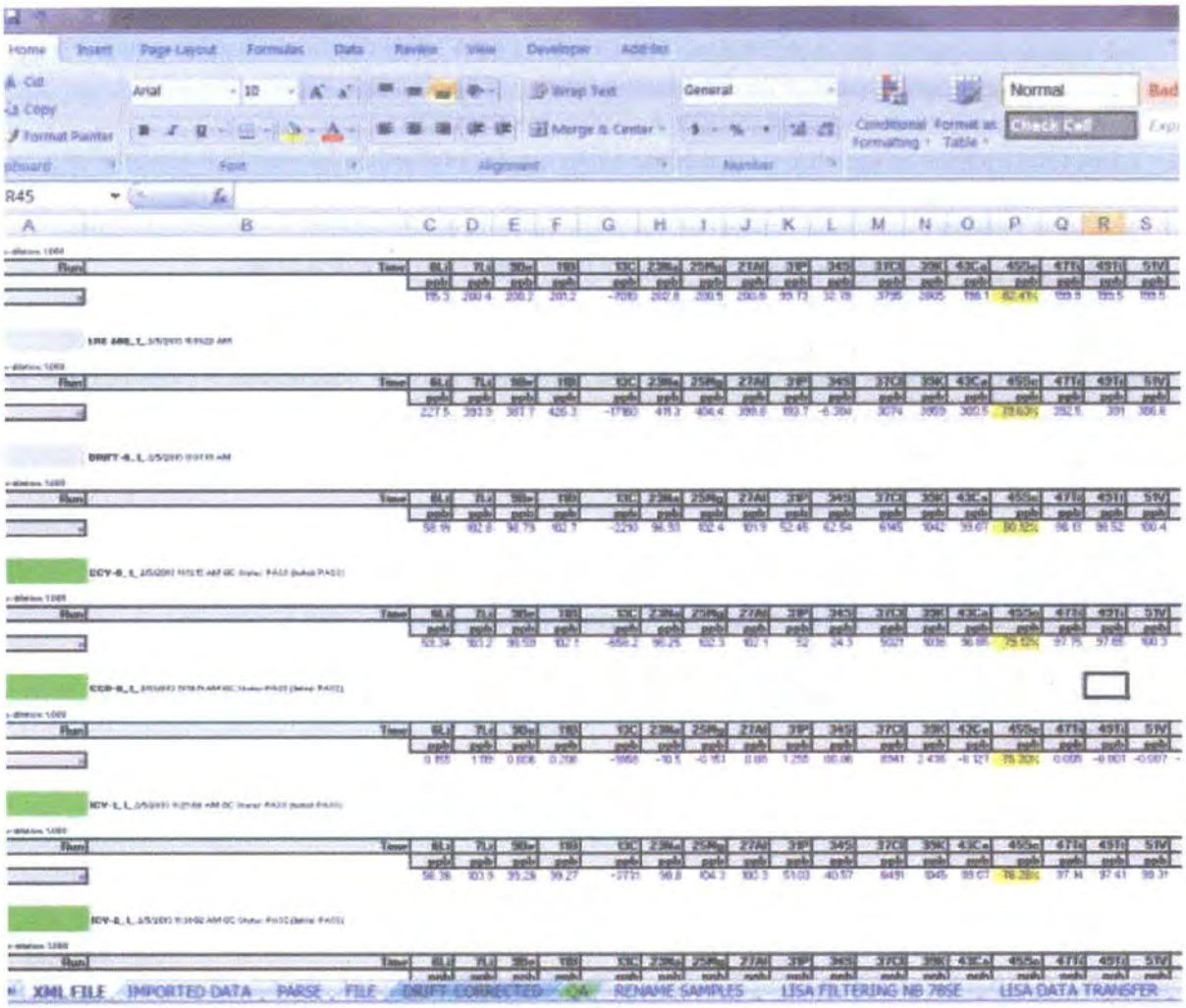

Figure 8 Template file for data import and manipulation

$$C_c = C \times DF$$

Where DF is the Drift Correction given by:

$$DF = \frac{CCV}{Average(D_i, D_j)}$$

Where CCV is the numeric value of the CCV standard and D_i and D_j are succeeding pairs of responses for the Drift samples.

f. QA-is the worksheet where the reported responses for each analyte are evaluated for compliance with QC guidelines

g. RENAME SAMPLE- the sample name used to identify samples on the instrument is actually an abbreviated label. The sample name required by the LIMS contains the full order name and the sub sample designation for each dilution. The CONCATENATION function is used to string together the appropriate parts of the final sample label. Each subsample requires the same format. Examples are: 13-00214-001#DFA, 13-00214-001#DFB.

h. LISA FILTERING- in the FILE worksheet an MDL is calculated using the replicates analyzed at the end of the experiment as in Section 8.0.1.6.4. These values are then copied into the first row of the FILTERING worksheet. Reported concentrations less than the MDL are reported as 0.00, while those above are left unchanged. These are the values exported to the LIMS.

i. LISA DATA TRANSFER- the filtered data are copied as values from the FILTERING worksheet into the DATA TRANSFER worksheet. The Se82 data must be compared with the Se78 data for each subsample. If Se is greater than 2 µg/L, the Se78 value is used. The number is copied from Se78 into the Se82 column. After these substitutions have been made, the entire Se78 column is deleted. ***It is imperative that this column be removed before the data is transferred to LISA.***

References

1. EPA Method 200.8, 1994, Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma-Mass Spectrometry Revision 5.4 EMMC Version
2. Application Note 40722, Thermo Fisher Scientific, 2007, USEPA Method 200.8 using the X-Series II ICP-MS.

MBMG Analytical SOP 07

Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma-Optical Emission Spectroscopy (ICP-OES)
EPA Method 200.7

Revision: 01
Effective Date: 07/01/2013

Reviewed by:

Jacqueline Timmer Chemist	Date
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Approved by:

Steven McGrath Acting Director	Date

STANDARD OPERATING PROCEDURE FOR ANALYSIS OF METALS AND TRACE ELEMENTS ON THE iCAP 6000 SERIES ICP-OES

SCOPE

Major metals and trace elements are analyzed by Inductively-Coupled-Plasma-Optical-Emission-Spectroscopy according to the protocols described in EPA Method 200.7. The instrument employed is a radial-view Thermo Scientific iCAP 6000 Series. This Standard Operating Procedure is an internal document subject to revisions that improve the efficiency of analysis and/or the quality of data produced, as defined in the governing method.

ANALYTE LIST

The reportable elements from ICP-OES analysis on the iCAP appear in Table 1 along with the analytical wavelengths used. Yttrium is used as an internal standard, which is pumped in with all standards and samples.

Table 4 Element Wavelengths

Element	λ Å	Element	λ Å
Al	3944	Mg	2852
Al	3961	Mn	2576
As	1890	Mo	2020
B	2497	Na	5889
Ba	4554	Na	5895
Be	3130	Na	8183
Ca	1840	Ni	2316
Ca	3179	P	1859
Cd	2288	Pb	2203
Co	2286	Sb	2068
Cr	2677	Se	1960
Cu	2247	Si	2516
Cu	3247	Sr	4077
Cu	3273	Ti	3349
Fe	2599	Tl	1908
Fe	2714	V	2924
K	7664	Y	2243
Li	6707	Y	3710
Mg	2790	Zn	2138

PREPARING STANDARDS AND SAMPLES

Calibration Standards

Standards used for calibration broadly fall into two categories:

≤5 μg/mL for trace elements and major metals;

>5 μg/mL for major metals.

Table 5. iCAP Calibration Standards

iCAP ICP CALIBRATION STANDARDS

Volume of Standards: 100 mL (grams)

			Metals		
	mL	mL	mL	mL	
	S7	S21	P[A]	Na ,K ,Ca, Mg, Fe, Al	
S1	1.00	1.00	0.400		
S2	5.00	5.00	2.00	0.500	
BLANK					1% HNO_3

A P Standard 40 mL (grams)
P 1.00 mL of 10000 ug/mL standard

Standards 7 and 21 are stock multi-element standards at 100 ug/mL

All elements are 10,000 ug/L stock solutions.

DILUENT IS 1% HNO_3

Table 2 summarizes the makeup of all standards. Standard 7 and 21 are commercial blends of seven and twenty-one elements respectively. For calibration, SPEX® standards are used, while for calibration verification, AnChem® standards are used to make up the ICV. The P solution is made by diluting 1.00 mL of P stock standard to 40.0 mL (g) in a 50 mL centrifuge tube.

QC Standards

Compliance with EPA Method 200.7 and the associated CLP protocol requires that a number of standards be run to verify the calibration and performance of the instrument prior to analyzing unknown samples. These consist of the ICV, ICSA, ICSAB, the MDL Check, and the LFB samples, which are analyzed prior to unknowns. These are summarized in Table 3, along with the recipe for formulation. **Note that the MDL Check stock standard is a 10X dilution of the CRDL1-100 standard provided by suppliers.** Analyze the LL ICP standard nine times at the end of a run.

Laboratory Control Samples

At least one LCS should be run per 20 samples analyzed. These can be any of the Laboratory Performance samples received from ERA or the USGS, or a specially ordered QC check sample with known concentrations.

Table 6. QC Standard Formulations

QC STANDARDS ICP					
ACRONYM	NAME	Vol (mL)	WORKING STOCK STANDARD	Vol (mL)	DILUENT
CCV	Continuing Calibration Verification	100	Std 7, Std 21, P	2.50, 2.50, 1.00	1% HNO_3
CCB	Continuing Calibration Blank		Same as Blank		
CCVH	Continuing Calibration Verification	100	Na, K, Ca, Mg, Fe, Al	0.250	1% HNO_3
ICV	Independent Calibration Verification	100	AnChem S7 and S21	5.00, 5.00	1% HNO_3
ICB	Independen ICalibration Verification		Same as Blank		
MDL Check	Method Detection Limit Check Sample	10	CRDL stock standard	0.100	1% HNO_3
ICSA	Interference Check Sample A- contains high concentrations of interferents Al Fe, Ca 500 mg/L Mg 200 mg/L	10	ICSA Stock	1.00	1% HNO_3
ICSAB	Interference Check Sample AB- contains high concentrations of interferents and low concentrations of trace elements	10	ICSA Stock (1.00) plus B stock	0.100	1% HNO_3
LFB	Laboratory Fortified Blank- a spike into a water blank	10	Std 7 and 21	0.100, 0.100	1% HNO_3
LFM	Laboratory Fortified Matrix - a typical sample matrix to which a spike is added	10	Std 7 and 21	0.100, 0.100	Sample
LL ICP	Accuracy of overlap w/ ICPMS verified	100	Std 7 and 21	0.250, 0.250	1%HNO_3
LRS 100	Linear Range Standard	50	Na, K, Ca, Mg, Fe, Al	0.500	1% HNO_3

Bring to 10.0 or 100.0 g with diluent

Unknown Samples
Fortified and Duplicate Samples
During the analyses, MD (Duplicate) and LFM (Fortified) samples must be run at a frequency of 1 per 10 samples.

Sample Storage, Preservation, and Preparation for Analysis
Samples are collected in high density polyethylene (HDPE) bottles as described in a project sampling and analysis plan (SAP). Preservation and storage are prescribed by EPA Method 200.7 as trace metal grade HNO_3 at 1% v/v.

For the determination of the dissolved elements, the sample must be filtered through a 0.45 µm pore diameter membrane filter at the time of collection or as soon thereafter as practically possible. (Glass or plastic filtering apparatus are recommended to avoid possible contamination. Only plastic apparatus should be used when the determinations of boron and silica are critical.) Use a portion of the filtered sample to rinse the filtration device, discard this portion, and collect the required volume of filtrate. Acidify the filtrate with nitric acid immediately following filtration to pH <2.

For the determination of total recoverable (TR) elements in aqueous samples, samples are **not** filtered, but acidified with nitric acid to pH <2 (normally, 3 mL of (1+1) acid per liter of sample is sufficient for most ambient and drinking water samples). Preservation may be done at the time of collection; however, to avoid the hazards of strong acids in the field, transport restrictions, and possible contamination it is recommended that the samples be returned to the laboratory within two weeks of collection and acid preserved upon receipt in the laboratory. Following acidification, the sample should be mixed, held for 16 hours, and then verified to be pH <2 just prior withdrawing an aliquot for digestion.

Total Recoverable Sample Preparation
Digestion of a 50 mL aliquot is performed in a plastic tube (purchased from CPI) in a digestion block under the hood. The sample is shaken and added to the volume mark in the digestion tube. One mL of concentrated trace metal grade nitric acid and 0.5 mL of concentrated OPTIMA grade hydrochloric acid are added. The temperature is set to 85° C until the volume reaches 25 mL. The tubes are covered with watch glasses and the temperature is increased to 90°C for 30 minutes. Upon completion, the tubes are cooled and brought to volume with deionized water.

Samples are ready for analysis when they have been appropriately diluted.

OPERATING THE iCAP 6000 SERIES USING iTEVA™ SOFTWARE
Click on the iTEVA icon to open the software. A dialog box will ask for a user name. The default user name is ***admin***. Access is not password protected.

Once in the software, click on the ***Analyst*** window. You have to choose the method to use. The method is saved at the beginning of each month and a new version saved after each use. The

methods are named MON_FY, e.g., JAN2012. The cursor has to be placed in the leftmost column of the table next to the method name to select the method.

Once in the method, three tabs can be seen at the bottom of the screen:

Analysis: Space for running system optimization samples and viewing results;
Method: Contains all the operating parameters and analyte list. Look under elements to view wavelengths, integration parameters, camera alignment, calibration curves;
Sequence: Provides a map of the autosampler trays and a table to enter sample ID. The full capabilities of the software are discussed in the iTEVA™ Software Manual.

Entering Sample Information into the Sequence Table
Once all the appropriate dilutions have been made to the samples and the necessary QC samples have been made, it is convenient to enter the appropriate information into a Sequence. The method has to be previously chosen, as described above. First, an AUTOSESSION is created or loaded. An Auto-session consists of one or more Sequences.

To begin an Auto-session, activate the **Sequence** tab in Analyst and choose **Auto-session** from the menu bar. Click **New Autosampler**. Click the *New* button in the window that opens. You can now create a new list or import a text file to create a list. To create a new list, select the radio button **Create New List and Auto-increment Samplename**. Enter the number of samples you wish to analyze and click *OK*. Check the **Shut Down Plasma** box under Conclusion. If a text file has already been exported, you can select **Import from Delimited Text File** instead of Create New List.

When the new Auto-session opens, it can be expanded to reveal a list of samples in the left column. Clicking on a sample will bring up a table into which all of the samples and QC samples can be entered. The format for entering sample names is to enter the sample label, followed by an underscore, followed by the dilution factor, e.g., 12-00252-001_1. This format allows easy parsing of data after completion of the run. More samples can be added by clicking the *Add Samples* icon.

The view can be toggled back and forth between the table and map of the autosampler racks by clicking the *List View* button near the top of the screen. This allows the location of samples and standards in the table to be located on the rack by dragging and dropping from the column on the left. Once all the samples have been entered and located, the **sequence should be saved as a unique name**. The convention for naming a file is FY_MON_Day, e.g., 12JAN20. Prior to beginning analysis, the instrument must be warmed up and the camera optimized.

PREPARING INSTRUMENT
Several steps must be taken to prepare the instrument for analyzing samples.

Cooling the Camera
The camera is a CCD chip and operates at a temperature of around -30° C. Argon must be purging the system before engaging the Peltier cooler. Verify that argon pressure to the instrument is 80 psi. Turn on the chiller by pressing the power button on the front.

Warning: If the camera is cooled without argon flowing, the detector will be damaged beyond repair at a cost of $30K.

Cleaning Nebulizer and Spray Chamber
Open the plasma access door. Remove the drain tube fitting on the bottom of the spray chamber. Separate the argon quick disconnect from the nebulizer. Disconnect the nebulizer from the tubing by unscrewing the end. Unclip the spray chamber from the torch base.

Remove the nebulizer. If the nebulizer appears to be blocked, use the PFA kit to remove obstructions. Soak in 20% HNO_3 if particularly dirty. For normal cleaning, methanol can be forced through the nebulizer with a syringe. Rinse spray chamber in 5% HNO_3 followed by DI water.

Insert the nebulizer back into the spray chamber and clip the spray chamber back onto the torch base. Reconnect all of the tube fittings.

Making Rinse Solution
Check the waste bottle to insure enough capacity is available. If the bottle is full, it should be emptied into a waste carboy for neutralization and metal removal prior to disposal.
Make up a bottle of rinse. The bottles have a capacity of 8 L and require 5% v/v HNO_3, so 400 mL of trace metal grade acid is added to the bottle and 18MΩ DI water filled to the mark.

Making Internal Standard
Internal standard is made in a 500 mL volumetric flask. Pipet 250 µL of 10000 µg/mL Yttrium standard into the flask. Fill to the line with 1% HNO_3.

Attaching Peristaltic Pump Tubing
Prior to igniting the plasma, the peristaltic pump tubing should be arranged and clamped into place. There are three windings to prepare:

White-White-spray chamber drain
Black-Black-nebulizer feed from autosampler
Orange-Green-nebulizer feed from internal standard

Thread the tubing into the clamp and push clamp into place. As viewed from the front, the pump rotates counter-clockwise; make sure that the peristaltic tubes are joined to their respective feed and destination tubes correctly. The feed direction would be from the right and the destination on the left.

Close the plasma access door.

STARTING INSTRUMENT

Opening the Plasma Status Dialog Box

Clicking on the small icon on the bottom menu bar in **Analyst** that looks like a small flame will open the plasma dialog box. Click on the Instrument Status button to show the interlocks and instrument temperatures. If any interlock is red then the plasma will not light. Check the temperatures to make sure they are satisfactory:

Camera Temperature: -46.00°C ± 2
Generator Temperature: 15.0°C
Optics Temperature: 38°C ± 0.5

If all the interlocks are green the Instrument Status light will be green in the Plasma Status window. Click **Plasma On** to light the plasma. Once the plasma is lit, let it stabilize for 30 minutes. The autosampler icon should be clicked to initiate contact and the uptake placed in the rinse position. This is done in the **Sequence** tab with the map showing by right clicking on the Rinse position and selecting **Go To Rinse**.

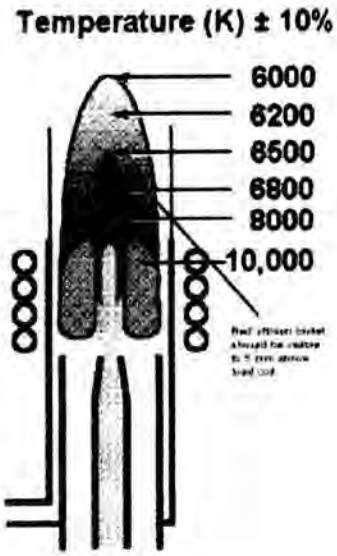

Figure 1. Yttrium bullet should be visible above load coil, extending to near top of torch.

OPTIMIZATION OF CONDITIONS

Yttrium Bullet

The emission characteristics of yttrium are used to determine if the nebulizer is functioning correctly. Place a tube of ~ 1,000 µg/mL sample of yttrium in the autosampler. Right click on the map position of the yttrium tube and choose **Go To _____**. Observe the plasma through the darkened glass shield. A red bullet should noticeably appear above the load coil, extending almost to the top of the quartz torch, as in Figure 1.

If the bullet is clearly visible, the nebulizer is functioning properly. If the bullet is barely visible above the coil, the instrument should be shut down and the nebulizer cleaned.

Peak Locator

Under Analyst, locate **Instrument** on the menu tab and select **Perform Peak Autoadjust**. A dialog box will appear listing the high standard, S-2. Move the sample uptake to aspirate S-2 and wait 30 seconds. Click **Run**. Wait until a check mark appears next to the sample name and move the autosampler to the rinse position for 1 minute. If no warning message appeared, one can be confident that all the analytical peaks have been located and optimized.

Fullframe Imaging

Final optimization of the optical path is performed by collecting a full frame image. Under **Analysis**, an icon of a "starry beaker" is found on the task bar. Standard S-2 is aspirated and the beaker is clicked. A dialog box pops up. Two images are possible to collect: one of the low wavelengths and the other of the high wavelengths. A 30 second sample delay is incorporated. Click Run with the Low Wavelength chosen. The sample takes several minutes to complete.

When you see the results for the sample are posted, the starry beaker icon will become active again. Click on it again, but select the High Wavelength and set the sample flush delay to zero. After the sample is complete, return the uptake to rinse and select the **Method** tab and choose **Elements**.

Pixel Selection

Highlight the first element on the list (Al). In the Element window, select the Subarray window. Depending on whether an analytical line is in the low or high region of the spectrum, you have to toggle back and forth between the full frame images to obtain the right one. In **Full Frame View**, brighten the image until exposed pixels appear inside the box. If the exposed bright pixel within the cluster is not centered within the box, it can be moved with the arrows below. Switch to **2-D View.** A Gaussian shaped peak should be seen with pixel bars highlighted for the peak measurement location and background subtraction position. The analytical line should be centered under the peak and not extend to the tail. The background position should be located at the lowest intensity in the window. Try to optimize to obtain the greatest **Signal/Background**, as indicated in the lower part of the screen. Continue through the complete element list, optimizing the peak observation settings. When finished, save the method.

Look at blank sample and set background.

CONDUCTING THE ANALYSIS

Switch to the **Sequence** tab. All the samples should be located in the autosampler rack map and the tubes loaded in the correct position. If communication to the autosampler has not been established, click on the autosampler icon in the top task bar. A yellow arrowhead will be illuminated. Once the arrow is clicked, the system will execute the analyses, first performing the calibration.

The results of the calibration should be monitored by going to Method, Elements, and clicking the **Fit** icon (which is a graph). Insure that the correlation coefficient (r^2) is at least 0.999.

Results of the included QC samples should be monitored to see if immediate corrective actions need to be implemented to save the run.

Corrective Actions

If the calibration is inadequate or one of the QC samples is out of compliance, the first action is reanalysis. Oftentimes the sample will have to be re-diluted. If the run needs to be aborted to implement a corrective action, go the **Sequence** tab and click the red square on the taskbar. To restart the run, go to the sample list and right click on the sample to be run first. The dialog box will ask if the start action (calibration) should be executed. If recalibration is unnecessary, choose **No**. Proceed with the analysis.

Completing the Analysis

If a long run is planned, it is prudent to choose a stop action that includes shutting off the plasma. This is done when setting up the run by choosing **Shutdown** as the **Stop Action**. The chiller must be turned off manually by pressing the power button.

DATA STORAGE AND RETRIEVAL

In the **Method** tab, under **Automated Output**, the box that automatically saves data to the database should be checked. That will insure that all samples will be resident in the database.

To retrieve data, go to **Publisher** from the iTEVA Control Center. Choose **Report** from the menu and **New**. Then select **Horizontal Table Report** and click Open. A Sample Query dialog box will appear. Choose **Samples Between** and adjust the date to cover the time of the run in question. Click **Search**. A table of sample results will pop up that includes the Full Frame images and calibration runs. Choose **Select All**. De-select results that you do not want included, such as the Full Frame images. Click **OK**.

The software will produce a report format in which the samples are arranged down the side and the elements across the top. The preferred format for saving is as an Excel spreadsheet. Click Report on the menu and choose Export. Choose Excel Data-Only as the format and save to the Bureau drive in the Labdata folder.

DATA REVIEW

Quality Control

QC samples should be monitored during the analysis to insure that critical failures requiring corrective action are detected as soon as possible to save the run. Otherwise, the entire batch of samples may need to be re-analyzed. According to EPA Method 200.7, the criteria are:

QC Check Sample	Criteria	Corrective Action
CCV_0	95-105% Recovery	Stop-correct-reanalyze
CCV	90-110% Recovery	Stop-correct-reanalyze
CCB	<2.2x MDL	
ICV	95-105% Recovery	Stop-correct-reanalyze
ICB	<2.2xMDL	Stop-correct-reanalyze
MDL Check	80-120%	NA
ICSA	Al, Ca, Fe, Mg 80-120%	Stop-correct-reanalyze
ICSAB	Same as ICSA with interfered elements showing 80-120% recovery.	Stop-correct-reanalyze
LFB	85-115% Recovery	Flag w/ N
LFM	75-125% Recovery	Flag w/ N
LL ICP	85 – 115% Recovery	

Appendix C. Well Logs

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MOUAT INDUSTRIES * RMIS-1
GWIC Id: 129492

Section 1: Well Owner(s)
1) MOUAT INDUSTRIES (MAIL)
COLUMBUS
N/A N/A N/A [04/22/1992]

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SW¼

County: STILLWATER
Geocode:

Latitude	Longitude	Geomethod	Datum
45.627494	109.248318	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date
3575.4			

Addition **Block** **Lot**

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: SIMCO ROTARY DRILL

Section 5: Well Completion Date
Date well completed: Wednesday, April 22, 1992

Section 6: Well Construction Details
There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2	6	4				STEEL
0	18.3	2				PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
8	18	2		0.020	SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
6	7	BENTONITE	
7	18.3	10-20 SILICA SAND	

Section 7: Well Test Data

Total Depth: 18.3
Static Water Level:
Water Temperature:

Unknown Test Method *

Yield _ gpm.
Pumping water level _ feet.
Time of recovery _ hours.
Recovery water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	9.7	ALLUVIUM-QUATERNARY SANDY LEAN CLAY;ABOUT 70% LOW PLASTICITY FINES; 25% PREDOMINANTLY FINE SAND;5% PREDOMINANTLY FINE TO MED-HARD GRAVEL;BROWN;MODERATE REACTION WITH HCL.
9.7	18.3	PORLY GRADED GRAVEL W/SAND AND COBBLES;ABOUT 60% FINE TO COARSE-HARD GRAVEL;35% FINE TO COARSE HARD SAND;5% NONPLASTIC FINES;TRACE OF HARD COBBLE GRAY;NO REACTION WITH HCL.

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: MCLAUGHLIN
License No: -
Date Completed: 4/22/1992

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MOUAT INDUSTRIES * RMIS-2
GWIC Id: 129493

Section 1: Well Owner(s)
1) MOUAT INDUSTRIES (MAIL)
COLUMBUS AIRPORT
N/A N/A N/A [04/30/1992]

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SW¼

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.627494	109.248318	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date
3571.8			

Addition	Block	Lot

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: SIMCO ROTARY DRILL

Section 5: Well Completion Date
Date well completed: Thursday, April 30, 1992

Section 6: Well Construction Details
There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-2.1	2.2	4				STEEL
0	14.5	2				PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
4.2	14.2	2		0.020	SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
2.2	3.2	BENTONITE	
3.2	14.5	10-20 SILICA SAND	

Section 7: Well Test Data

Total Depth: 14.5
Static Water Level:
Water Temperature:

Unknown Test Method *

Yield _ gpm.
Pumping water level _ feet.
Time of recovery _ hours.
Recovery water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	9.4	ALLUVIUM-QUATERNARY SANDY LEAN CLAY;ABOUT 70% LOW PLASTICITY FINES; 25% PREDOMINATELY FINE SAND;5% FINE TO COARSE- HARD GRAVEL;BROWN;MODERATE REACTION W/HCL.
9.4	14.5	POORLY GRADED GRAVEL W/SAND & COBBLES:ABOUT 60% FINE TO COARSE-HARD GRAVEL;35% FINE TO COARSE-HARD SAND;5% NONPLASTIC FINES;TRACE OF HARD COBBLES; GRAY;NO REACTION WITH HC1.

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: MCLAUGHLIN
License No: -
Date Completed: 4/30/1992

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MOUAT INDUSTRIES * RMIS-4
GWIC Id: 129495

Section 1: Well Owner(s)
1) MOUAT INDUSTRIES (MAIL)
COLUMBUS AIRPORT
N/A N/A N/A [05/05/1992]

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SW¼

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.627494	109.248318	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date
3571.8			

Addition	Block	Lot

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: SIMCO ROTARY DRILL

Section 5: Well Completion Date
Date well completed: Tuesday, May 05, 1992

Section 6: Well Construction Details
There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	15.6	2				PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
5.3	15.3	2		0.020	SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
3.3	4.3	BENTONITE	
4.3	15.6	10-20 SILICA SAND	

Section 7: Well Test Data

Total Depth: 15.6
Static Water Level
Water Temperature:

Unknown Test Method *

Yield _ gpm.
Pumping water level _ feet.
Time of recovery _ hours.
Recovery water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	0	ALLUVIUM-QUATERNARY
0	5.8	SANDY LEAN CLAY:ABOUT 65% LOW PLASTICITY FINES; 30% PREDOMINANTLY FINE SAND;5% FINE TO COARSE-HARD GRAVEL;BROWN;MODERATE REACTION WITH HCL.
5.8	15.6	POORLY GRADED GRAVEL W/SAND & COBBLES:ABOUT 55% FINE TO COARSE-HARD GRAVEL;40% FINE TO COARSE-HARD SAND;5% NONPLASTIC FINES;TRACE OF HARD COBBLES; GRAY;NO REACTION WITH HCL.

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: MCLAUGHLIN
License No: -
Date Completed: 5/5/1992

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MOUAT INDUSTRIES * RMIS-5
GWIC Id: 129496

Section 1: Well Owner(s)
1) MOUAT INDUSTRIES (MAIL)
COLUMBUS AIRPORT
N/A N/A N/A [04/29/1992]

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SW¼

County: STILLWATER
Geocode:

Latitude	Longitude	Geomethod	Datum
45.627494	109.248318	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date
3571.3			

Addition **Block** **Lot**

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: SIMCO ROTARY DRILL

Section 5: Well Completion Date
Date well completed: Wednesday, April 29, 1992

Section 6: Well Construction Details
There are no borehole dimensions assigned to this well.

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	14.9	2				PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
4.6	14.6	2		0.020	SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
2.6	3.6	BENTONITE	
3.6	14.9	10-20 SILICA SAND	

Section 7: Well Test Data

Total Depth: 14.9
Static Water Level:
Water Temperature:

Unknown Test Method *

Yield _ gpm.
Pumping water level _ feet.
Time of recovery _ hours.
Recovery water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	0	ALLUVIUM-QUATERNARY
0	9.4	SANDY LEAN CLAY:ABOUT 70% LOW PLASTICITY FINES;25% PREDOMINANTLY FINE SAND;5% FINE TO COARSE-HARD GRAVEL;BROWN;MODERATE REACTION WITH HCL
9.4	14.9	POORLY GRADED GRAVEL WITH SAND & COBBLES:ABOUT 60% FINE TO COARSE-HARD GRAVEL;35% FINE TO COARSE-HARD SAND;5% NONPLASTIC FINES;TRACE OF HARD COBBLES; GRAY;NO REACTION WITH HCL.

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: MCLAUGHLIN
License No: -
Date Completed: 4/29/1992

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MOUAT INDUSTRIES * RMIS-8
GWIC Id: 129499

Section 1: Well Owner(s)
1) MOUAT INDUSTRIES (MAIL)
COLUMBUS AIRPORT
N/A N/A N/A [05/04/1992]

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SW¼

County
STILLWATER

Geocode

Latitude	Longitude	Geomethod	Datum
45.62749391625	109.2483177665	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date
3570.7			

Addition **Block** **Lot**

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: SIMCO ROTARY DRILL

Section 5: Well Completion Date
Date well completed: Monday, May 04, 1992

Section 6: Well Construction Details
There are no borehole dimensions assigned to this well

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	17.9	2				PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
7.6	17.6	2		0.020	SLOTS

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
5.6	6.6	BENTONITE	
6.6	17.9	10-20 SILICA SAND	

Section 7: Well Test Data

Total Depth: 17.9
Static Water Level:
Water Temperature:

Unknown Test Method *

Yield _ gpm.
Pumping water level _ feet.
Time of recovery _ hours.
Recovery water level _ feet.

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	0	ALLUVIUM-QUATERNARY
0	5.8	SANDY LEAN CLAY;ABOUT 65% LOW PLASTICITY FINES; 30% PREDOMINANTLY FINE SAND;5% FINE TO COARSE-HARD GRAVEL;BROWN;MODERATE REACTION WITH HCL.
5.8	17.9	POORLY GRADED GRAVEL WITH SAND & COBBLES:ABOUT 60% FINE TO COARSE-HARD GRAVEL;35% FINE TO COARSE-HARD SAND;5% NONPLASTIC FINES;TRACE OF HARD COBBLES; GRAY;NO REACTION WITH HCL.

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name:
Company: MCLAUGHLIN
License No: -
Date Completed: 5/4/1992

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MOUAT INDUSTRIES * WELL MIS-11A
GWIC Id: 267782

Section 1: Well Owner(s)
1) MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (MAIL)
N/A
N/A MT N/A [No Date]

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.631548	109.245296	NAV-GPS	NAD83

Ground Surface Altitude	Method	Datum	Date
3572.42	NAV-GPS	NAD83	8/15/2012

Addition	Block	Lot

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method:

Section 5: Well Completion Date
Date well completed: Sunday, January 23, 1994

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	18	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0.22	7.4	2				PVC-SCHED 40

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
7.4	17.4	2			SCREEN-CONTINUOUS-PVC

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	2.3	CONCRETE	
2.3	5.5	GRANULAR BENTONITE	
5.5	18	10-20 COLORADO SILICA SAND	

Section 7: Well Test Data

Total Depth: 17.4
Static Water Level: 9.74
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log
Geologic Source
Unassigned

From	To	Description
0	0.25	GRASS AND ROOTS, CLAY AND SILT, BROWN, WET, FROZEN
0.25	2.5	CLAY, TRACE SILT, DARK BROWN, MOIST FROZEN
2.5	4.8	SILT AND FINE SAND, BROWN DRY
4.8	18	GRAVEL, SOME FINE TO COARSE SAND, COBBLES, BROWN TO GRAY, WET

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: DOUG BECK
Company: OKEEFE DRILLING CO
License No: WWC-564
Date Completed: 1/23/1994

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MOUAT INDUSTRIES * WELL MIS-11B
GWIC Id: 267789

Section 1: Well Owner(s)

1) MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (MAIL)

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.631552	109.245355	NAV-GPS	NAD83

Ground Surface Altitude	Method	Datum	Date
3572.42	NAV-GPS	NAD83	8/15/2012

Measuring Point Altitude	Method	Datum	Date Applies
3572.42	NAV-GPS	NAVD88	8/15/2012 2:00:00 PM

Addition	Block	Lot

Section 3: Proposed Use of Water

MONITORING (1)

Section 4: Type of Work

Drilling Method:

Section 5: Well Completion Date

Date well completed: Monday, January 24, 1994

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	28	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0.19	17.1	2				PVC-SCHED 40

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
17.1	27.1	2			SCREEN-CONTINUOUS-PVC

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont.Fed?
0	2.5	CONCRETE PAD	
2.5	12.5	CEMENT BENTONITE GROUT	
12.5	15.1	BENTONITE PELLETS	
15.1	28	10-20 COLORADO SILICA SAND	

Section 7: Well Test Data

Total Depth: 27.1
Static Water Level: 9.78
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source

Unassigned

From	To	Description
0	0.25	GRASS AND ROOTS, CLAY AND SILT, DARK BROWN, MOIST TO WET, FROZEN
0.25	3	CLAY, TRACE SILT, DARK BROWN, SEMI-FROZEN, DAMP TO MOIST
3	4.5	SILT AND FINE SAND, BROWN DRY
4.5	25	GRAVEL, SOME FINE TO COARSE SAND, COBBLES, BROWN, DRY, DRY TO DAMP
25	28	CLAY/DECOMPOSED SHALE, TRACE TO LITTLE SAND, GRAY TO DARK GRAY, SOFT, MOIST TO WET

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: DOUG BECK
Company: OKEEFE DRILLING CO
License No: WWC-564
Date Completed: 1/24/1994

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MOUAT INDUSTRIES * MIS-14
GWIC Id: 267376

Section 1: Well Owner(s)
1) MONTANA DEPARTMENT OF ENVIRONMENTAL QUALITY (MAIL)

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.627462	109.239683	NAV-GPS	NAD83

Ground Surface Altitude	Method	Datum	Date
3567.59	NAV-GPS	NAD83	8/2/2012

Measuring Point Altitude	Method	Datum	Date Applies
3566.44	NAV-GPS	NAVD88	8/2/2012

Addition	Block	Lot

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method:

Section 5: Well Completion Date
Date well completed: Monday, January 24, 1994

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	21.4	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
-1.59	6.2	2				PVC-SCHED 40

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
6.2	16.2	2			SCREEN-CONTINUOUS-PVC

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	2	CONCRETE PAD	
2	4	GRANULAR BENTONITE	
4	21.4	10-20 COLORADO SILICA SAND	

Section 7: Well Test Data

Total Depth: 16.2
Static Water Level:
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
Unassigned

From	To	Description
0	0.25	GRASS AND ROOTS, LITTLE FINE SAND, BROWN, DRY
0.25	2.5	SAND, FINE TO COARSE, LITTLE GRAVEL, BROWN, DRY TO DAMP
2.5	20.8	GRAVEL, SOME FINE TO COARSE SAND, COBBLES, BROWN, MOIST
20.8	21.4	DECOMPOSED SHALE/CLAY, LITTLE SAND AND SANDSTONE FRAGMENTS, DARK GRAY TO BLACK, MOIST

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: DOUG BECK
Company: OKEEFE DRILLING CO
License No: WWC-564
Date Completed: 1/24/1994

MONTANA WELL LOG REPORT

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Site Name: MOUAT INDUSTRIES * MIS-16
GWIC Id: 236502

Section 1: Well Owner(s)

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SE¼ NW¼

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.63296666625	109.2456735165	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: ROTARY AIR ROTARY

Section 5: Well Completion Date
Date well completed: Wednesday, September 07, 1994

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	26	7

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	9.6	2			FLUSH THREAD	PVC-SCHED 40

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
9.6	25.6	2			SCREEN-CONTINUOUS-PVC

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	2	CEMENT	
2	7	BENTONITE	
7	26	SAND	

Section 7: Well Test Data

Total Depth: 25.6
Static Water Level: 7
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source

111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	0.3	GRASS AND ROOTS, SOME SILT, TRACE FINE SAND, BROWN, DRY
0.3	10	CLAY, TRACE TO LITTLE SILT, LIGHT BROWN, DAMP WET. SILT CONTENTS INCREASES WITH DEPTH
10	25.6	GRAVEL, SOME FINE TO COARSE SAND, COBBLES, BROWN, WET
25.6	26	SHALE, DARK GRAY TO GRAY, VERY SOFT TO SOFT, DECOMPOSED TO HIGHLY WEATHERED

Driller Certification

All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: D. DURAN
Company: OKEEFE DRILLING CO
License No: -
Date Completed: 9/7/1994

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MOUAT INDUSTRIES * MIS-16
GWIC Id: 236603

Section 1: Well Owner(s)
1) MOUAT INDUSTRIES (MAIL)
COLUMBUS AIRPORT
N/A N/A N/A [No Date]

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SE¼ NW¼

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.63296666625	109.2456735165	TRS-SEC	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: AIR ROTARY

Section 5: Well Completion Date
Date well completed: Thursday, September 08, 1994

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	26.2	7

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	5.5	2			FLUSH THREAD	PVC-SCHED 40

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
5.5	25.6	2			SCREEN-CONTINUOUS-PVC

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	2	CEMENT	
2	4	BENTONITE	
4	26.2	SAND	

Section 7: Well Test Data

Total Depth: 26
Static Water Level: 7
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks

Section 9: Well Log

Geologic Source
111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	0.2	GRASS AND ROOTS, SOME SILT, TRACE FINE SAND, BROWN, DRY
0.2	4	SILT, LITTLE GRAVEL, TRACE FINE SAND, TRACE CLAY, BROWN, DRY
4	5	SILT, LITTLE CLAY, TRACE FINE SAND, BROWN, DAMP TO MOIST
5	6	SILT AND FINE SAND, TRACE GRAVEL, BROWN, MOIST
6	25	GRAVEL SOME FINE TO COARSE SAND, COBBLES, BROWN, MOIST TO WET
25	26.2	SHALE DARK GRAY TO GRAY, VERY SOFT TO SOFT, DECOMPOSED TO HIGHLY WEATHERED

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: D. DURAN
Company: OKEEFE DRILLING CO
License No: -
Date Completed: 9/8/1994

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MBMG - MO-09
GWIC Id: 236432

Section 1: Well Owner(s)

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SE¼ NW¼

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.6337	109.2459	NAV-GPS	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: SOLID STEM AUGER

Section 5: Well Completion Date
Date well completed: Wednesday, May 23, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	13	4

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	8	2			FLUSH THREAD	PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
8	13	2			FACTORY SLOTTED

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	5	CEMENT	
5	7	BENTONITE CHIPS	
7	13	SAND (10-20)	

Section 7: Well Test Data

Total Depth: 13
Static Water Level: 7.67
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks
MO-09

Section 9: Well Log

Geologic Source
111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	2	GRAVEL FILL
2	13	FILL - CLAY, SILT, SAND, AND GRAVEL
13	13	RESISTENT GRAVEL

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: FRED SCHMIDT
Company: MT BUREAU OF MINES & GEOLOGY
License No: MWC-34
Date Completed: 5/23/2007

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MBMG - MO-10
GWIC Id: 236438

Section 1: Well Owner(s)

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SE¼ NW¼

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.6333	109.246	NAV-GPS	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: HOLLOWSTEM AUGER

Section 5: Well Completion Date
Date well completed: Thursday, May 24, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	11	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	5	2			FLUSH THREAD	PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
5	10	2			FACTORY SLOTTED

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	3	CEMENT	
3	5	BENTONITE CHIPS	
5	10	SAND (10-20)	

Section 7: Well Test Data

Total Depth: 10
Static Water Level:
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks
MO-10 - SCREEN PULLED UP 1 FOOT DURING WELL COMPLETION. FLUSH MOUNT

Section 9: Well Log

Geologic Source
111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	11	GRAVEL (MAINLY >2 INCH DIAMETER COBBLES)

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: FRED SCHMIDT
Company: MT BUREAU OF MINES & GEOLOGY
License No: MWC-34
Date Completed: 5/24/2007

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MBMG - MO-11
GWIC Id: 236441

Section 1: Well Owner(s)

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SE¼ NW¼

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.6331	109.2452	NAV-GPS	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: HOLLOWSTEM AUGER

Section 5: Well Completion Date
Date well completed: Thursday, May 24, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	11	6

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	6	2			FLUSH THREAD	PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
6	11	2			FACTORY SLOTTED

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
1	3	SAND	
3	5.6	BENTONITE CHIPS	
5.6	11	SAND (10-20)	

Section 7: Well Test Data

Total Depth: 11
Static Water Level:
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks
MO-11 - FLUSH MOUNT

Section 9: Well Log

Geologic Source
111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	11	GRAVEL (MAINLY >2 INCH DIAMETER COBBLES)

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: FRED SCHMIDT
Company: MT BUREAU OF MINES & GEOLOGY
License No: MWC-34
Date Completed: 5/24/2007

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MBMG - MO-25
GWIC Id: 236442

Section 1: Well Owner(s)

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SE¼ NW¼

County	Geocode
STILLWATER	

Latitude	Longitude	Geomethod	Datum
45.6333	109.2439	NAV-GPS	NAD83

Ground Surface Altitude	Method	Datum	Date

Addition	Block	Lot

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: SOLID STEM AUGER

Section 5: Well Completion Date
Date well completed: Tuesday, June 05, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	13.6	4

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	8	2			FLUSH THREAD	PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
8	13	2			FACTORY SLOTTED

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	5	CEMENT	
5	6.5	BENTONITE CHIPS	
6.5	13	SAND (10-20)	

Section 7: Well Test Data

Total Depth: 13
Static Water Level: 9.5
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks
MO-25

Section 9: Well Log

Geologic Source
111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	1.5	TOP SOIL
1.5	4	GREENISH WEATHERED CEMENT
4	13.6	WEATHERED CEMENT
13.6	13.6	GRAVEL

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: FRED SCHMIDT
Company: MT BUREAU OF MINES & GEOLOGY
License No: MWC-34
Date Completed: 6/5/2007

MONTANA WELL LOG REPORT

This well log reports the activities of a licensed Montana well driller, serves as the official record of work done within the borehole and casing, and describes the amount of water encountered. This report is compiled electronically from the contents of the Ground Water Information Center (GWIC) database for this site. Acquiring water rights is the well owner's responsibility and is NOT accomplished by the filing of this report.

Site Name: MBMG - MO-26
GWIC Id: 236443

Section 1: Well Owner(s)

Section 2: Location

Township	Range	Section	Quarter Sections
02S	20E	27	SE¼ NW¼

County: STILLWATER
Geocode:

Latitude	Longitude	Geomethod	Datum
45.6336	109.2449	NAV-GPS	NAD83

Ground Surface Altitude | **Method** | **Datum** | **Date**

Addition | **Block** | **Lot**

Section 3: Proposed Use of Water
MONITORING (1)

Section 4: Type of Work
Drilling Method: SOLID STEM AUGER

Section 5: Well Completion Date
Date well completed: Tuesday, June 05, 2007

Section 6: Well Construction Details

Borehole dimensions

From	To	Diameter
0	15	4

Casing

From	To	Diameter	Wall Thickness	Pressure Rating	Joint	Type
0	9	2			FLUSH THREAD	PVC

Completion (Perf/Screen)

From	To	Diameter	# of Openings	Size of Openings	Description
9	14	2			FACTORY SLOTTED

Annular Space (Seal/Grout/Packer)

From	To	Description	Cont. Fed?
0	7.5	CEMENT	
7.5	9.5	BENTONITE CHIPS	
9.5	14	SAND (10-20)	

Section 7: Well Test Data

Total Depth: 14
Static Water Level: 11
Water Temperature:

** During the well test the discharge rate shall be as uniform as possible. This rate may or may not be the sustainable yield of the well. Sustainable yield does not include the reservoir of the well casing.*

Section 8: Remarks
MO-26

Section 9: Well Log

Geologic Source
111SNGR - SAND AND GRAVEL (HOLOCENE)

From	To	Description
0	3	TOP SOIL
3	15	CEMENT
15	15	RESISTENT GRAVEL

Driller Certification
All work performed and reported in this well log is in compliance with the Montana well construction standards. This report is true to the best of my knowledge.

Name: FRED SCHMIDT
Company: MT BUREAU OF MINES & GEOLOGY
License No: MWC-34
Date Completed: 6/5/2007

APPENDIX B

APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

IDENTIFICATION OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR THE MOUAT INDUSTRIES NPL SITE

INTRODUCTION

40 C.F.R. § 300.415(i) and guidance and policy issued by the Environmental Protection Agency ("EPA") require that removal actions under CERCLA comply with substantive provisions of applicable or relevant and appropriate standards, requirements, criteria, or limitations ("ARARs") of state and federal environmental laws and state facility siting laws "to the extent practicable considering the exigencies of the situation." Because this removal action need not be completed any more quickly than a remedial action, EPA believes this removal action should achieve ARARs to the same extent as a remedial action. 40 C.F.R. § 300.430(e)(9)(iii)(B).

This document identifies ARARs that are expected to apply to the activities to be conducted under the Mouat Industries NPL Site removal action. The following ARARs or groups of related ARARs are each identified by a statutory or regulatory citation, followed by a brief explanation of the ARAR and a brief discussion as to how and to what extent the ARAR is expected to apply to the activities to be conducted under this removal action.

Substantive provisions of the requirements listed below are identified as ARARs pursuant to 40 CFR § 300.400. ARARs that are within the scope of this removal action must be attained during and at the completion of the removal action.[1] No permits are anticipated for the removal action for the Mouat site in accordance with Section 121(e) of CERCLA.

TYPES OF ARARs

ARARs are either "applicable" or "relevant and appropriate." Both types of requirements are mandatory for remedial actions under Superfund guidance.[2] Applicable requirements are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental facility siting laws that specifically address a hazardous substance, pollutant, contaminant, removal action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal

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[1] 40 CFR Section 300.435(b)(2); Preamble to the National Oil and Hazardous Substances Pollution Contingency Plan, 55 Fed. Reg. 8755-8757 (March 8, 1990).

[2] CERCLA § 121(d)(2)(A), 42 U.S.C. § 6921(d)(2)(a). See also, 40 C.F.R. § 300.430(f)(1)(i)(A).

requirements may be applicable.[3]

Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to hazardous substances, pollutants, contaminants, removal actions, locations, or other circumstances at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and are more stringent than federal requirements may be relevant and appropriate.[4]

The determination that a requirement is relevant and appropriate is a two-step process: (1) determination if a requirement is relevant and (2) determination if a requirement is appropriate. In general, this involves a comparison of a number of site-specific factors, including an examination of the purpose of the requirement and the purpose of the proposed CERCLA action; the medium and substances regulated by the requirement and the proposed requirement; the actions or activities regulated by the requirement and the removal action; and the potential use of resources addressed in the requirement and the removal action. When the analysis results in a determination that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as if it were applicable.[5]

ARARs are contaminant, location, or action specific. Contaminant specific requirements address chemical or physical characteristics of compounds or substances on sites. These values establish acceptable amounts or concentrations of chemicals which may be found in or discharged to the ambient environment.

Location specific requirements are restrictions placed upon the concentrations of hazardous substances or the conduct of cleanup activities because they are in specific locations. Location specific ARARs relate to the geographical or physical positions of sites, rather than to the nature of contaminants at sites.

Action specific requirements are usually technology based or activity based requirements or limitations on actions taken with respect to hazardous substances, pollutants or contaminants. A given cleanup activity will trigger an action specific requirement.

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3 40 C.F.R. § 300.5.

4 40 C.F.R. § 300.5.

5 CERCLA Compliance with Other Laws Manual, Vol. I, OSWER Directive 9234.1-01, August 8, 1988, p. 1-11.

Such requirements do not themselves determine the cleanup alternative, but define how chosen cleanup methods should be performed.

Many requirements listed as ARARs are promulgated as identical or near identical requirements in both federal and state law, usually pursuant to delegated environmental programs administered by EPA and the state. The Preamble to the NCP provides that such a situation results in citation to the state provision and treatment of the provision as a federal requirement.

Also contained in this list are policies, guidance or other sources of information which are "to be considered" in the selection of the remedy and implementation of the response action. Although not enforceable requirements, these documents are important sources of information which EPA and the State of Montana Department of Environmental Quality (MDEQ) may consider during selection of the remedy, especially in regard to the evaluation of public health and environmental risks; or which will be referred to, as appropriate, in selecting and developing cleanup actions.[6]

This list constitutes MDEQ's and EPA's detailed description of ARARs for use at the Mouat Industries NPL Site in making removal action decisions. This list will be used in evaluating the compliance of the various removal alternatives with ARARs. However, the final determination of ARARs that will ultimately apply to the site and the final determination of compliance with ARARs or applicability of ARAR waivers will be presented in the Action Memorandum.

I. CONTAMINANT SPECIFIC ARARs

A. Federal and State Groundwater ARARs.

Compliance points for groundwater ARARs are throughout the Mouat Industries NPL Site.

i. State of Montana requirements.

a. ARM § 16.20.1002 and -1003 (applicable).

ARM § 16.20.1002 provides that groundwater is classified I through IV based on its present and future most beneficial uses, and states that groundwater is to be classified according to actual quality or use, whichever places the groundwater in a higher class. Class I is the highest quality class; class IV the lowest. Based upon its specific conductance, groundwater throughout the entire Mouat site is considered Class I groundwater.

ARM § 16.20.1003 sets the standards for the different classes of groundwater. Concentrations of dissolved substances in Class I or

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6 40 CFR Section 300.400(g)(3); 40 CFR Section 300.415(i); Preamble to the NCP, 55 Fed. Reg. 8744-8746 (March 8, 1990).

II groundwater may not exceed the human health standards listed in department Circular WQB-7. Concentrations of dissolved or suspended substances must also not exceed levels which render the waters harmful, detrimental or injurious to public health. Maximum allowable concentrations of these substances also must not exceed acute or chronic problem levels which would adversely affect existing beneficial uses or the designated beneficial uses of groundwater of that classification.

Contaminant	WQB-7 Standard
Chromium (hexavalent)	100μg/l
Chromium (trivalent)	100μg/l

b. ARM § 16.20.1011 (applicable).

This section provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality unless the board is satisfied that a change is justifiable for economic or social development and will not preclude present or anticipated use of such waters.

ii. Federal requirements.

Safe Drinking Water Act, 42 U.S.C. § 300f, et seq., National Primary and Secondary Drinking Water Regulations, 40 C.F.R. Parts 141 and 142 (Relevant and Appropriate). The National Primary and Secondary Drinking Water Regulations (40 C.F.R. Parts 141 and 143) establish maximum contaminant levels (MCLs) for chemicals in drinking water distributed in public water systems. These are enforceable in Montana under the Public Water Safety Act, 75-6-101 et. seq., M.C.A. and ARM § 16.20.204. Safe Drinking Water Act MCLs are not applicable for the Mouat site removal action because contaminated groundwater found within the site is currently not a source for public water supplies. There is no known public use of groundwater underlying or coming into contact with contaminants from the Mouat site. These standards may be applicable in the future should EPA detect an exceedance at a public water outlet. The standard would be applicable at the outlet.

The drinking water standards are relevant and appropriate for groundwater in situ because that groundwater is a potential source of drinking water. The determination that the drinking water standards are relevant and appropriate for portions of the Mouat site removal action is fully supported by the regulations and guidance. The Preamble to the NCP clearly states that the MCLs are relevant and appropriate for groundwater that is a current or potential source of drinking water. See 55 Fed. Reg. 8750, March 8, 1990, and 40 C.F.R. § 300.430(e)(2)(i)(B). MCLs developed under the Safe Drinking Water Act generally are ARARs for current or potential drinking water sources. See, EPA Guidance On Remedial Action For Contaminated Groundwater at Superfund Sites, OSWER Dir.

#9283.1-2, December 1988.

In addition, maximum contaminant level goals (MCLGs) may also be relevant and appropriate in certain site-specific situations. See 55 Fed. Reg. 8750-8752. MCLGs are health-based goals which are established at levels at which no known or anticipated adverse effects on the health of persons occur and which allow an adequate margin of safety. According to the NCP, MCLGs that are set at levels above zero must be attained by remedial actions for ground or surface waters that are current or potential sources of drinking water, where the MCLGs are relevant and appropriate under the circumstances of the release. Where the MCLG for a contaminant has been set at a level of zero, the MCL promulgated for that contaminant must be attained.

The MCLGs and MCLs for chromium:

contaminant	MCL (mg/l)	MCLG (mg/l)
chromium	0.1	0.1

Resource Conservation and Recovery Act (RCRA) standards for groundwater found at 40 CFR Part 264, Subpart F, incorporated by reference pursuant to ARM § 17.54.702, may be relevant and appropriate if hazardous waste or something similar is placed or maintained in a solid waste management unit as a result of this response action. If so, they would be identified at a later date. The RCRA standards would be no more stringent than the MCLs or MCLGs identified above.

B. Federal and State of Montana Surface Water ARARs.

1. State of Montana Surface Water Quality Requirements, Montana Water Quality Act, MCA § 75-5-101 et seq., and implementing regulations. General. The Clean Water Act, 33 U.S.C. § 1251, et seq., provides the authority for each state to adopt water quality standards (40 CFR Part 131) designed to protect beneficial uses of each water body and requires each state to designate uses for each water body. Pursuant to this authority and the criteria established by Montana surface water quality regulations, ARM § 16.20.601, et seq., Montana has established the Water-Use Classification system. Under ARM § 16.20.608(1), waters of Yellowstone River drainage to the Laurel water supply intake have been classified "B-1." Ditches and certain other bodies of surface water must also meet these requirements.[7] Certain of the B-1 standards, codified at ARM § 16.20.618, as well as Montana's nondegradation requirements, are presented below.

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7 As provided under ARM § 16.20.603(25), "'surface waters' means any waters on the earth's surface, including but not limited to, streams, lakes, ponds, and reservoirs; and irrigation and drainage systems discharging directly into a stream, lake, pond, reservoir or other surface water. Water bodies used solely for treating, transporting or impounding pollutants shall not be considered surface water."

a. **ARM § 16.20.618 (applicable).** Waters classified B-1 are, after conventional treatment, suitable for drinking, culinary and food processing purposes. These waters are also suitable for bathing, swimming and recreation, growth and propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers, and use for agricultural and industrial purposes. This section provides also that concentrations of carcinogenic, bioconcentrating, toxic or harmful parameters which would remain in water after conventional water treatment may not exceed standards set forth in department circular WQB-7. WQB-7 provides that "whenever both Aquatic Life Standards and Human Health Standards exist for the same analyte, the more restrictive of these values will be used as the numeric Surface Water Quality Standard." For the primary Contaminants of Concern the Circular WQB-7 standards are listed below.

Contaminant	WQB-7 Standard
Chromium, hexavalent	11 $\mu g/l$
Chromium, trivalent	100 $\mu g/l$

The B-1 classification standards at ARM § 16.20.618 also include the following criteria: 1) dissolved oxygen concentration must not be reduced below the levels given in department circular WQB-7; 2) hydrogen ion concentration (pH) must be maintained within the range of 6.5 to 8.5; 3) the maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units; 4) temperature increases must be kept within prescribed limits; 5) no increases above naturally occurring concentrations of sediment, settleable solids, oils, floating solids, which will or are likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife are allowed; 5) True color must be kept within specified limits.

Alternatively, site-specific criteria may be developed using the procedures given in the Water Quality Standards Handbook (US EPA, Dec. 1983), provided that other routes of exposure to toxic parameters by aquatic life are addressed. These standards set the contaminant specific requirement for ambient water quality in the stream.

b. **ARM § 16.20.633 (applicable).** Provides that surface waters must be free of substances attributable to industrial practices or other discharges that will: (a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines; (b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials; (c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible; (d) create concentrations or combinations of materials which are toxic or harmful to human,

animal, plant or aquatic life; (e) create conditions which produce undesirable aquatic life.

ARM § 16.20.633 also states that no waste may be discharged and no activities conducted which, either along or in combination with other waste activities, will cause violation of surface water quality standards; provided a short term exemption from a surface water quality standard may be authorized by the department under certain conditions.

c. **ARM § 16.20.708 (applicable)**. Existing and anticipated uses of surface water and water quality to support those uses must be maintained.

2. **Federal Surface Water Quality Requirements, Clean Water Act, 33 U.S.C. §§ 1251 et seq. (applicable)**. As provided under Section 303 of the Clean Water Act, 33 U.S.C. § 1313, the State of Montana has promulgated water quality standards. See the discussion above under State surface water quality requirements.

C. **Federal and State Air Quality Requirements**.

1. **National Ambient Air Quality Standards, 40 CFR § 50.6 (PM-10) (applicable)**. This provision establishes standards for PM-10 particulates (the corresponding state standard is found at ARM § 16.8.821).

2. **Montana Ambient Air Quality Regulations, ARM §§ 16.8.807, -.815, -.818, and -.821 (applicable)**.

a. **ARM § 16.8.807**. This provision establishes sampling, data collection and analytical requirements to ensure compliance with ambient air quality standards.

b. **ARM § 16.8.809**. Establishes sampling, data collection, recording, and analysis to ensure compliance with ambient air quality standards.

e. **ARM § 16.8.821**. PM-10 concentrations in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

II. LOCATION SPECIFIC REQUIREMENTS

The statutes and regulations set forth below relate to the preservation of certain natural resources which may be adversely affected by the Mouat site removal action. They require that steps be taken to minimize the impact of the removal action upon any such resources.

A. **Floodplain Management, 40 CFR § 6.302(b), and Executive**

Order No. 11988 (applicable). These require that actions be taken to avoid, to the extent possible, adverse effects associated with direct or indirect development of a floodplain, or to minimize adverse impacts if no practicable alternative exists. If this removal action is found to potentially affect the floodplain, the action memo will contain a Statement of Findings which will set forth the reasons why the proposed action must be located in or affect the floodplain; a description of significant facts considered in making the decisions to locate in or affect the floodplain or wetlands including alternative sites or actions; a statement indicating whether the selected action conforms to applicable state or local floodplain protection standards; a description of the steps to be taken to design or modify the proposed action to minimize potential harm to or within the floodplain; and a statement indicating how the proposed action affects the natural or beneficial values of the floodplain.

B. **Protection of Wetlands, 40 C.F.R. Part 6, Appendix A, Executive Order No. 11990 (applicable)**. This ARAR requires Federal agencies and the PRP to avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists. Wetlands are defined as those areas that are inundated or saturated by groundwater or surface water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Compliance with this ARAR will be achieved through consultation with the U.S. Fish and Wildlife Service and the U.S. Corp of Engineers, to determine the existence and category of wetlands present at the site, and any avoidance or mitigation and replacement which may be necessary.

C. **Floodplain and Floodway Management Act and Regulations, MCA 76-5-401, et seq., ARM § 36.15.601, et seq. (applicable)**. Sets forth conditions upon which certain uses or activities may occur in flood plain and flood fringe.

D. **Natural Streambed and Land Preservation Act and Regulations, MCA 75-7-102 and ARM §§ 36.2.404, 405, and 406 (applicable)**. May be applicable if this removal action alters or affects a streambed or its banks. The adverse effects of any such action must be minimized.

E. **Migratory Bird Treaty Act, 16 U.S.C. §§ 703 et seq. (applicable)**. This requirement establishes a federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds. Specific mitigative measures may be identified for compliance with this requirement.

F. **Bald Eagle Protection Act, 16 U.S.C. §§ 668 et. seq.**

(applicable). This requirement establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that any cleanup of the site does not unnecessarily adversely affect the bald and golden eagles. Specific mitigative measures may be identified for compliance with this requirement.

G. **Resource Conservation and Recovery Act and regulations, 40 CFR § 264.18 (a) and (b) (relevant and appropriate)**. Any discrete waste units created by site cleanup actions must comply with the siting restrictions and conditions found in these sections. These sections require management units to be designed, constructed, operated and maintained to avoid washout, if they are within or near the 100 year flood plain.

H. **Solid Waste Management Act and regulations, MCA 75-1-201, et seq., ARM § 16.14.505(1)**. Sets forth requirements applying to the location of any solid waste management facility. Among other things, the location must have sufficient acreage, must not be within a 100-year floodplain, must be located so as to prevent pollution of ground, surface, and private and public water supply systems, and must allow for reclamation of the land.

III. ACTION SPECIFIC REQUIREMENTS

A. State and Federal Water Requirements.

1. **Clean Water Act Point Source Discharges requirements, 33 U.S.C. § 1342**. Section 402 of the Clean Water Act, 33 U.S.C. § 1342, et seq., authorizes the issuance of permits for the "discharge" of any "pollutant." This includes storm water discharges associated with "industrial activity." See, 40 CFR § 122.1(b)(2)(iv). "Industrial activity includes inactive mining operations that discharge storm water contaminated by contact with or that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts or waste products located on the site of such operations, see, 40 CFR § 122.26(b)(14)(iii); landfills, land application sites, and open dumps that receive or have received any industrial wastes including those subject to regulation under RCRA subtitle D, see, 40 CFR § 122.26(b)(14)(v); and construction activity including clearing, grading, and excavation activities, see, 40 CFR § 122.26(b)(14)(x). Because the State of Montana has been delegated the authority to implement the Clean Water Act, these requirements are enforced in Montana through the Montana Pollutant Discharge Elimination System (MPDES). The MPDES requirements are set forth below.

a. **Substantive MPDES Permit Requirements, ARM §§ 16.20.1318-1320 (applicable)**. These set forth the substantive requirements applicable to all MPDES and NPDES permits. The substantive requirements, including the requirement to properly operate and maintain all facilities and systems of treatment and

control are applicable requirements.

b. **Technology-Based Treatment, ARM §§ 16.20.925 and 1320 (applicable).** Provisions of 40 C.F.R. Part 125 for criteria and standards for the imposition of technology-based treatment requirements are adopted and incorporated in MDEQ permits. Although the permit requirement would not apply to on-site discharges, the substantive requirements of Part 125 are applicable, i.e., for toxic and nonconventional pollutants treatment must apply the best available technology economically achievable (BAT); for conventional pollutants, application of the best conventional pollutant control technology (BCT) is required. Where effluent limitations are not specified for the particular industry or industrial category at issue, BCT/BAT technology-based treatment requirements are determined on a case by case basis using best professional judgment (BPJ). See CERCLA Compliance with Other Laws Manual, Vol. I, August 1988, p. 3-4 and 3-7. See footnote 7, above, for a definition of "state waters."

2. **Additional State of Montana requirements.**

a. **Water Quality Statute and Regulations (all applicable).**

i. **Causing of Pollution, M.C.A. Section 75-5-605.** This section of the Montana Water Quality Act prohibits the causing of pollution of any state waters. Pollution is defined as contamination or other alteration of physical, chemical, or biological properties of state waters which exceeds that permitted by the water quality standards.[8]

ii. **Placement of Wastes, M.C.A. Section 75-5-605.** This provision states that it is unlawful to place or caused to be placed any wastes where they will cause pollution of any state waters. Any permitted placement of waste is not placement if the agency's permitting authority contains provisions for review of the placement of materials to ensure it will not cause pollution to state waters.

iii. **Nondegradation, M.C.A. Section 75-5-303.** This provision states that existing uses of state waters and the level of water quality necessary to protect the uses must be maintained and protected.

(a). **ARM § 16.20.708.** This provides that for any surface water, existing and anticipated uses and the water quality necessary to protect these uses must be maintained and protected unless degradation is allowed under the nondegradation rules at ARM § 16.20.711.

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[8] See MCA § 75-5-103(19).

(b). **ARM § 16.20.1011**. This provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality unless degradation may be allowed under the principles established in § 75-5-303, MCA, and the nondegradation rules at ARM § 16.20.706 et seq.

iv. **Stormwater Runoff**.

(a). **ARM § 26.4.633**. All surface drainage from a disturbed area must be treated by the best technology currently available.

(b). **General Permits**. Under ARM § 16.20.601, et seq., and ARM § 16.20.1301, et seq., including ARM § 16.20.1314, the Water Quality Division has issued general stormwater permits for certain activities. The substantive requirements of the following permits are applicable for the following activities: (1) for construction activities: General Discharge Permit for Storm Water Associated with Construction Activity, Permit No. MTR100000 (November 17, 1992); (2) for mining activities: General Discharge Permit for Storm Water Associated with Mining and with Oil and Gas Activities, Permit No. MTR300000 (May 18, 1993).[9] (3) for industrial activities: General Discharge Permit for Storm Water Associated with Industrial Activity, Permit No. MTR000000 (October 26, 1994).[10]

Generally, the permits require the permittee to implement Best Management Practices (BMP) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health or the environment. However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, an individual MPDES permit or alternative general permit may be required.

v. **Surface Water, ARM § 16.20.633**. Prohibits discharges containing substances that will: (a) settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines; (b) create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials; (c) produce odors, colors or other conditions which create a nuisance or render undesirable tastes to fish flesh or make fish inedible; (d) create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or

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9 This permit covers point source discharges of storm water from mining and milling activities (including active, inactive, and abandoned mine and mill sites) including activities with Standard Industrial Code 14 (metal mining).

10 Industrial activities are defined as all industries defined in 40 CFR 122, 123, and 124, excluding construction, mining, oil & gas extraction activities and stormwater discharges subject to effluent limitations guidelines. This includes wood treatment operations, as well as the production of slag.

aquatic life; or (e) create conditions which produce undesirable aquatic life.

B. **RCRA Subtitle C Requirements (relevant and appropriate, possibly applicable).** The presentation of RCRA Subtitle C requirements in this section assumes that there will be many solid wastes at the Mouat site, and that some of these may be left in place in "waste management areas" as a result of this removal action. Because of the similarity of these waste management areas to the RCRA "waste management unit," certain discrete portions of the RCRA Subtitle C implementing regulations will be relevant and appropriate for the Mouat site removal action. Also, although it is unlikely that hazardous wastes still exist at the Mouat site, it is possibille that such wastes may exist there. Therefore, RCRA Subtitle C and implementing regulations are hereby designated as applicable for any hazardous wastes that are actively "managed" as part of the Mouat site removal action or that were "placed" after 1980. Should hazardous wastes be discovered as part of any further investigation activity, EPA reserves the right to identify RCRA Subtitle C requirements in more detail at a later date.

1. **40 C.F.R. Part 264 Subpart F. General Facility Standards.** This is potentially relevant and appropriate for hazardous or similar wastes at this site. Any waste management unit or similar area would be required to comply with the following requirements. These are not final cleanup standards for the Mouat site.

a. **40 C.F.R.§§ 264.92, .93. and .94.** Prescribes groundwater protection standards.

b. **40 C.F.R. § 264.97.** Prescribes general groundwater monitoring requirements.

e. **40 C.F.R. § 264.98.** Prescribes requirements for monitoring and detecting indicator parameters.

2. **Closure requirements.**

a. **40 C.F.R. § 264.111.** This provides that the owner or operator of a hazardous waste management facility must close the facility in a way that minimizes the need for further maintenance, and controls or eliminates the leaching or escape of hazardous waste or its constituents, leachate, or runoff to the extent necessary to protect human health and the environment.

b. **40 C.F.R. § 264.117.** This provision incorporates monitoring requirements in Part 264, including those mentioned at Part 264.97 and Part 264.303. It governs the length of the post-closure care period, permits a lengthened security period, and prohibits any use of the property which would disturb

the integrity of the management facility.

c. 40 C.F.R. § 264.310. This specifies requirements for caps, maintenance, and monitoring after closure.

3. 40 C.F.R. § 264.301. Prescribes design and operating requirements for landfills.

a. 40 C.F.R. § 264.301(a). This provides for a single liner and leachate collection and removal system.

b. 40 C.F.R. § 264.301(f). This requires a run-on control system.

c. 40 C.F.R. § 264.301(g). This requires a run-off management system.

d. 40 C.F.R. § 264.301(h). This requires prudent management of facilities for collection and holding of run-on and run-off.

e. 40 C.F.R. § 264.301(i). This requires that wind dispersal of particulate matter be controlled.

C. **Federal and State RCRA Subtitle D Requirements (relevant and appropriate).**

40 CFR Part 257 establishes criteria under Subtitle D of the Resource Conservation and Recovery Act for use in determining which solid waste disposal facilities and practices pose a reasonable probability of adverse effects on health or the environment. See 40 CFR § 257.1(a). This part comes into play whenever there is a "disposal" of any solid or hazardous waste from a "facility." "Disposal" is defined as "the discharge, deposit, injection, dumping, spilling, leaking, or placing of any solid waste or hazardous waste into or on any land or water so that such solid waste or hazardous waste or any constituent thereof may enter the environment or be emitted into the air or discharged into any waters, including ground waters." See 40 CFR § 257.2. "Facility" means "any land and appurtenances thereto used for the disposal of solid wastes." Solid waste requirements are listed herein because there may be disposal of solid wastes as a result of this removal action.

1. 40 CFR § 264.257 (incorporated by reference in Montana under ARM § 17.54.702). Criteria for Classification of Solid Waste Disposal Facilities and Practices. The activities to be performed for the Mouat site removal action are expected to comply with the following requirements.

a. 40 CFR § 257.3-1. Washout of solid waste in facilities in a floodplain posing a hazard to human life, wildlife,

or land or water resources shall not occur.

b. 40 CFR § 257.3-2. Facilities shall not contribute to the taking of endangered species or the endangering of critical habitat of endangered species.

c. 40 CFR § 257.3-3. A facility shall not cause a discharge of pollutants, dredged or fill material, into waters of the United States in violation of sections 402 and 404 of the Clean Water Act, as amended, and shall not cause nonpoint source pollution, in violation of applicable legal requirements implementing an areawide or statewide water quality management plan that has been approved by the Administrator under Section 208 of the Clean Water Act, as amended.

d. 40 CFR § 257.3-4. A facility shall not contaminate an underground source of drinking water beyond the solid waste boundary or beyond an alternative boundary specified in accordance with this section.

e. 40 CFR § 257.3-8(d). Access to a facility shall be controlled so as to prevent exposure of the public to potential health and safety hazards at the site.

2. State of Montana Solid Waste Requirements (all relevant and appropriate).

a. ARM § 17.50.505(1) and (2). Sets forth standards that all solid waste disposal sites must meet, including the requirements that (1) Class II landfills must confine solid waste and leachate to the disposal facility. If there is the potential for leachate migration, it must be demonstrated that leachate will only migrate to underlying formations which have no hydraulic continuity with any state waters; (2) adequate separation of group II wastes from underlying or adjacent water must be provided; and (3) no new disposal units or lateral expansions may be located in wetlands. ARM § 17.50.505 also specifies general soil and hydrogeological requirements pertaining to the location of any solid waste management facility.

b. ARM § 17.50.506. Specifies design requirements for landfills. Landfills must either be designed to ensure that MCLs are not exceeded or the landfill must contain a composite liner and leachate collection system which comply with specified criteria.

c. ARM § 17.50.513. Sets forth general operational and maintenance and design requirements for solid waste facilities using landfilling methods. Specific operational and maintenance requirements specified in ARM § 17.50.513 that are

relevant and appropriate are run-on and run-off control systems requirements, requirements that sites be fenced to prevent unauthorized access, and prohibitions of point source and nonpoint source discharges which would violate Clean Water Act requirements. ARM § 16.14.506 specifies design requirements for landfills. All landfills must contain a composite liner and leachate collection system which comply with specified criteria. Landfills must either be designed to ensure that MCLs are not exceeded or comply with further composite liner and leachate collection system criteria.

d. **ARM § 17.50.523**. Specifies that solid waste must be transported in such a manner as to prevent its discharge, dumping, spilling or leaking from the transport vehicle.

e. **ARM § 17.50.530**. Sets forth the closure requirements for landfills. Class II landfills must meet the following criteria: (1) install a final cover that is designed to minimize infiltration and erosion; (2) design and construct the final cover system to minimize infiltration through the closed unit by the use of an infiltration layer that contains a minimum 18 inches of earthen material and has a permeability less than or equal to the permeability of any bottom liner, barrier layer, or natural subsoils or a permeability no greater than 1 X 10-5 cm/sec, whichever is less; (3) minimize erosion of the final cover by the use of a seed bed layer that contains a minimum of six inches of earthen material that is capable of sustaining native plant growth and protecting the infiltration layer from frost effects and rooting damage; (4) revegetate the final cover with native plant growth within one year of placement of the final cover.

f. **ARM § 17.50.531**. Sets forth post closure care requirements for Class II landfills. Post closure care must be conducted for a period sufficient to protect human health and the environment. Post closure care requires maintenance of the integrity of the integrity and effectiveness of any final cover, including making repairs to the cover as necessary to correct the effects of settlement, subsidence, erosion, or other events, and preventing run-on and run-off from eroding or otherwise damaging the cover and comply with the groundwater monitoring requirements found at ARM Title 16, chapter 14, subchapter 7.

D. **Air Requirements (all applicable)**.

1. **ARM § 16.8.1401(2), (3), and (4)**. Airborne particulate matter. There shall be no production, handling, transportation, or storage of any material, use of any street, road, or parking lot, or operation of a construction site or demolition project unless reasonable precautions are taken to control emissions of airborne particles. Emissions shall not exhibit an opacity exceeding 20% or greater averaged over 6 consecutive minutes.

2. **ARM § 16.8.1404(2)**. Visible Air Contaminants.

Emissions into the outdoor atmosphere shall not exhibit an opacity of 20% or greater averaged over 6 consecutive minutes.

3. **ARM § 16.8.1427.** Nuisance or odor bearing gases. Gases, vapors and dusts will be controlled such that no public nuisance is caused within the Mouat site.

4. **ARM § 26.4.761(2)(a), (e), (h), (j), and (k).** Fugitive dust control measures such as 1) watering, stabilization, or paving of roads, 2) vehicle speed restrictions, 3) stabilization of surface areas adjoining roads, 4) restriction of travel on other than authorized roads, 5) enclosing, covering, watering, or otherwise treating loaded haul truck, 6) minimizing area of disturbed land, and 7) revegetation, must be planned and implemented, if any such measure or measures are appropriate for this removal action.

F. Air Quality Requirements (applicable).

Removal activities will comply with the following requirements to ensure that existing air quality will not be adversely affected by the Mouat removal action.

2. **ARM § 16.8.818.** Settled particulate matter shall not exceed a 30 day average of 10 grams per square meter.

3. **ARM § 16.8.821.** The concentration of PM-10 in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

IV. TO BE CONSIDERED DOCUMENTS (TBCs)

The use of documents identified as TBCs is addressed in the Introduction, above. A list of TBC documents is included in the Preamble to the NCP, 55 Fed. Reg. 8765 (March 8, 1990). Those documents, plus any additional similar or related documents issued since that time, will be considered by EPA and MDEQ during the conduct of the RI/FS, during remedy selection, and during remedy implementation.

V. OTHER LAWS (NON-EXCLUSIVE LIST)

CERCLA defines as ARARs only federal environmental and state environmental and siting laws. Design, implementation, and operation and maintenance must nevertheless comply with all other applicable laws, both state and federal, if the remediation work is done by parties other than the federal government or its contractors.

The following "other laws" are included here to provide a reminder of other legally applicable requirements for actions being

conducted at the reservoir sediments operable unit. They do not purport to be an exhaustive list of such legal requirements, but are included because they set out related concerns that must be addressed and, in some cases, may require some advance planning. They are not included as ARARs because they are not "environmental or facility siting laws." As applicable laws other than ARARs, they are not subject to ARAR waiver provisions.

Section 121(e) of CERCLA exempts removal or remedial actions conducted entirely on-site from federal, state, or local permits. This exemption is not limited to environmental or facility siting laws, but applies to other permit requirements as well.

A. Other Federal Laws

1. Occupational Safety and Health Regulations. The federal Occupational Safety and Health Act regulations found at 29 CFR § 1910 are applicable to worker protection during conduct of response activities.

B. Other Montana Laws

1. Groundwater Act. Section 85-2-505, MCA, precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.

2. Public Water Supply Regulations. If response action at the site requires any reconstruction or modification of any public water supply line or sewer line, the construction standards specified in ARM § 16.20.401(3) must be observed.

3. Groundwater Act. Section 85-2-516, MCA, states that within 60 days after any well is completed a well log report must be filed by the driller with the DNRC and the appropriate county clerk and recorder.

4. Water Rights. Section 85-2-101, MCA, declares that all waters within the state are the state's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation of natural aquatic ecosystems.

Parts 3 and 4 of Title 85, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with in any action using or affecting waters of the state. Some of the specific requirements are set forth below.

Section 85-2-301, MCA, of Montana law provides that a person may only appropriate water for a beneficial use.

Section 85-2-302, MCA, specifies that a person may not appropriate water or commence construction of diversion, impoundment, withdrawal or distribution works therefor except by applying for and receiving a permit from the Montana Department of Natural Resources and Conservation. While the permit itself may not be required under federal law, appropriate notification and submission of an application should be performed and a permit should be applied for in order to establish a priority date in the prior appropriation system. A 1991 amendment imposes a fee of $1.00 per acre foot for appropriations of ground water, effective until July 1, 1993.

Section 85-2-306, MCA, specifies the conditions on which groundwater may be appropriated, and, at a minimum, requires notice of completion and appropriation within 60 days of well completion.

Section 85-2-311, MCA, specifies the criteria which must be met in order to appropriate water and includes requirements that:

1. there are unappropriated waters in the source of supply;

2. the proposed use of water is a beneficial use; and

3. the proposed use will not interfere unreasonably with other planned uses or developments.

Section 85-2-402, MCA, specifies that an appropriator may not change an appropriated right except as provided in this section with the approval of the DNRC.

Section 85-2-412, MCA, provides that, where a person has diverted all of the water of a stream by virtue of prior appropriation and there is a surplus of water, over and above what is actually and necessarily used, such surplus must be returned to the stream.

5. <u>Occupational Health Act</u>, §§ 50-70-101 <u>et seq</u>., MCA. ARM § 16.42.101 addresses occupational noise. In accordance with this section, no worker shall be exposed to noise levels in excess of the levels specified in this regulation. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910.95 applies.

ARM § 16.42.102 addresses occupational air contaminants. The purpose of this rule is to establish maximum threshold limit values for air contaminants under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. In accordance with this rule, no worker shall be exposed to air contaminant levels in excess of the threshold limit values listed in the regulation.

This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR § 1910.1000 applies.

6. **Montana Safety Act**. Sections 50-71-201, 202 and 203, MCA, state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe. The employer must also do every other thing reasonably necessary to protect the life and safety of its employees. Employees are prohibited from refusing to use or interfering with the use of safety devices.

7. **Employee and Community Hazardous Chemical Information Act**. Sections 50-78-201, 202, and 204, MCA, state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.

APPENDIX C

METHOD FOR DETERMINING STATISTICAL TREND GROUNDWATER MONITORING LOCATIONS MOUAT INDUSTRIES, COLUMBUS MONTANA

Method for Determining Statistical Trend
Groundwater Monitoring Locations
Mouat Industries, Columbus, Montana

Test for Trends

The Mann-Kendall test for trend, as proposed in the Post-Removal Site Control Plan is a non-parametric test for statistical trend. The Mann-Kendall test is appropriate for evaluation of groundwater as the test can be run with datasets where values are missing, sample intervals are uneven and when the data do not conform to a particular distribution. The Mann-Kendall test can be applied to datasets with non-detect values when the non-detect result is substituted by a common value lower than the smallest measured value.

The following text describes how the Mann-Kendall test should be applied to Mouat Site data and how results are to be reported.

The Mann-Kendall test relies on three statistical metrics, which will be reported for each well sampled. The first metric, the S statistic, is based on the sum of the differences between data in sequential order [1]. The coefficient of variation (COV) is calculated from the standard deviation divided by the mean for the dataset. The third critical statistic in the Mann-Kendall evaluation is the Confidence Limit (CL). The CL, as it applies to this project, is a measure of confidence in *rejecting* the null hypothesis (H_0), that the data show no trend.

The Mann-Kendall method tests H_0 against the alternative hypothesis (H_A) -- that the data show a trend. For datasets with 40 or less sample results, the probability (p) of accepting H_0 is determined from the Mann-Kendall table of probabilities[1], based on the number of samples (n, for $n < 40$) and the absolute value of the S statistic. Specifically, p is the probability of obtaining a value of S equal or greater than the calculated value for n when no trend is present. We define the CL as ($1-p$) %. The CL is inversely proportional to p, and directly proportional to both S and n.

For this project H_0 is fully rejected when $p < 0.05$, corresponding to $\alpha = 0.05$ and a CL of 95%. When the CL is between 90 – 95% ($0.1 > p > 0.05$), H_0 is rejected, but the trend is weak. The weakness of the trend is identified by using the terms "Probably Increasing" or "Probably Decreasing" to describe the data. For CL > 95% ($p < 0.05$), the data demonstrate strongly "Increasing" or "Decreasing" trends. A CL between 90% and 95%, will not trigger contingent actions.

When the CL is below 90% ($p > 0.1$), H_0 is accepted, and no trend is detected. For this project, depending on the values of S and COV, the data are assigned 'Stable' or 'No Trend' status. A 'Stable' result occurs when $S < 0$ and the COV is low (COV<1). No Trend is the default result.

By using the method described above, data from each well location can be categorized in one of 8 ways: Increasing trend (I), Decreasing trend (D), Probably Increasing trend (PI), Probably Decreasing trend (PD), Stable (S), No Trend (NT), non-detect (ND) or insufficient data to determine a trend (N/A) (for $n < 4$).

Method for Determining Statistical Trend
Groundwater Monitoring Locations
Mouat Industries, Columbus, Montana

S Statistic	**CL > 95%**	**95%>CL>90%**	**CL<90%**
S > 0	Increasing	Probably Increasing	Stable (COV<1) No Trend (COV>1)
S < 0	Decreasing	Probably Decreasing	No Trend

The Mann-Kendall test requires results from four independent sampling events to determine a trend. Some wells in the Monitoring Plan Well Network (MPWN) have several years of historic data. Because the confidence in the trend (CL) is proportional to the number of samples (n), wells with longer histories may show stronger trends. For example, down gradient wells MIS-15, MIS-16, and RMIS-4 have data from 13 sample events since 1996. Other locations have been installed recently, and do not currently have sufficient data to determine a trend. In order to account for differences in the historic record, both recent and overall trends for each well will be calculated. Overall trends will be calculated using the full dataset for each well. Recent trends will be calculated using the most recent 4 sampling results for each well. Decisions on the status of the well will be made based on the recent trend, but may be modified after review of the overall trend.

REFERENCES

1. Gilbert, R.O., *Statistical Methods for Environmental Pollution Monitoring.* 1987, New York: van Nostrand Reinhold.

2. USEPA, *ProUCL 4.0 Statistical Software.* 2007, National Exposure Research Lab, EPA: Las Vegas, Nevada.

APPENDIX D

INSTITUTIONAL CONTROLS

1065961 - R8 SDMS

ORDINANCE NO. 328

AN ORDINANCE OF THE TOWN COUNCIL OF THE TOWN OF COLUMBUS, MONTANA, AMENDING SUBSECTION D OF SECTION 17.76.010 AND SECTION 17.76.040 OF THE COLUMBUS MUNICIPAL CODE

WHEREAS, the U.S. Environmental Protection Agency has allowed the removal of groundwater use restrictions from the Superfund overlay district (SOD), excepting the block placement area; and

WHEREAS, the U.S. Environmental Agency Protection Agency has requested that the Town amend Subsection D of Section 17.76.010 and Section 17.76.040 of the Columbus Municipal Code to reflect the removal of the groundwater use restrictions from the SOD, excepting the block placement area.

NOW, THEREFORE, be it ordained by the Town Council of the Town of Columbus, Montana:

1) Subsection D of Section 17.76.010 of the Columbus Municipal Code is hereby amended to read as follows:

> "D. Limiting well use and prohibiting drilling of wells within the SOD block placement area; and ..."

2) The first sentence under Section 17.76.040 of the Columbus Municipal Code is hereby amended to read as follows:

> "17.76.040 Limitations on groundwater use.
>
> The following limitations apply to groundwater use and related activities within the Superfund overlay district block placement area:..."

3) This Ordinance shall become effective thirty (30) days after its passage and approval.

PASSED by the Town Council and approved by the Mayor this 3rd day March, 2008.

Gary Woltermann - Mayor

ATTEST:

Ronald D. Barndt - Town Clerk

325257

Return to:
Timberweld Manufacturing Company
PO Box 21000
Billings, MT 59103

325257 DEED8 Pages: 1
STATE OF MONTANA STILLWATER COUNTY
RECORDED: 01/17/2006 10:47 KOI: WARRANTY D
Pauline Mishler CLERK AND RECORDER
FEE: 07.00 BY: Pauline M Mishler
TO: VENDER LAW FIRM, PC P.O. BOX 80548, BILLINGS, MT 59102

WARRANTY DEED

FOR A VALUABLE CONSIDERATION, receipt of which is hereby acknowledged, the undersigned, TOWN OF COLUMBUS, a Municipal Corporation, of PO Box 549, Columbus, MT 59019, hereby grants unto TIMBERWELD MANUFACTURING COMPANY, of PO Box 21000, Billings, MT 59103, the real property in Stillwater County, Montana, more particularly described as:

Industrial Sites Addition to the
Town of Columbus, Montana
Block 2 : Lots 1 and 2
as shown on Plat No. 179163

TO HAVE AND TO HOLD unto the Grantee, and Grantee's successors and assigns, forever, SUBJECT TO THE FOLLOWING:

(a) Reservations and exceptions in patents from the United States or the State of Montana;
(b) Existing easements and rights of way;
(c) All building, use, zoning, sanitary and environmental restrictions;
(d) Taxes and assessments for 2006 and subsequent years;
(e) This conveyance is subject to the provisions of Chapter 17.76, SOD, Superfund Overlay District, of the Columbus Municipal Code;

TOGETHER WITH all tenements, hereditaments and appurtenances thereto belonging or any wise appertaining.

EXCEPT with reference to items referred to in paragraphs (a) to (e) inclusive, this Deed is given with the usual covenants expressed in Section 30-11-110, M.C.A.

DATED this 3rd day of January, 2006.

GRANTOR:

TOWN OF COLUMBUS

By: Gary Woltermann
GARY WOLTERMANN, Mayor

STATE OF MONTANA)
: ss.
County of Stillwater)

This instrument was acknowledged before me on January 3, 2006, by GARY WOLTERMANN, Mayor.

Douglas D. Howard
[Signature of Notary]

Douglas D. Howard
[Typed, stamped or printed Name of Notary]
Notary Public for the State of Montana.
Residing at Columbus, Montana.
[City of Residence]
My commission expires Nov. 15, 2006.
[Month Day Year]

D. HOWARD
NOTARY
SEAL
MONTANA

ENVIRONMENTAL
PROTECTION AGENCY
MAY 1 2 2005
MONTANA

Chapter 15.08

WATER WELL REGULATIONS

Sections:

15.08.010 **Definitions.**
15.08.020 **Compliance required.**
15.08.030 **Permit required for installation.**
15.08.040 **Procedure where water well is in existence.**
15.08.050 **Permissible use of water wells.**
15.08.060 **Inspection.**
15.08.070 **Permits.**
15.08.080 **Violation—Penalty.**

15.08.010 Definitions.

For the purposes of this chapter, the following terms, phrases, words, and their derivations shall have the meaning given herein. When not inconsistent with the context, words used in the present tense include the future, words in the plural number include the singular number, and words in the singular number include the plural number. The word "shall" is always mandatory and not merely directory.

"Water well" means any form of dug, drilled or other water producing system independent of the town water system and independent of any normal irrigation ditch system. (Prior code § 4.10.010)

15.08.020 Compliance required.

It is unlawful for any person to install or operate any water well within the town limits or on property served by the town water system without first conforming to the provisions of this chapter. (Prior code § 4.10.020)

15.08.030 Permit required for installation.

All persons who desire to install a water well after the effective date of this chapter shall obtain approval of their proposed installation and a permit therefore in advance from the director of public works and shall give notice of completion of the installation. (Prior code § 4.10.030)

15.08.040 Procedure where water well is in existence.

All persons who have installed water wells prior to the effective date of this chapter shall, in lieu of a permit, notify the director of public works of such existing installation. Failure to give such notice shall be a violation of this chapter.

Compliance Dates. All water well systems installed prior to the effective date of this chapter and in nonconformity herewith shall be converted, modified, adjusted or otherwise made to comply herewith as follows:

Any metering or plumbing charges required by the director of public works and the terms of this chapter shall be accomplished within ninety (90) days from and after the inspection by the director of public works. (Prior code § 4.10.040)

15.08.050 Permissible use of water wells.

Residential. Water wells covered by this chapter shall be used on residential properties only for yard and garden purposes and may not be used for any household purposes and the same may not be connected to or in any way plumbed so that they can be used in conjunction with or attached to the water lines connected to the town water system.

Commercial and Industrial. Any water wells used for commercial or industrial purposes must be plumbed according to the requirements of the director of public works and may not be connected to pipes used in common with the town water supply system so as to prevent contamination of the municipal water system. (Prior code § 4.10.050)

15.08.060 Inspection.

To insure and protect the health and welfare of the people of the town who are using the town water supply system, an inspection of all water wells by the director of public works shall be made before the same are placed in operation. (Prior code § 4.10.060)

15.08.070 Permits.

A permit to drill a water well shall be issued by the town clerk upon completion of a written application by the person desiring to drill a water well and a payment of a fee of seventy-five dollars ($75.00) for said permit and inspection. A permit shall be valid for one year after the date of issuance. (Ord. 268 § 1, 1995: prior code § 4.10.070)

15.08.080 Violation—Penalty.

Any person violating any of the provisions of this chapter shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in an amount not exceeding five hundred dollars ($500.00) or be subject to imprisonment for a term not to exceed six months, or both.

Each day such violation is committed or permitted to continue, shall constitute a separate offense and shall be punishable hereunder. (Ord. 283 § 15, 1997: prior code § 4.10.080)

ORDINANCE NO. 321

AN ORDINANCE AMENDING SECTIONS 17.08.010, 17.20.020, 17.20.090, 17.24.090, 17.28.090, 17.32.020, 17.32.090, 17.36.020, 17.36.090, 17.40.100, 17.48.020, 17.48.090, 17.52.020, 17.52.090, 17.56.090, 17.60.090, 17.64.010, 17.64.030, 17.64.070, 17.64.080, 17.64.090, 17.72.020, 17.72.090, 17.76.010, 17.76.020, CHAPTER 17.88, SECTIONS 17.92.020, 17.92.030, 17.96.020, 17.96.070, 17.96.090, 17.96.110, 17.100.030, 17.100.050, 17.100.070, CHAPTERS 17.104, 17.108, 17.112, and 17.116, and ADDING SECTION 17.76.40 TO THE COLUMBUS ZONING ORDINANCE.

WHEREAS, the City-County Planning Board acting in its capacity as Columbus Zoning Commission has recommended amendments to the above-referenced chapters and sections contained in the Columbus Zoning Ordinance, Title 17, Zoning, of the Columbus Municipal Code as set forth in attached Exhibit "A" for the purpose of clarifying and updating said Ordinance; and

WHEREAS, prior to making its recommendations, the City-County Planning Board conducted a public hearing on August 24, 2000, regarding the proposed amendments to the Columbus Zoning Ordinance; and

WHEREAS, public notice of the public hearing was published in the Stillwater County News on August 12 and 19, 2004; and

WHEREAS, the Town Council deems it appropriate to adopt the recommendations of the Columbus Zoning Commission.

NOW, THEREFORE, pursuant to the authority granted under Section 76-2-305, MCA, be it ordained by the Town Council of the Town of Columbus, Montana, that the amendments to the above-referenced sections and chapters of the Columbus Municipal Code as set forth in the attached Exhibit A are hereby adopted.

BE IT FURTHER ORDAINED by the Town Council of the Town of Columbus, Montana, that this ordinance shall become effective thirty (30) days after its final passage and approval.

PASSED by the Town Council and approved by the Mayor this 1st day of November, 2004.

Webb Mandeville - Mayor

ATTEST:

Ronald D. Barndt - Town Clerk

Chapter 17.76

SOD SUPERFUND OVERLAY DISTRICT

Sections:

17.76.010 Intent.
17.76.020 Additional application requirements.
17.76.030 Performance standards for block placement area.
17.76.040 Limitations on groundwater use.
17.76.050 Sunset provision

17.76.010 Intent.

The intent of the superfund overlay district (SOD) is to protect public health, safety and welfare while allowing appropriate use of lands within the district. This intent will be accomplished by:

A. Assuring that land use in the superfund overlay district is compatible with protecting, and providing for permanent preservation and maintenance of remedial actions implemented pursuant to the superfund law, including soil caps, treated concrete blocks, and other remedial structures;

B. Requiring that any development in the block placement area of the SOD be preceded by submittal of detailed site and construction plans, prepared by an architect or engineer, for review and approval by the town as an institutional control in the context of the federal superfund law;

C. Requiring submittal of as built plans with certification from an architect or engineer that site development and construction in the block placement area was completed in compliance with this zoning title and federal superfund law;

D. Limiting well use and prohibiting drilling of wells within the SOD; and

E. Placing a notice to purchasers on any deed, contract for sale, or other instrument of conveyance before any lot or parcel, or any interest in any lot or parcel, in the superfund overlay district is conveyed. (Ord. 298 § 1 (part) (11.02.191), 1997)

17.76.020 Additional application requirements.

All applications for uses and development in the superfund overlay area shall include the following information:

A. As with other permit applications, an application form, an accurate site plan and review fees; and

B. A detailed grading and drainage plan prepared by an engineer showing the location, dimensions and depth of all excavations, volumes of material to be moved, and other drainage features; and

C. Detailed plans prepared by an architect or engineer showing how remedial structures such as soil caps, treated concrete blocks, and other structures will be protected and maintained in relation to the proposed ~~site development~~ in the block placement area; and

D. Test results that confirm that any fill material proposed to be imported to the ~~site~~ block placement area has less than 0.1 mg/l total chromium in toxicity characteristic leaching procedure (TCLP) extracts or written certification that no fill material will be imported; and

E. Bearing capacities, design loads and wheel loads resulting from uses proposed for the ~~site~~block placement area. (Ord. 298 § 1 (part) (11.02.192), 1997)

Code and the city of Columbus zoning code. Load limits for buildings or structures will not exceed six thousand (6,000) pounds per square foot.

G. Asphalt paving can be substituted for the uppermost six inches of the gravel cover. In this case, the asphalt will be placed in two courses--a four inch base course and a two inch surface wearing course.

H. The fences around the soil cover areas must be maintained by the property owner and the gates must be kept locked. To protect the soil cover, wheeled vehicles must be excluded from soil cover areas except for soil cover and vegetation maintenance. (Ord. 298 § 1 (part) (11.02.193), 1997)

17.76.040 Limitations on groundwater use.

The following limitations apply to groundwater use and related activities within the superfund overlay district:

A. Installation or operation of new groundwater wells, groundwater fed ponds or channels, and other groundwater extraction or recovery systems will not be permitted.

B. Use of groundwater from existing wells, ponds, springs, seeps or any other groundwater recovery or extraction system will not be permitted, except for lawn irrigation use, use of the existing golf course pond, and groundwater monitoring of wells.

C. Excavation below the groundwater table (static groundwater level) for any purpose will not be allowed except for temporary excavation work necessary for construction purposes including placement of footings and utilities. Such temporary excavation work shall require a permit from the town of Columbus. (Ord. 298 § 1 (part) (11.02.194), 1997)

17.76.40 Sunset Provision

Application requirements and limitations for groundwater use shall sunset and will no longer be applicable after the U.S. Environmental Protection Agency allows the removal of these restrictions from the Superfund Overlay District.

ORDINANCE NO. 247

AN ORDINANCE REPEALING CHAPTER 11.02, ZONING REGULATIONS, OF THE EXISTING ORDINANCES AND ADOPTING "TOWN OF COLUMBUS ZONING REGULATIONS, AMENDED 1995", WHICH SHALL BE CODIFIED AS CHAPTER 11.02.

WHEREAS, the Town Council deems a complete revision of the Town's existing zoning ordinances to be in the public interest, and

WHEREAS, the Town Council deems it appropriate to adopt airport zoning, and

WHEREAS, the City-County Planning Board was appointed to serve as the Columbus Zoning Commission to undertake a thorough review of the Town's current zoning ordinances and map and to make recommendations to update the ordinances, and

WHEREAS, the Columbus Zoning Commission has spent considerable time reviewing the Town's existing zoning ordinances and drafting proposed revisions, and

WHEREAS, the Columbus Zoning Commission held a public hearing in the matter on November 22, 1994, after publishing legal notice of the hearing in the November 2, 1994, issue of the *Stillwater County News*, and

WHEREAS, all public comments were considered by the Columbus Zoning Commission before it made its final recommendation that the Town Council adopt the Town of Columbus Zoning Regulations, Amended 1995, and

WHEREAS, the Town Council deems it in the public interest to adopt Town of Columbus Zoning Regulations, Amended 1995;

NOW, THEREFORE, pursuant to the authority granted under Sections 7-5-4202, 67-8-201, and 76-2-301, MCA, (1993), be it ordained by the Town Council of the Town of Columbus, Montana:

Section 1: That the Town of Columbus Zoning Regulations, Amended 1995, are hereby adopted and shall be codified as Chapter 11.02 of the Official Code of the Town of Columbus, Montana.

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Section 2: That all ordinances or parts of ordinances in conflict herewith shall be repealed upon the effective date of this Ordinance.

Section 3: That this Ordinance shall become effective thirty (30) days after its passage and approval.

PASSED by the Town Council and approved by the Mayor this 6th day of March, 1995.

Jack Kenyon - Mayor

ATTEST:

Ronald D. Berndt - Town Clerk

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being filed
security as law document

SECTION 11.02.190

SOD - SUPERFUND OVERLAY DISTRICT

Subsections:

11.02.191 Intent
11.02.192 Additional Application Requirements
11.02.193 Performance Standards for Block Placement Area
11.02.194 Limitations for Groundwater Use

11.02.191 Intent. The intent of the Superfund Overlay District (SOD) is to protect public health, safety and welfare while allowing appropriate use of lands within the district. This intent will be accomplished by:

1. assuring that land use in the Superfund Overlay District is compatible with protecting, and providing for permanent preservation and maintenance of remedial actions implemented pursuant to the Superfund law, including soil caps, treated concrete blocks, and other remedial structures;

2. requiring that any development in the block placement area of the SOD be preceded by submittal of detailed site and construction plans, prepared by an Architect or Engineer, for review and approval by the Town as an institutional control in the context of the federal Superfund law;

3. requiring submittal of as built plans with certification from an Architect or Engineer that site development and construction was completed in compliance with this Zoning Ordinance and federal Superfund law;

4. limiting well use and prohibiting drilling of wells within the SOD; and

5. placing a notice to purchasers on any deed, contract for sale, or other instrument of conveyance before any lot or parcel, or any interest in any lot or parcel, in the Superfund overlay district is conveyed.

11.02.192 Additional Application Requirements. All applications for uses and development in the Superfund Overlay Area shall include the following information:

1. As with other permit applications, an application form, an accurate site plan, and review fees; and

2. a detailed grading and drainage plan prepared by an Engineer showing the location, dimensions and depth of all excavations, volumes of material to be moved, and other drainage features;

quality of the document being filmed
SITE
MOU966

3. detailed plans prepared by an Architect or Engineer showing how remedial structures such as soil caps, treated concrete blocks, and other structures will be protected and maintained in relation to the proposed site development;

4. test results that confirm that any fill material proposed to be imported to the site has less than 0.1 mg/l total chromium in toxicity characteristic leaching procedure (TCLP) extracts or written certification that no fill material will be imported; and

5. bearing capacities, design loads, and wheel loads resulting from uses proposed for the site.

11.02.193 Performance Standards for Block Placement Area.
The following standards apply to the block placement area within the Superfund Overlay District.

1. No excavation will be permitted through the 24 inch thick soil or gravel cover except for building or utility construction as described in item 6. (Excavation is permitted at the existing sanitary sewer only for purposes of sewer maintenance and improvement).

2. Areas with gravel cover and block placement can be used for vehicle parking, material storage and related traffic. This includes: trucks up to the maximum gross vehicle weight and axel loads permitted under the Montana Department of Highways adopted "Federal Bridge Formula"; forklifts up to 50,000 pounds gross weight with up to 37,000 pounds on a single axel with four tires; and construction equipment with up to 7,200 pounds per square foot under the actual tire or track contact area.

3. Areas with a vegetated soil cover cannot be used for any purpose unless a gravel cover or a gravel and asphalt overlay is placed over the 24-inch thick soil cover or a gravel cover that meets the following criteria:

   - The gravel will be select road stone from a local source. Gravel already on the site will be used to the extent possible; off-site gravel sources will be used only if on-site quantities of suitable gravel are not sufficient. This gravel will be well sorted with a range of particle sizes to facilitate close compaction and to minimize voids and permeability in the cover after placement and compaction.

   - The gravel will be separated from the underlying blocks and soils by a woven geotextile designed to reduce migration of gravel particles downward into the block-south layer and of block pieces upward into the gravel layer.

   - The gravel layer will be approximately 2 feet (24 inches) thick.

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SITE
MOU900

- The gravel will be placed in 6 to 12 inch lifts to facilitate grading and compaction. Each lift will be compacted with a motorized road construction type roller.

- The finished surface of gravel will be graded to promote precipitation runoff to perimeter diversion ditches. The center elevation of the gravel surface will be approximately one foot above the perimeter elevations, and the average surface slope will be one percent.

- The gravel surface will be designed and installed to accommodate vehicular traffic and open storage of materials. Operation of vehicles such as trucks and forklifts will promote compaction of the surface gravel and further reduce infiltration.

- Maintenance of the gravel cover will be by the landowner or lessee.

4. The soil and gravel covers constructed pursuant to (3) above must be maintained by the property owner to prevent degradation. Damage due to erosion, wind, burrowing animals, vehicles, or other causes must be repaired promptly by the property owner.

5. The perimeter drainage channels and culverts must be maintained by the City of Columbus Public Works Department in an open, free-flowing condition.

6. If any building or structure (including related utilities) is to be constructed on the block placement areas, sufficient soil must be placed over initial cover so that any excavation required for this construction does not penetrate the placed blocks. Any building or structure, including the related utilities, must meet all applicable requirements of the Montana State Building Code and the City of Columbus Zoning Code. Load limits for buildings or structures will not exceed 6,000 pounds per square foot.

7. Asphalt paving can be substituted for the uppermost 6 inches of the gravel cover. In this case, the asphalt will be placed in two courses—a 4 inch base course and a 2 inch surface wearing course.

8. The fences around the soil cover areas must be maintained by the property owner and the gates must be kept locked. To protect the soil cover, wheeled vehicles must be excluded from soil cover areas except for soil cover and vegetation maintenance.

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11.02.194 Limitations on Groundwater Use.
The following limitations apply to groundwater use and related activities within the Superfund Overlay District.

1. Installation or operation of new ground water wells, groundwater fed ponds or channels, and other groundwater extraction or recovery systems will not be permitted.

2. Use of groundwater from existing wells, ponds, springs, seeps or any other groundwater recovery or extraction system will not be permitted, except for lawn irrigation use, use of the existing golf course pond, and groundwater monitoring of wells.

3. Excavation below the groundwater table (static groundwater level) for any purpose will not be allowed except for temporary excavation work necessary for construction purposes including placement of footings and utilities. Such temporary excavation work shall require a permit from the Town of Columbus.

being filmed
SITE
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TOWN OF COLUMBUS

ADMINISTRATIVE RECORD

1139799 - R8 SDMS

408 E 1st Ave N
P.O. BOX 549
COLUMBUS, MONTANA 59019
406-322-5313 Fax 406-322-4176

ENVIRONMENTAL
PROTECTION AGENCY
MAR 17 2010
MONTANA OFFICE

March 16, 2010

Roger Hoogerheide
USEPA Superfund Project Manager
United State Environmental Protection Agency
Region 8, Montana Office
Federal Building, 10 West 15th Street, Suite 3200
Helena, MT 59626

Daryl Reed
DEQ Superfund Project Manager
Montana Department of Environmental Quality
PO Box 200901
Helena, MT 59620-0901

RE: Mouat Industrics NTL Site

Dear Roger and Daryl:

Enclosed please find a copy of Town Ordinance No. 336 that was adopted by the Columbus Town Council on second reading during its March 15, 2010, regular meeting for the purpose of amending the institutional controls pertaining to the block placement area within the Mouat Industries Superfund Site overlay district as recommended by your agencies. The Ordinance will become effective April 15, 2010.

Please contact me if there are any further questions or concerns.

Sincerely yours,

Douglas D. Howard

DDH-mah

Please reply to:
Phone: 406-322-4429

DOUGLAS D. HOWARD, Town Attorney
219 N. 4th St. - P. O. Box 926
Columbus, MT 59019

Fax: 406-322-4449

Second Reading

ORDINANCE NO. 336

AN ORDINANCE OF THE TOWN COUNCIL OF THE TOWN OF COLUMBUS, MONTANA, AMENDING SUBSECTIONS F, G AND H OF SECTION 17.76.030 OF THE COLUMBUS MUNICIPAL CODE

WHEREAS, the Montana Department of Environmental Quality and the US Environmental Protection Agency have recommended changes to Subsections F, G and H of Section 17.76.030, of the Columbus Municipal Code pertaining to performance standards for the block placement area within the Mouat Industries Superfund Site overlay district based on the November, 2009, Mouat Industries Superfund Site Structural Capacity and Institutional Controls Reassessment Final Report prepared by the Bureau of Mines and Geology Montana Tech of the University of Montana; and

WHEREAS, the Town Council is agreeable to making the recommended changes.

NOW, THEREFORE, be it ordained by the Town Council of the Town of Columbus, Montana:

1) Subsection F of Section 17.76.030 of the Columbus Municipal Code is hereby amended to read as follows:

"F. If a building is constructed within the block placement area, excavation required for this construction and trenching for utilities is allowed. Excavated waste may be placed back into the foundation excavation and compacted as backfill to support the foundation and /or disposed of according to state of Montana approved methods. Any building or structure, including the related utilities, must meet all applicable requirements of the Montana State Building Code and the Town of Columbus zoning code. Load limits for buildings or structures will not exceed six thousand (6,000) pounds per square foot as long as waste is left in place"

2) Subsection G of Section 17.76.030 of the Columbus Municipal Code is hereby amended to read as follows:

"G. Asphalt paving can be substituted for the uppermost four inches of gravel cover. In this case, the asphalt will be placed in three courses— a minimum two-inch gravel base course, a four-inch asphalt base course, and a two-inch surface wearing course.

3) Subsection H of Section 17.76.030 of the Columbus Municipal Code is hereby amended to read as follows:

"H. Maintenance of fences around the soil cover areas as well as locked gates are no longer deemed necessary. However, the property owner must maintain the vegetated soil cover or gravel cover on the site.

4) That all Ordinances or parts of Ordinances in conflict herewith shall be repealed upon the effective date of this Ordinance

5) This Ordinance shall become effective thirty (30) days after its passage and approval

PASSED by the Town Council and approved by the Mayor on second reading this 15th day March, 2010

Gary Woltermann – Mayor

ATTEST

Ronald D Barndt - Town Clerk

APPENDIX E

CORRESPONDENCE BETWEEN EPA AND TOWN OF COLUMBUS REGARDING INSTITUTIONAL CONTROLS

1090843 - R8 SDMS

TOWN OF COLUMBUS

P.O. Box 549
COLUMBUS, MONTANA 59019

PROTECTION AGENCY
OCT 1 1995
MONTANA OFFICE

October 12, 1995

ADMINISTRATIVE RECORD

Ronald A. Bertram, Environmental Scientist
United States Environmental Protection Agency
Region VIII, Montana Office
Federal Bldg. - 301 S. Park
Drawer 10096
Helena, MT 59626-0096

RE: **MOUAT INDUSTRIES SUPERFUND SITE**

Dear Mr. Bertram:

This shall confirm that the current and anticipated future use of the area associated with the Mouat Industries Site and groundwater plume as shown on the attached diagram referenced as Sheet No. 5-2 and dated April 11, 1995, will continue to be Commercial/Industrial and Recreational. There is no future residential construction anticipated in the Superfund Overlay District.

If you have any further questions and concerns in regard to this matter, please contact me.

Sincerely yours,

Jack Kenyon

Jack Kenyon
Mayor

JK:gl
Attachment
pc: Ron Barndt, Town Clerk

8010805
453050

STILLWATER COUNTY

Elevation [illegible]

Population, Census [illegible]

Cattle [illegible]

Sheep [illegible]

Horses [illegible]

Total Pop

Crops [illegible]

Winter Wheat [illegible]

Oats [illegible]

Hay [illegible]

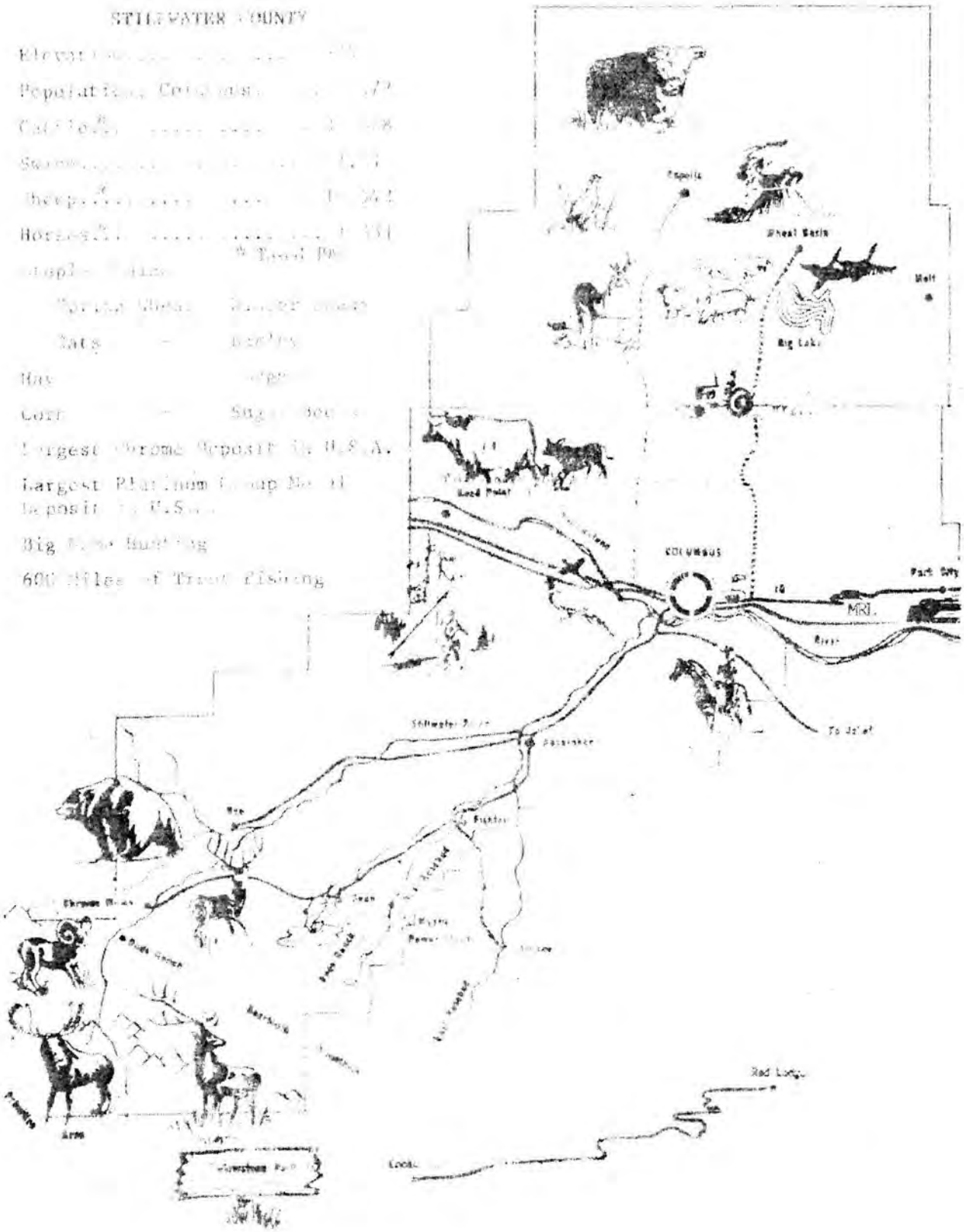
Corn [illegible] Sugar Beets

Largest Chrome Deposit in U.S.A.

Largest Platinum Group Metal Deposit in U.S.A.

Big Game Hunting

600 Miles of Trout Fishing



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VIII, MONTANA OFFICE
FEDERAL BUILDING, 301 S. PARK, DRAWER 10096
HELENA, MONTANA 59626-0096

1090491 - R8 SDMS

Ref: 8MO

April 8, 1996

ADMINISTRATIVE RECORD

Douglas D. Howard, Esq.
Town Attorney
Town of Columbus
P.O. Box 926
Columbus, Montana 59019

Dear Mr. Howard:

This is in response to your April 3, 1996 letter requesting clarification as to whether areas zoned for residential use can be used for that purpose within the Superfund Overlay District associated with the Mouat Industries Superfund Site. EPA acknowledges that it is appropriate for the Town of Columbus to permit land uses within the Superfund Overlay District for which areas have already been zoned as long as the restrictions placed on these uses by Section 11.02.190 of the Superfund Overlay District are strictly enforced. At the same time, EPA believes that the Town should to the extent that there is no conflict with pre-existing Town Zoning Ordinances, avoid any future residential zoning in the Superfund Overlay District which was the intent of EPA's request in the October 5, 1995 letter.

If you have any questions, please contact me at (406) 441-1150, ext. 258.

Sincerely,

Ronald A. Bertram

Ronald A. Bertram
Environmental Scientist

cc: Bob Fox, 8MO
Andy Lensink, 8RC
Jim Scott, DEQ

8010405

441990

Printed on Recycled Paper

CONCURRENCE COPY

Ref: 8MO

April 8, 1996

Douglas D. Howard, Esq.
Town Attorney
Town of Columbus
P.O. Box 926
Columbus, Montana 59019

Dear Mr. Howard:

This is in response to your April 3, 1996 letter requesting clarification as to whether areas zoned for residential use can be used for that purpose within the Superfund Overlay District associated with the Mouat Industries Superfund Site. EPA acknowledges that it is appropriate for the Town of Columbus to permit land uses within the Superfund Overlay District for which areas have already been zoned as long as the restrictions placed on these uses by Section 11.02.190 of the Superfund Overlay District are strictly enforced. At the same time, EPA believes that the Town should to the extent that there is no conflict with pre-existing Town Zoning Ordinances, avoid any future residential zoning in the Superfund Overlay District which was the intent of EPA's request in the October 5, 1995 letter.

If you have any questions, please contact me at (406) 441-1150, ext. 258.

Sincerely,

Ronald A. Bertram
Environmental Scientist

cc: Bob Fox, 8MO
Andy Lensink, 8RC
Jim Scott, DEQ
FCD: April 8, 1996:bertram;columbus.007

1090514 - R8 SDMS

TOWN OF COLUMBUS

P.O. Box 549
COLUMBUS, MONTANA 59019

ENVIRONMENTAL PROTECTION AGENCY
APR 1 1996
MONTANA OFFICE

April 3, 1996

ADMINISTRATIVE RECORD

Ronald A. Bertram, Environmental Scientist
United States Environmental
Protection Agency
EPA Region VIII, Montana Office
Federal Building - 301 S. Park
Drawer 10096
Helena, MT 59626-0096

RE: **MOUAT INDUSTRIES SUPERFUND SITE**

Dear Ron:

Pursuant to today's phone conference, enclosed please find copies of your letter to me of October 5, 1995, map of the Mouat Industries Site showing the Superfund Overlay District referred to in your letter, and official Columbus zoning map with the area about which I am concerned colored green.

The area colored green was zoned R-2 (Single Family Residential) when the Town's Zoning Ordinances were completely revised in March, 1995. City/County Planning Administrator John Beaudry has informed me that the zoning map and regulations were reviewed and approved by the USEPA and FMC before final adoption by the Town.

The Town Council is currently in the process of rezoning this area R-3 which would permit multi-family residential units.

My concern is that there is an obvious conflict between the Town's Zoning Ordinances pertaining to that portion of this area within the Superfund Overlay District which permits residential use and the certification which you requested from the Town in your letter of October 5, 1995, that there would be no future residential use in this area. The Town needs clarification from the USEPA as to whether this area can be used for residential purposes subject to restrictions pertaining to the Superfund Overlay area as the Town had originally

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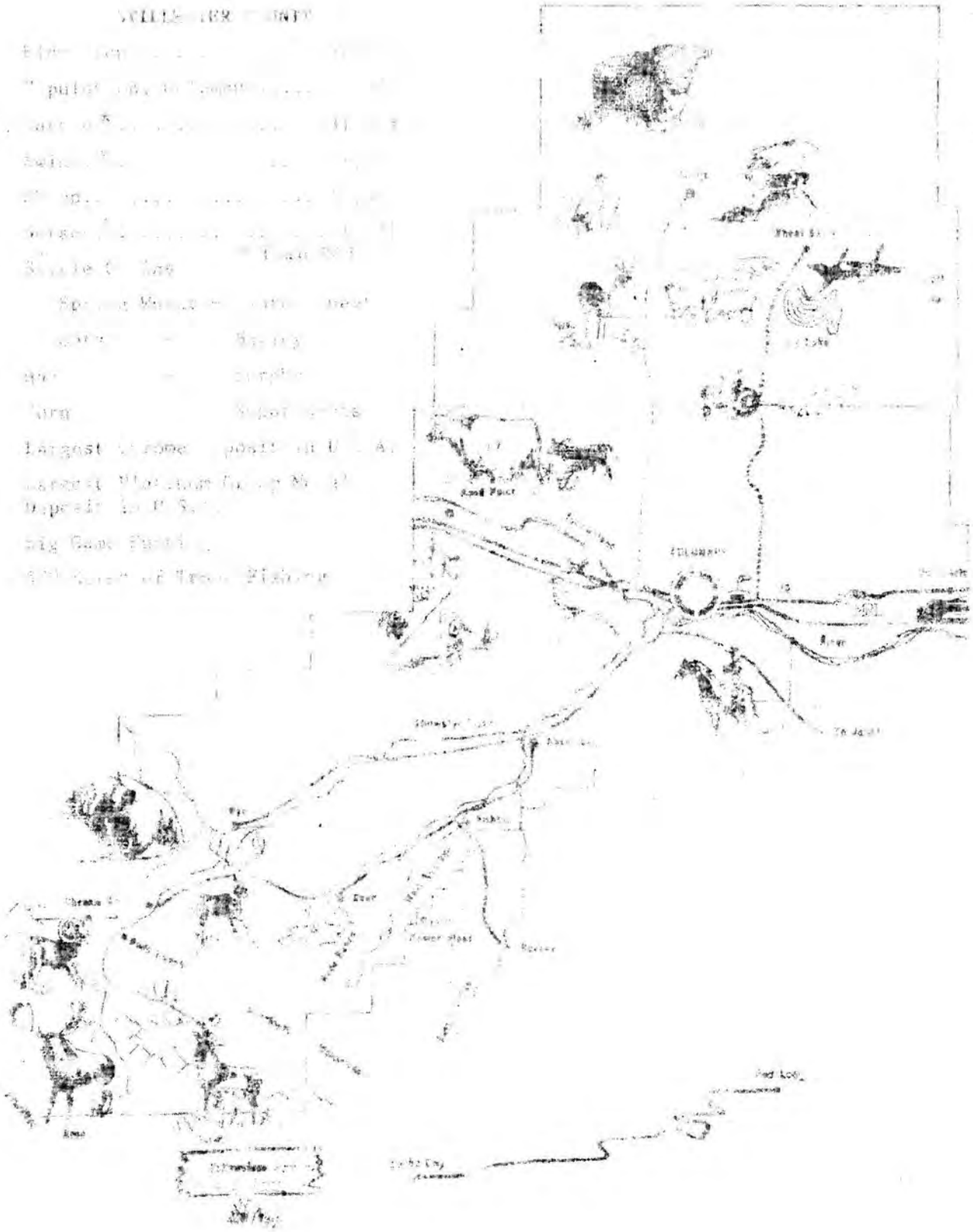
Phone: 406-322-4429
DOUGLAS D. HOWARD, Town Attorney
219 N. 4th St. - P. O. Box 926
Columbus, MT 59019



understood, or whether any future non-existing residential use is to be prohibited, which seems to be what you were requesting in your letter of October 5, 1995.

Since the Town Council will be considering the final adoption of the Rezoning Ordinance at its April 15, 1996, meeting, I would appreciate hearing from you in regard to this matter as soon as possible. If you have any further questions or concerns or need any additional information, please contact me.

Sincerely yours,

Doug Howard

Douglas D. Howard

DDH:grl

TOWN OF COLUMBUS

P.O. BOX 549
COLUMBUS, MONTANA 59019
PHONE: (406) 322-5313

ENVIRONMENTAL PROTECTION AGENCY
MAY 19 2005

May 18, 2005

Ronald A. Bertram
U.S. Environmental Protection Agency
Region VIII, Montana Office
10 W. 15th St., Suite 3200
Helena, MT 59626

Re: Mouat Industries Site

Dear Ron:

I am writing in regard to items 2 and 3 contained in the May 6, 2005, letter that you received from Daryl Reed, State Project Officer, for the Federal Superfund Section of the Montana Department of Environmental Quality. In regard to item 2 of the above-referenced letter, the Town's existing Ordinances include Chapter 17.76, SOD Superfund Overlay District, a copy of which is enclosed for your reference. It is my understanding that the provisions and restrictions pertaining to the block placement area will continue to be applicable and it is only the limitation on ground water use pertaining to land located outside the block placement area that will be lifted. I will recommend that the Town Council adopt a resolution or ordinance to that effect. Any land located within the block placement area will continue to be subject to the provisions of Chapter 17.76 and any deed conveying title to land located within the block placement area will include the following language:

> " This conveyance is subject to the provisions of Chapter 17.76, SOD Superfund Overlay District, of the Columbus Municipal Code."

In regard to item 3 of the May 6, 2005 letter, enclosed please find a copy of Chapter 15.08, Water Well Regulations, of the Columbus Municipal Code. Section 15.08.050 specifically provides that residential water wells shall be used only for yard and garden purposes and may not be used for any household purposes.

Please let me know if there are any further questions or concerns pertaining to these two items.

Also, earlier you faxed me a copy of the April 13, 2005, Notice of Completion letter signed by Max H. Dodson, Assistant Regional Administrator. Apparently, the original of the letter that was supposed to come to me was sent somewhere else. Since the letter authorizes the Town to lift the ground water restrictions, it is an important document from the Town's perspective. If possible, I would like to receive an original of the letter with an ink signature that can be kept in the Town's permanent records. Any assistance that you can provide in obtaining a signed original letter for the Town would be greatly appreciated.

It will be good to get this project closed out. Your cooperation and assistance in that regard have been greatly appreciated.

8010408

COPY

453337

Please reply to:
Phone: 406-322-4429

DOUGLAS D. HOWARD, Town Attorney
219 N. 4th St. - P. O. Box 926
Columbus, MT 59019

Fax: 406-322-4449

Please give me a call if there are any further questions or concerns.

Sincerely yours,

DOUGLAS D. HOWARD

DDH:vj
Enclosures
Cc: Webb Mandeville, Mayor
Town Council
Ron Barndt, Town Clerk
Dennis Holten, DPW

Please reply to:

Phone: 406-322-4429

DOUGLAS D. HOWARD, Town Attorney
219 N. 4th St. - P. O. Box 926
Columbus, MT 59019

Fax: 406-322-4449

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8
999 18TH STREET - SUITE 300
DENVER, CO 80202-2466
http://www.epa.gov/region8

SITE O.U. Mouat
DEQ File # 11-01-09-06
Admin. Record: Yes____ No____
Administrative Record #____
Confidential: Yes____ No____
Key Words/Comments:____

April 13, 2005

Ref: 8EPR

Robin Bullock
AERL/ARCO
317 Anaconda Road
Butte, Montana 59701

Mr. John F. Stillmun, Esq.
FMC Corporation
1735 Market Street
Philadelphia, PA 19103

Town of Columbus
c/o: Douglas D. Howard, Town Attorney
PO Box 926
Columbus, Montana 59019

Mary Westwood, Director
Governmental Relations
Monte Vista Company
PO Box 3118
Billings, MT 59107-118

RECEIVED
APR 20 2005
Dept. of Environmental Quality
Remediation Division

John Walker Ross, Esq. (On Behalf of William Mouat)
Brown, Gerbase, Cebull, Fulton, Harman & Ross
315 North 24th Street
PO Box Drawer 849
Billings, MT 59103-0849

Joe Hucke, President
Timberweld Manufacturing
PO Box 21000
1643 24th Street W.
Billings, MT 59103

RE: Notice of Completion for a Non-Time Critical Removal Action (UAO Docket No. CERCLA-VIII-96-22) at the Mouat Industries NPL Site, Columbus, Montana.

Printed on Recycled Paper

Dear Respondents:

EPA has reviewed the Final Closure Report (Report) submitted by ARCO in partial fulfillment of the requirements of the Unilateral Administrative Order (Docket No CERCLA-VIII-96-22) for the conduct of a Non-Time Critical Removal Action to address the groundwater contamination at the Mouat Industries NPL Site, Columbus, Montana. EPA believes the Report demonstrates that the terms of the Unilateral Administrative Order (Docket No CERCLA-VIII-96-22) have been met. Specifically, the Report demonstrates that the following work required by the Order has been completed:

- Data shows that the MCL for total chromium in groundwater and the WQB-7 standards for total chromium in groundwater has not been exceeded for a period of three consecutive years.
- Data shows that all remaining wells not included in the Monitoring Plan Well Network but within the Superfund Overlay District do not exceed the MCL or WQB-7 standards for total chromium in groundwater.
- Institutional controls over land use and groundwater use have been established and enforced by the Town of Columbus.
- The Respondents have implemented the RAWP attached to the Order.
- The Respondents have submitted and implemented an approved Health and Safety Plan in accordance with the Order.
- All sampling and analyses were performed in accordance with a Quality Assurance and Sampling Plan provided by EPA.
- All reporting requirements were performed in accordance with the Order including annual analytical results reports for monitoring activities.
- The Respondents submitted a Final Closure Report as required by the Order.

EPA, as required under the Order (Section XII, Notice of Completion), is providing this notification that all work has been completed in accordance with UAO Docket No. CERCLA-VIII-96-22, with the exception of the continuing obligation to maintain institutional controls on the use of the property where the treated soil blocks have been placed.

In regard to the institutional controls on groundwater use as required pursuant to the Superfund Overlay District Zoning Ordinance (Section 11.02.190, Superfund Overlay District), EPA believes the restrictions can be lifted in accordance with the Order. The condition for lifting the groundwater use restrictions is stated in Section VI, page 13 of the Order as follows:

> *The restrictions on groundwater use can be lifted by the Town of Columbus after response action objectives are met (the MCL for chromium in groundwater and the WQB-7 standards for chromium in groundwater has not been exceeded for a period of three consecutive years).*

The Town of Columbus is authorized by this letter to lift the groundwater use restrictions as required pursuant to the Superfund Overlay District Zoning Ordinance. Land use restrictions

must remain on the block placement area. The Town of Columbus has agreed to enforce the land use restrictions on the block placement area through deed restrictions.

By my signature below, this Notice of Completion is issued.

Sincerely,

Max H Dodson, Assistant Regional Administrator
Office of Ecosystems Protection and Remediation
U.S. Environmental Protection Agency, Region VIII

cc: John F. Wardell, 8MO
Ronald A. Bertram, 8MO
Bob Fox, 8MO
Dana Stotsky, ENF-L
Sandi Olsen, DEQ
Daryl Reed, DEQ
Vic Andersen, DEQ
Tom Root, DEQ
Kevin Kirley, DEQ

TOWN OF COLUMBUS

P.O. BOX 549
COLUMBUS, MONTANA 59019
PHONE: (406) 322-5313

ENVIRONMENTAL PROTECTION AGENCY
MAY 19 2005
Mail Room

May 18, 2005

RECEIVED
MAY 23 2005
Dept. of Environmental Quality
Remediation Division
SITE O.U. Mouat
DEQ File # 11-01-09-06
Admin. Record: Yes_____ No_____
Administrative Record #_____
Confidential: Yes_____ No_____
Key Words/Comments:_____

Ronald A. Bertram
U.S. Environmental Protection Agency
Region VIII, Montana Office
10 W. 15th St., Suite 3200
Helena, MT 59626

Re: Mouat Industries Site

Dear Ron:

I am writing in regard to items 2 and 3 contained in the May 6, 2005, letter that you received from Daryl Reed, State Project Officer, for the Federal Superfund Section of the Montana Department of Environmental Quality. In regard to item 2 of the above-referenced letter, the Town's existing Ordinances include Chapter 17.76, SOD Superfund Overlay District, a copy of which is enclosed for your reference. It is my understanding that the provisions and restrictions pertaining to the block placement area will continue to be applicable and it is only the limitation on ground water use pertaining to land located outside the block placement area that will be lifted. I will recommend that the Town Council adopt a resolution or ordinance to that effect. Any land located within the block placement area will continue to be subject to the provisions of Chapter 17.76 and any deed conveying title to land located within the block placement area will include the following language:

> " This conveyance is subject to the provisions of Chapter 17.76, SOD Superfund Overlay District, of the Columbus Municipal Code."

In regard to item 3 of the May 6, 2005 letter, enclosed please find a copy of Chapter 15.08, Water Well Regulations, of the Columbus Municipal Code. Section 15.08.050 specifically provides that residential water wells shall be used only for yard and garden purposes and may not be used for any household purposes.

Please let me know if there are any further questions or concerns pertaining to these two items.

Also, earlier you faxed me a copy of the April 13, 2005, Notice of Completion letter signed by Max H. Dodson, Assistant Regional Administrator. Apparently, the original of the letter that was supposed to come to me was sent somewhere else. Since the letter authorizes the Town to lift the ground water restrictions, it is an important document from the Town's perspective. If possible, I would like to receive an original of the letter with an ink signature that can be kept in the Town's permanent records. Any assistance that you can provide in obtaining a signed original letter for the Town would be greatly appreciated.

It will be good to get this project closed out. Your cooperation and assistance in that regard have been greatly appreciated.

Please reply to:
Phone: 406-322-4429

DOUGLAS D. HOWARD, Town Attorney
219 N. 4th St. - P. O. Box 926
Columbus, MT 59019

Fax: 406-322-4449

Please give me a call if there are any further questions or concerns.

Sincerely yours,

DOUGLAS D. HOWARD

DDH:vj
Enclosures
Cc: Webb Mandeville, Mayor
Town Council
Ron Barndt, Town Clerk
Dennis Holten, DPW

Please reply to:

Phone: 406-322-4429

DOUGLAS D. HOWARD, Town Attorney
319 N. 4th St. - P. O. Box 926
Columbus, MT 59019

Fax: 406-322-4449

Town of Columbus

408 E 1st Ave N
PO Box 549
Columbus, MT 59019
406-322-5313 Fax 406-322-4176

ENVIRONMENTAL PROTECTION AGENCY
FEB 02 2009
MONTANA OFFICE

January 30, 2009

Site SBID 0865 04=00
Confidential: Yes ____ No ____
Admin. Record: Yes ____ No ____
Key Words/Comments. ____

Roger Hoogerheide
U.S. EPA Remedial Project Manager
Federal Building, 10 West 15th Street, Suite 3200
Helena, MT 59626

RE: Institutional Controls at Mouat Industries NTL Site

Dear Roger:

Enclosed please find the January 20, 2009, letter prepared and signed by Daryl Reed and you, which has now been signed on behalf of the Town by Mayor Gary Woltermann.

Please let me know if anything further is needed from the Town in regard to this matter.

Sincerely yours,

Doug Howard

Douglas D. Howard

DDH-mah

Cc: Ron Barndt (with copy of referenced letter)
Dennis Holten (with copy of referenced letter)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 8, MONTANA OFFICE
FEDERAL BUILDING, 10 W. 15th STREET, SUITE 3200
HELENA, MONTANA 59626

ENVIRONMENTAL PROTECTION AGENCY

FEB 02 2009

MONTANA OFFICE

Montana Department of ENVIRONMENTAL QUALITY

Ref: 8MO

January 20, 2009

Re: Institutional Controls at Mouat Industries NPL Site

In 1996 the United States Environmental Protection Agency (EPA) issued a Unilateral Administrative Order (UAO) for Conduct of a Non-Time Critical Removal Action at the Mouat Industries National Priorities List Site (Site) to a number of parties, including the Town of Columbus (Town). The Town responded to the order by letter dated August 15, 1996, agreeing to enforce the institutional controls over land use and groundwater use at the Site as its role in complying with the UAO.

Through this correspondence EPA and the Montana Department of Environmental Quality (DEQ) want to confirm certain ongoing and future actions for which the Town will be responsible in compliance with the UAO to eliminate any confusion about the nature and extent of these continuing obligations. EPA is currently proposing a partial deletion of the surface and subsurface soils at the Site. EPA and DEQ are also finalizing a Post Removal Site Control Plan for the Site. The Post Removal Site Control Plan summarizes the history of the Site, including orders issued and response actions conducted to date. In addition, the Post Removal Site Control Plan describes the future actions that are required to ensure protectiveness at the Site under Superfund, including the future monitoring to be conducted and the institutional and engineering controls to be maintained.

The chromium contaminated surface and subsurface soils at the Site were addressed through two removal actions while two other Action Memoranda addressed Site controls and groundwater. The primary removal action involved on-Site treatment of the contaminated soils resulting in 5' x 5' x 6' blocks which were placed in a repository on-Site.

In the 1996 Action Memorandum EPA specified that annual monitoring of four wells located immediately along the down-gradient perimeter of the Site would be required for 30 years. The Post Removal Site Control Plan identifies additional monitoring which will be conducted by EPA, DEQ, and their contractors. As described in the Post Removal Site Control Plan, EPA and DEQ will also conduct reviews every five years to determine if the remedy continues to be protective of human health and the environment. These reviews will continue for as long as waste is left in place above levels that allow for unlimited use and unrestricted exposure.

The UAO and the Post Removal Site Control Plan also require that certain institutional controls be maintained and enforced on the Site. These non-engineered instruments are employed to minimize potential for human exposure, limit land/resource use, and/or protect the integrity of the remedy. The enforcement and implementation of institutional controls at the Site is the primary responsibility of the Town, with the involvement of EPA and DEQ in determining compliance with Superfund requirements. Section V of the Post Removal Site Control Plan describes in detail the engineering and institutional controls that are to be maintained for the Site, as well as the primary roles of the parties relating to those controls. This letter serves to confirm the parties' understanding and continued acceptance of their respective roles in ensuring the proper maintenance and enforcement of the institutional controls for the Site.

A zoning ordinance (Chapter 17.76) approved by the Town Council in March 1995 created the Superfund Overlay District ("SOD"). The intent of the SOD is to protect public health, safety and welfare while allowing appropriate use of lands within the SOD. The SOD ordinance includes restrictions and requirements relating to land use and groundwater use and is described in more detail in the Post Removal Site Control Plan. The SOD includes a process to ensure review and approval of any planned development in the block placement area as well as measures to ensure the permanent preservation and maintenance of soil caps, treated concrete blocks, and other remedial structures, including the Site cover, drainage facilities, and fences. The Town is required to implement and enforce these institutional control requirements under the UAO. The requirements of the SOD ordinance cannot be amended, suspended, or otherwise rendered ineffective without the prior written approval of EPA and DEQ.

To ensure compliance with the federal Superfund law as provided in the SOD, the Town agrees to notify EPA and DEQ of any proposed land use change and/or development of the Site that would affect the block placement area or remedial structures such as vegetative caps, drainage facilities, or fences. Such notification will be given in writing sufficiently in advance of any action by the Town to approve such changes to allow EPA and DEQ to determine whether the proposed changes could adversely affect the maintenance or protectiveness of the Superfund remedial measures at the Site. Such notice will include any information required in the ordinance, such as detailed site and construction plans, and other information necessary to determine the potential impact of the proposed changes on the Superfund remedial measures. Such notification should be provided to the following addresses and reference the Mouat Industries NPL Site CERCLIS ID # MTD021997689:

Superfund Project Manager
Montana Department of Environmental Quality
P.O. Box 200901
Helena, Montana 59620-0901

Superfund Project Manager
United States Environmental Protection Agency
Region 8, Montana Office
Federal Building, 10 W. 15th Street, Suite 3200
Helena, Montana 59626

EPA's and DEQ's review will determine whether the proposed changes may be allowed consistent with the requirements of the federal Superfund law and ensuring that the protectiveness of the Superfund remedial measures is not inappropriately compromised by the proposed changes.

DEQ and EPA agree to meet with the Town at least once every five years to discuss the Site land use and groundwater use restrictions. These meetings are designed to provide better understanding of the issues associated with these restrictions as well as notify the Agencies of any upcoming land use changes that may require a more comprehensive review.

Montana Tech of The University of Montana is currently conducting an evaluation of the geotechnical and structural capacities of the Site. This work is expected to be completed by the summer of 2009 and may include recommendations for changes to these institutional controls and guidance for possible future development of the Site.

Please acknowledge your understanding of and agreement to the obligations outlined here by signing this letter below.

Sincerely,

Daryl Reed
DEQ Superfund Project Manager

Roger Hoogerheide
USEPA Superfund Project Manager

So agreed by the Town of Columbus:

Name: GARY G WOLTERMANN
Title: MAYOR

01-29-2009
Date