P_4 Production, LLC

A JOINT VENTURE OF

MONSANTO imagine™

SOLUTIA™ Applied Chemistry, Creative Solutions™

SOUTHEAST IDAHO MINE-SPECIFIC SELENIUM PROGRAM

Comprehensive Site Investigation

Sampling and Analysis Plan—Final

April 2004

Prepared by

MWH

2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005

STATE OF IDAHO

DEPARTMENT OF ENVIRONMENTAL QUALITY

15 West Center • Soda Springs, Idaho 83276 • (208) 547-1940

Dirk Kempthorne, Governor
C. Stephen Allred, Director

May 3, 2004

Robert L. Geddes
Monsanto Company
PO Box 816
Soda Springs, Idaho 83276

Re: Conditional Approval of SI and EE/CA Sampling Plans For Ballard, Henry and Enoch Valley Mines
Monsanto Site-Specific Investigations

The Idaho Department of Environmental Quality (DEQ) is issuing this conditional approval of P4 Production's revised *Comprehensive Site Investigation Sampling and Analysis Plan* and *Project-Specific Field Sampling Plans* submitted on April 28, 2004 for the Ballard, Henry and Enoch Valley mines. This approval requires implementation of the following conditions and clarifications necessary to address interagency concerns. We understand P4's field sampling teams will be mobilizing on May 5th and the final sampling plan documents will be issued to the Agencies in hard copy upon receipt of this approval.

Based on our review of P4's responses to the previous Agencies comments and our follow up discussions with interagency representatives, it appears the majority of the comments were sufficiently addressed. However, the following conditions are required for the remaining concerns:

1. P4 will design and implement a site-specific investigation component to characterize the vegetation on the South Henry Dump within and adjacent to BLM's Grazing Allotment #14109. The characterization effort will include a minimum of 20 random vegetation samples analyzed for selenium content to develop a statistically-valid mean vegetation concentration with supporting data variance information.
2. DEQ was unable to find any reference to the specific soil-sampling interval proposed by the sampling plans. For soils collocated with vegetation samples, the sampling interval will be 0 to 12 inches to be reasonably representative of root zone selenium concentrations.
3. As acknowledged in the interagency responses, sediment-sampling efforts will focus on areas where deposition of fine sediment has occurred. The lab will sieve

sediment samples and analyze the fraction that is less than 0.2 mm representing the bioavailable sediment fraction.

4. The Agencies will not pre-approve one-time sampling events for site characterization purposes as proposed in the sampling plans for several of the media investigations. We reserve our right to require additional sampling during subsequent phases of investigation if the data evaluation efforts warrant further data to fully characterize the subject media and/or operational units.
5. There is some concern regarding the proposed time period for vegetation sampling and the possibility of temporal selenium uptake concentration differences due to transpiration, metabolic growth rates, or variation in late-season selenium source concentrations. P4 will identify three riparian quadrats for June vegetation sampling with repeat vegetation sampling during the proposed August vegetation sampling event to evaluate these concerns. One of the June/August quadrats will be sampled and analyzed discretely (5 random, discrete points) to provide single sample point variance estimates. The other two quadrats may be sampled and analyzed by the proposed compositing method.
6. P4 will also select one additional August riparian zone quadrat, one wetland area quadrat, and one waste rock dump transect to sample and analyze discretely to develop single point variance information. The single point data from the selected quadrats/transect can be mathematically averaged for composite sample comparisons.

The Department appreciates your efforts in addressing our concerns. Please submit your final SAP/FSPs to the Agencies as soon as possible. This conditional approval letter is incorporated by reference into the final sampling plans and should be available to those individuals responsible for site investigation sampling activities. If you have any questions or comments, please do not hesitate to call me.

Respectfully,

Richard L. Clegg, P.E.
DEQ On-Scene Coordinator

Cc.	W. Wright-MWH	B. Stout-BLM	D. Tomten-USEPA
	J. Jones-USFS	D. Fox-BIA	C. Cutler-ShoBan Tribes
	S. Burch-USFWS	D. Tanner-DEQ	C. Morris-IDL

Executive Summary

This Sampling and Analysis Plan (SAP) for the comprehensive mine-specific site investigations at Enoch Valley, Henry, and Ballard mines describes general environmental investigation activities and procedures, including quality and health and safety procedures, which P_4 Production will use to conduct the site investigations (SIs) under their Southeast Idaho Mine-Specific Selenium Program. The SAP is organized into three parts:

- Part 1—Program Field Sampling Plan (PgmFSP; to be supplemented with appropriate mine-specific Project FSPs or PjtFSPs);
- Part 2—Program Quality Assurance Plan (PgmQAP); and,
- Part 3—Program Health and Safety Plan (PgmHSP).

The PgmFSP references a brief program background and summarizes the objectives of the comprehensive mine-specific SIs (i.e., program objectives are inclusive of all three mine's objectives). Mine-specific objectives can be found in their respective project-specific work plan (PjtWP). The PgmFSP describes tasks and subtasks by environmental medium that will be undertaken and presents procedures for sample collection, handling, and analysis for the entire program. The PgmFSP is designed to be used in conjunction with the appropriate mine-specific PjtFSPs and PjtWPs for the comprehensive mine-specific SIs at P_4 Production's Enoch Valley, Henry and Ballard mines.

The PgmQAP describes program-specific data requirements and standard operating procedures for the measurement of field parameters and sample collection for laboratory analysis. It also presents quality assurance (QA) and quality control (QC) procedures to assure that the data are precise, accurate, representative, comparable, and complete.

The PgmHSP describes health and safety procedures to be followed by the field teams to assure that all fieldwork is conducted safely and in accordance with the requirements of the United States Department of Labor's Mine Safety and Health Administration as well as their Occupational Safety and Health Administration.

The objectives of the comprehensive SI sampling effort for each of the three mines were formulated in accordance with the data quality objectives process documented in Section 3.0 of each mine-specific PjtWP. As a general objective, the data collection process will be focused on that information which is necessary to evaluate and select a removal action alternative in the EE/CA process. The amount of such data to be collected will be what is sufficient to conduct such evaluation and selection. The combined or comprehensive program sampling objectives are described in Section 3.0 of the PgmFSP and the mine-specific sampling objectives are described in detail in Section 3.3 of the three PjtWPs.

The SAP will serve as the guidance manuals for the comprehensive mine-specific site investigation field efforts. Therefore, each team will have one copy of this document at all times when in the field. Each subcontract laboratory is also required to maintain a copy of this plan to be used as reference when conducting work supportive of the comprehensive SIs.

P_4 Production, LLC

A JOINT VENTURE OF

MONSANTO imagine™

SOLUTIA™ Applied Chemistry, Creative Solutions™

SOUTHEAST IDAHO MINE-SPECIFIC SELENIUM PROGRAM

Comprehensive Site Investigation

Program Field Sampling Plan—Final

April 2004

Prepared by

MWH

2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005

TABLE OF CONTENTS

1.0 INTRODUCTION 1-1
2.0 PROGRAM BACKGROUND 2-3
2.1 PROGRAM HISTORY 2-3
2.2 P_4 PRODUCTION VOLUNTARY ACTIONS 2-5
3.0 INVESTIGATION OBJECTIVES 3-6
4.0 SAMPLING LOCATIONS, FREQUENCY, AND SCHEDULE 4-11
4.1 TASK 1: SURFACE WATER AND SEDIMENT INVESTIGATION 4-17
4.1.1 Subtask 1b—Surface Water and Sediment Sampling 4-17
4.2 TASK 3: GEOLOGY AND GROUNDWATER INVESTIGATION 4-17
4.2.1 Subtask 3a—Phase 1 Investigation 4-17
4.2.2 Subtask 3b—Phase II Investigation 4-17
4.3 TASK 4: SOIL INVESTIGATION 4-18
4.3.1 Subtask 4b—Characterization of Extent of Riparian Zone Soil Contamination at Streams, Ponds, Seeps, Springs, and Wetlands 4-18
4.3.2 Subtask 4c—Characterization of Waste Rock Dump Extent of Soil Contamination 4-18
4.3.3 Subtask 4d—Agronomic Testing of Unreclaimed, Poorly Reclaimed, and Well Reclaimed Land 4-18
4.4 TASK 5: AQUATIC ECOLOGY 4-18
4.4.1 Subtask 5a—Stream Habitat Assessment 4-19
4.4.2 Subtask 5b—Fish Tissue Quality Investigation 4-19
4.5 TASK 6: TERRESTRIAL ECOLOGICAL INVESTIGATION 4-19
4.5.1 Subtask 6a—Habitat Assessment of Ponds, Wetlands, and Non-Fish Bearing Streams 4-19
4.5.2 Subtask 6b—Characterization of Extent of Riparian Zone Vegetation Contamination at Streams, Ponds, Seeps, Springs, and Wetlands 4-19
4.5.3 Subtask 6f—Characterization of Waste Rock Dump Extent of Vegetation Contamination 4-20
4.6 TASK 7: FACILITIES INVESTIGATION 4-20
5.0 SAMPLE DESIGNATION 5-21
6.0 SAMPLE COLLECTION AND ANALYSIS 6-23
6.1 STATION ACCESS REQUIREMENTS 6-23
6.2 TASK 1: SURFACE WATER AND SEDIMENT INVESTIGATION 6-24
6.2.1 Surface Water Collection 6-24
6.2.2 Surface Water Quality Assurance/Quality Control 6-24
6.2.3 Surface Water Field Parameter Measurements 6-25
6.2.4 Surface Water Flow Measurements 6-25
6.2.5 Surface Water Analyses 6-26
6.2.6 Sediment Collection 6-28
6.2.7 Sediment Quality Assurance/Quality Control 6-28

6.2.8 Sediment Analyses 6-29
6.3 TASK 3: GEOLOGY AND GROUNDWATER INVESTIGATION 6-29
6.3.1 Well Inventory for Phase I, Activity 3a-2 6-29
6.3.2 Spring and Seep Survey for Phase I, Activity 3a-3 6-30
6.3.3 Spring and Dump Seep Flow Characterization for Phase I, Activity 3a-4 6-30
6.3.4 Groundwater Collection for Phase I, Activity 3a-5, and Phase II, Activity 3b-2 6-30
6.3.5 Monitoring Well Installation for Phase II, Activity 3b-1 6-31
6.3.6 Groundwater Quality Assurance/Quality Control 6-31
6.3.7 Groundwater Analyses 6-31
6.4 TASK 4: SOIL INVESTIGATION 6-32
6.4.1 Soil Collection at Riparian Areas for Subtask 4b 6-32
6.4.2 Soil Collection at Waste Rock Dump Transects for Subtask 4c 6-34
6.4.3 Soil Collection for Agronomic Testing at Ballard Mine for Subtask 4d 6-36
6.4.4 Soil Quality Assurance/Quality Control 6-37
6.4.5 Soil Analyses 6-37
6.5 TASK 5: AQUATIC ECOLOGY 6-40
6.5.1 Stream Habitat Assessment for Subtask 5a 6-40
6.5.2 Fish Collection for Subtask 5b 6-40
6.5.3 Fish Quality Assurance/Quality Control 6-40
6.5.4 Fish Analyses 6-41
6.6 TASK 6: TERRESTRIAL ECOLOGICAL INVESTIGATION 6-41
6.6.1 Habitat Assessment for Subtask 6a 6-41
6.6.2 Vegetation Collection at Riparian Areas for Subtask 6b 6-41
6.6.3 Vegetation Collection at Waste Rock Dump Transects for Subtask 6f 6-41
6.6.4 Vegetation Quality Assurance/Quality Control 6-42
6.6.5 Vegetation Analyses 6-42
6.7 TASK 7: FACILITIES INVESTIGATION 6-42
6.8 SAMPLE HANDLING AND SHIPPING 6-43
7.0 REFERENCES 7-45

LIST OF TABLES

Table 3-1 Program Work Breakdown Structure Tasks, Subtasks, and Activities
Table 4-1 Program Sampling Locations, Frequency, and Schedule
Table 6-1 Field Contacts
Table 6-2 Surface Water, Sediment, and Fish (Forage & Salmonid) Analytes
Table 6-3 Groundwater Analytes
Table 6-4 Surface Soil and Vegetation Analytes
Table 6-5 Ballard Mine–Agronomic Soil Analytes

LIST OF FIGURES

Figure 2-1 Program Sampling Locations

LIST OF FIGURES (Continued)

Figure 6-1 Waste Rock Dump Sampling Transects

APPENDICES

Appendix A Scientific Collecting Permit

ACRONYMS AND ABBREVIATIONS

AA	atomic absorption spectroscopy
ACZ	ACZ Laboratories, Inc.
AH	aquatic habitat assessment
ASAP	as soon as possible
ASTM	American Society for Testing and Materials
BMP	best management practices
CO	Colorado
c/o	care of
DQO	data quality objective
dw	dry weight
EE/CA	engineering evaluation/cost analysis
EDL	estimated detection limit
FI	salmonids
FF	forage fish
ft	feet
ft^2	square feet
GPS	global positioning system
GW	groundwater
ICP	inductively coupled plasma
ID	Idaho
IDEQ	Idaho Department of Environmental Quality
IDWR	Idaho Department of Water Resources
i.e.	id est (latin, that is to say; in other words)
IMA	Idaho Mining Association
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MOU	Interagency Memorandum of Understanding concerning Contamination from Phosphate Mining Operations in Southeast Idaho
MS	mass spectroscopy
MWH	MWH, Inc. (formerly Montgomery Watson, Inc.)
NA	not applicable
P_4 Production	P_4 Production, L.L.C.
PgmHSP	program health and safety plan
PgmFSP	program field sampling plan

ACRONYMS AND ABBREVIATIONS (Continued)

PgmQAP	program quality assurance plan
PjtFSP	project field sampling plan
PjtWP	project work plan
SAP	sampling and analysis plan
SE	sediment
SI	site investigation
SO	soil
Solutia	Solutia, Inc.
SOP	standard operating procedure
SW	surface water
TBD	to be determined
TH	terrestrial habitat assessment
TtEMI	TetraTech EM, Inc.
U of I	University of Idaho, Moscow
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
VE	vegetation
QA	quality assurance
QC	quality control

1.0 INTRODUCTION

This PgmFSP is presented by P_4 Production in accordance with the requirements of the administrative order on consent signed by P_4 Production, IDEQ, USEPA, and USFS and formally executed on November 14, 2003. The PgmFSP presented herein supports the comprehensive mine-specific SI, which is scheduled to be conducted for two to three years, based on the hydrogeologic data needs, at P_4 Production's Enoch Valley, Henry, and Ballard mines. Early action EE/CAs may be conducted prior to SI completion for other media or operational units that have been fully characterized.

Monsanto Company has been involved in phosphate mining and phosphorus production in southeastern Idaho since the 1950s. P_4 Production is a joint venture between Monsanto and Solutia Inc. The joint venture was established in September 1997 when Solutia was formed from Monsanto. Solutia was the operating partner for P_4 Production until May 2001 when Monsanto became P_4 Production's operating partner.

The work scope includes the collection and analyses of a set of surface water, sediment, groundwater, soil, vegetation, and fish tissue samples from in and around the P_4 Production Enoch Valley, Henry, and Ballard mines. Furthermore, the scope includes data compilation, habitat assessments, and analyses of climatologic and geologic data.

This PgmFSP is the first part of the three-part Site Investigation SAP. Part two of the SAP is the PgmQAP and part three is the PgmHSP. The PgmFSP is meant to be used in conjunction with three mine-specific PjtFSPs. The three PjtFSPs are for Enoch Valley, Henry and Ballard mines and will include any information that is specific to those individual mines.

- Section 1 – Introduction: This section presents the organization of the PgmFSP.

- Section 2 – Program Background: This section provides the program history and is inclusive of all three P_4 Production mines, Enoch Valley, Henry, and Ballard mines.

- Section 3 – Investigation Objectives: This section presents the program objectives of the Site Investigation and briefly describes how the objectives will be achieved. Objectives specific to a given mine (a subset of those for the program as a whole) are provided in each mine-specific PjtWP.

- Section 4 – Sampling Locations, Frequency, and Schedule: This section identifies locations, frequency, and schedule for field sampling of various media and for aquatic and terrestrial habitat assessments.

- Section 5 – Sample Designation: This sections describes how samples will be labeled in the field.

- Section 6 – Sample Collection and Analysis: This section summarizes sampling protocols that field teams will follow for collecting, preserving, storing, and transporting samples. In addition, laboratory methods for sample analysis are identified.

- Section 7 – References: This section lists references cited in this PgmFSP.

The SAP will serve as the sampling guidance document for field personnel and will accompany field crews during the field investigation activities. Subcontractors and analytical laboratories will also be asked to keep a copy of the SAP readily accessible. The SAP will be used during sample collection, sample handling, sample analysis, data analysis, and reporting as appropriate.

2.0 PROGRAM BACKGROUND

This section provides the program history relating to all three P_4 Production mines, Enoch Valley, Henry, and Ballard Mines.

2.1 PROGRAM HISTORY

Phosphate mining has been an ongoing activity within the Southeast Idaho Resource Area since Conda Mine started operations in 1919. Today four companies including P_4 Production operate phosphate mines in the Resource Area, and the ore obtained from these mines is locally processed into fertilizer and elemental phosphorous, two important products in the world's economy. Phosphate mining and processing form an important economic foundation for southeast Idaho.

In late 1996, six horses pastured downstream of a closed, reclaimed phosphate mine were diagnosed with chronic selenosis. This event prompted concern by mine operators, the public, local, state and federal agencies about potential selenium impacts to the environment. To address these concerns, the IMA formed a Selenium Committee in early spring 1997 to identify the source and extent of selenium and other trace element impacts associated with phosphate mining activities. The IMA voluntarily conducted multiple regional investigations through June 2000 and developed mitigation measures to address selenium and other target element releases and to minimize the potential threat to the environment. The IMA assisted IDEQ with data collection as part of the 2001 Area-Wide Study discussed below.

In July 2000, federal, tribal, and state agencies signed an *Interagency Memorandum of Understanding concerning Contamination from Phosphate Mining Operations in Southeast Idaho* (MOU). The MOU specified the IDEQ as the lead agency for coordinating the Area Wide Investigation and for establishing regional clean-up guidance to assist lead agencies in implementing future site-specific remedial efforts in the Southeast Idaho Phosphate Mining Resource Area.

The IDEQ contracted TtEMI to assist in the 2001 Area-Wide Study and in the development of human health and ecological risk assessments associated with past phosphate mining operations in the Resource Area. The risk assessment work was conducted as part of the Area-Wide Scope of Work referenced in the MOU. IDEQ published the *Final Area Wide Human Health and Ecological Risk Assessment, Selenium Project Southeast Idaho Phosphate Mining Resource Area* in December 2002 (IDEQ 2002). The risk assessment was performed on an area-wide bases and concluded that regional human health risks and population-level ecological risks are unlikely based on current conditions, and that the areas impacted by historic and on-going releases are limited to approximately 5% of the overall Resource Area. The human health assessment did identify several areas that could present elevated risks under conditions of sole use over extended periods of time such as residential use of waste rock piles or fish diets exclusively limited to a few impacted first order streams. However,

these conditions were considered highly unlikely based on area land use and regional observations over the past five years.

In April 2003, IDEQ published the *Final Draft Area Wide Risk Management Plan* (IDEQ 2003). The purpose of the plan is to provide regional risk management guidance for addressing releases of selenium and related trace metals originating from historic phosphate mining operations in Southeast Idaho. The proposed action levels, remedial action goals and remedial action objectives are intended to assist the designated lead agencies and mining companies in selecting individual site remedies that focus the use of limited resources and support a consistent regional approach to risk management. The document provides a brief summary of Area Wide activities to date, a synopsis of the removal action process being implemented to address mine-specific concerns, and a comprehensive discussion of risk management issues, including goals and objectives, and the development of risk-based action levels.

MWH and P_4 Production have an extensive understanding of the area as a result of all the previous Selenium Investigations that have been ongoing since 1997. A comprehensive data set exists of historical data from various media. P_4 Production, under the umbrella of the IMA, participated in extensive sampling throughout the Southeast Idaho Phosphate Resource Area. P_4 Production has information regarding Enoch Valley, Henry, and Ballard mines from 1997-present, with various media being sampled at, and adjacent to, the mines. These have included the following media:

- Benthic macroinvertebrates;
- Forage fish;
- Salmonids;
- Small mammals;
- Terrestrial invertebrates;
- Terrestrial worms;
- Plankton;
- Periphyton;
- Groundwater;
- Riparian vegetation;
- Submergent macrophytes;
- Surface soils;
- Sediment;
- Surface water;
- Vegetation;
- Beef;
- Bird eggs; and,
- Elk.

P_4 Production initiated a fourteen-month Interim Surface Water and Sediment Investigation in May 2002 for Enoch Valley, Henry and Ballard mines, the results of which will be reported in the comprehensive SI Report (MWH 2002a, MWH 2002b).

For a map of the three mines and their associated facilities and drainages, see Figure 2-1, *Program Sampling Locations*, which covers the entire program area. For site-specific maps and site-specific backgrounds of these mines, see the appropriate mine-specific PjtFSPs.

In August 2003, MWH prepared a *Summary of Work Performed to Date Under Various Southeast Idaho Selenium Programs* (MWH, 2003) for P_4 Production that summarized the conclusions of all selenium related investigations, studies, and reports completed by the IMA Selenium Committee, private companies, government agencies, and representatives thereof. The summary consists of reports produced since 1997 under one of the various industry- or agency-conducted selenium-response programs in the Resource Area. Such reports that are in any way pertinent to P_4 Production's Southeast Idaho Mine-Specific Selenium Program are presented in the summary by production date.

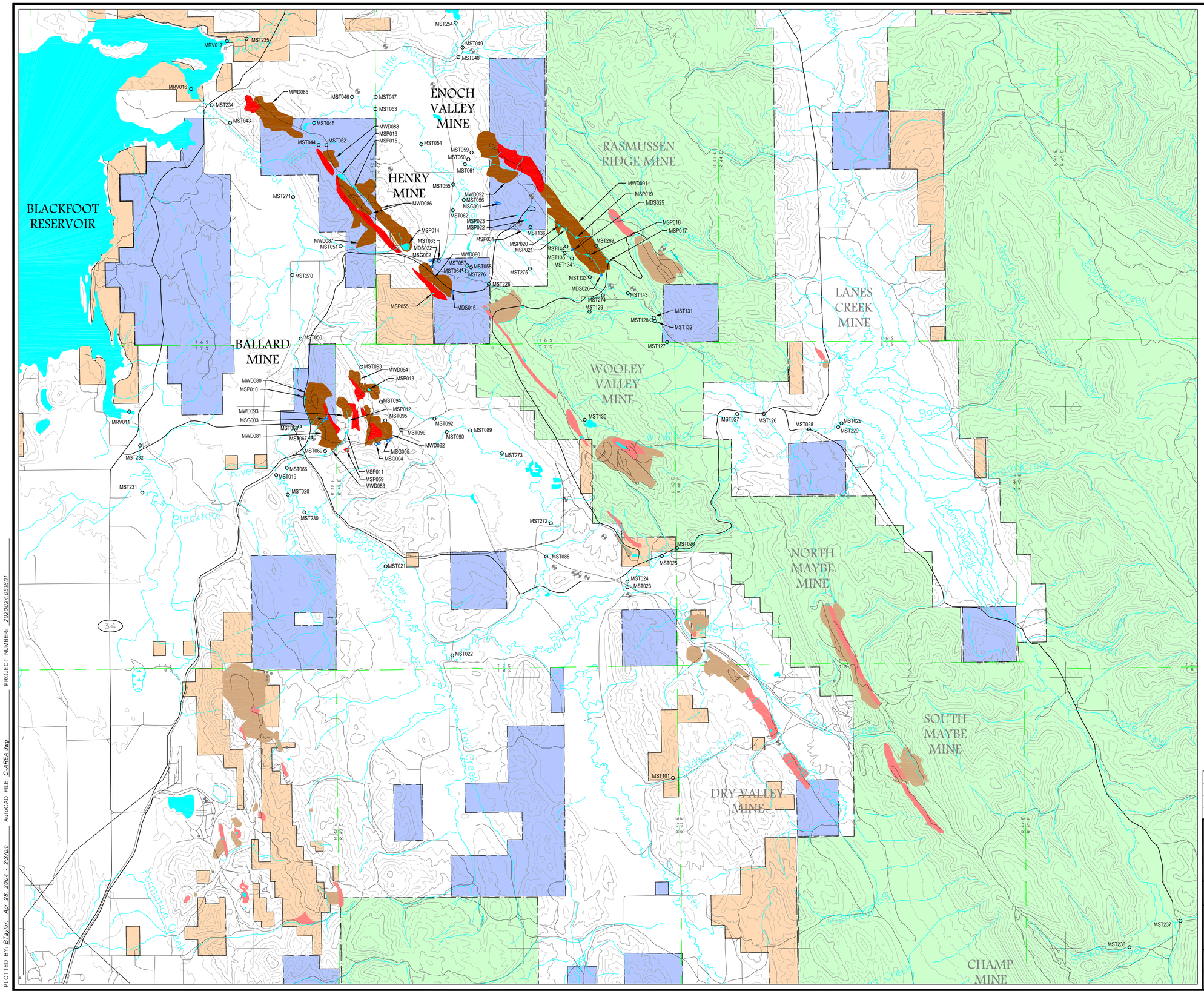
For additional details on the regional history and for descriptions of the previous IMA Selenium Investigations can be found in Section 2.4 of the EE/CA work plans for Enoch Valley, Henry, and Ballard mines, which is identical for each mine.

2.2 P_4 PRODUCTION VOLUNTARY ACTIONS

To date, P_4 Production has undertaken a variety of voluntary actions in and around the mine sites to abate the release of selenium from waste rock. These actions include:

- Road construction use low-selenium content materials;
- Ditch liners to prevent runoff infiltration;
- Directing run-on water around disturbed areas;
- Directing overburden or backfill runoff;
- Material placement to prevent contamination from mined materials;
- Encapsulated overburden dumps;
- Non-shale overburden dumps;
- Caps and covers of waste rock piles;
- Partially backfilling final mine pits to cover exposed ore bodies;
- Position of final pit at highest elevation to reduce the formation of pit lakes;
- Topsoil management; and,
- Noxious and selenium-accumulating weed control program.

More information regarding these programs will be available from the agency/industry draft *Selenium Management Practices* BMP manual. P_4 Production expects this manual to be finalized shortly.



LEGEND

- CONTOURS
- CREEKS/RIVERS
- LAKES/PONDS
- MARSH
- HIGHWAYS
- ROADS
- RAILROAD
- STATE LINE
- COUNTY LINE
- TOWNSHIP AND RANGE
- NATIONAL FOREST
- BUREAU OF LAND MANAGEMENT
- STATE OF IDAHO
- MINE PIT LOCATION
- MWD001 WASTE ROCK DUMP LOCATION
- MSP001 STOCK POND LOCATION
- MDS001 WASTE ROCK DUMP SEEP
- MSG001 SPRING STATION
- MST001 STREAM STATION
- PRODUCTION WELL

MAP KEY

SCALE
0 4000 8000
Feet

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
1	UPDATE FROM SW & SED INV	04-04	PBS	BLT	PBS
0	INTERIM SW & SED INV	05-02	PBS	BLT	PBS

P4 PRODUCTION

PROJECT:
COMPREHENSIVE SITE INVESTIGATION

DRAWING TITLE:
PROGRAM SAMPLING LOCATIONS

MWH

Sheet 1 Of 1 Sheets
SCALE: As Shown
FIGURE No. 2-1

PLOTTED BY: BTaylor, Apr 28, 2004 - 2:37pm AutoCAD FILE: C-AREA.dwg PROJECT NUMBER 20020024.051601

3.0 INVESTIGATION OBJECTIVES

The program objectives of the SI for P_4 Production's Enoch Valley, Henry, and Ballard mines were formulated in accordance with the DQOs process documented in Section 3.1 of the PjtWPs (MWH 2004a). As a general objective, the data collection process is to provide those data that are necessary to evaluate among and select a removal action alternative in the EE/CA process. The amount of such data to be collected will be what is sufficient to conduct such evaluation and selection. The scope of work for the EE/CA is detailed in the EE/CA work plan (MWH, 2004b).

The following program objectives are for all three mines—Enoch Valley, Henry, and Ballard—. A presentation of objectives on a mine-specific basis can be found in Section 3.3 of the individual PjtWPs. In summary, program objectives 1 through 21 are applicable to all three mines; whereas objective 22 is applicable to Enoch Valley Mine only, and objective 23 is applicable to Ballard Mine only.

1. Determine if there are any past or current irrigation canals that could affect water flow on or near the mines.

2. Characterize surface water and sediment quality to support the characterization of riparian soil and vegetation quality and fish tissue quality, as well as to further quantify annual variability.

3. Compile local and regional climatologic data that may be pertinent to the characterization of annual and seasonal changes in runoff.

4. Compile and review available local and regional hydrogeologic data—e.g., published and unpublished hydrogeologic reports, geologic maps, cross sections, mine maps, and anecdotal information from mine geologists and managers—so as to make maximum use of such information.

5. Conduct a thorough well inventory within a three-mile radius of each mine to document locations and construction specifications of all mine production, agricultural, and domestic wells that could be relevant groundwater sampling stations.

6. Conduct a spring and seep survey on the mines and within the vicinity during runoff to identify any additional surface expressions of groundwater for characterization.

7. Measure flows of springs and dump seeps during runoff. For dump seeps the purpose is to evaluate alternatives. For springs the purpose is to characterize the nature of the aquifer and thus must occur over time to determine whether flows are continuous or seasonal.

8. Sample all relevant groundwater stations—including existing wells, springs, and seeps—for characterization of groundwater quality.

9. Install additional wells, if necessary, to address data gaps related to identified flow paths associated with potential sources, or possibly to confirm critical components of the updated conceptual hydrogeologic site model.

10. Conduct a water balance to help understand the hydrologic system of the mine.

11. Characterize the quality of riparian zone soil at streams, ponds, seeps, springs, and wetlands.

12. A habitat assessment of streams is needed to determine which streams do support fish or are capable of supporting fish.

13. Those stream stations that do support fish will be sampled to obtain fish tissue quality data.

14. A habitat assessment of ponds, wetlands, and non-fish-bearing streams will determine utilization by wildlife, livestock, and birds.

15. Riparian zone vegetation quality will be characterized to determine the extent of contamination in this habitat along streams, ponds, seeps, springs, and other wetlands.

16. P_4 Production will undertake a desk-top study to evaluate a suitable seed mixture that provides desirable traits for reclamation—erosion control, cover, and future grazing potential.

17. P_4 Production will incorporate asters into their weed control program, identify the locations of their occurrences on each mine, and begin to control them.

18. A veterinary toxicology panel will be formed to review existing information on livestock exposure to seleniferous vegetation on waste rock dumps. The panel, which will hopefully be chaired by Dr. Patricia Talcott, will help determine whether it is safe to allow different species of livestock to graze the dumps, any mitigating measures that need to be taken for grazing to occur, and to identify further data needs to allow these determinations to be made.

19. Existing mine maps will be compiled to be used in the EE/CA process to evaluate certain alternatives. Furthermore, a circum-dump reconnaissance of waste rock dumps at each mine site will be performed to identify and map mass wasting, potential mass wasting and control areas along dump boundaries. Prior to agronomic soil sampling at Ballard Mine, a reconnaissance will be performed to identify the different types of reclaimed areas.

20. Characterize the change in quality of soil from waste rock dumps onto adjacent rangeland in areas susceptible to mass wasting.

21. Characterize the change in quality of vegetation from waste rock dumps onto adjacent rangeland in areas susceptible to mass wasting.

22. The final stages of Enoch Valley Mine entailed the placement of a non-seleniferous cap to isolate seleniferous shales from the root zone. Performance monitoring of this cap will be conducted.

23. Conduct agronomic soil testing on unreclaimed, poorly reclaimed, and well reclaimed land on waste rock piles to evaluate potential reclamation alternatives at Ballard Mine.

The specific program work breakdown structure for the SI is presented below in Table 3-1, *Program Work Breakdown Structure Tasks, Subtasks, and Activities*. The SI program tasks in Table 3–1 are described in Section 4.0 of each individual PjtWP (MWH, 2004a). The tasks were derived with the above objectives in mind, as were the sampling locations and frequencies described in detail within Section 4.0 of this PgmFSP.

TABLE 3-1
PROGRAM WORK BREAKDOWN STRUCTURE
TASKS, SUBTASKS, AND ACTIVITIES

TASK	SUBTASK	ACTIVITY
Task 1—Surface Water and Sediment Investigation	Subtask 1a—Investigation of historical irrigation practices	
	Subtask 1b—Surface water and sediment sampling	Activity 1b-1—impacted riparian zones
		Activity 1b-2—fish tissue quality investigation
Task 2—Air Investigation	Subtask 2a—Data compilation	
Task 3—Geology and Groundwater Investigation	Subtask 3a—Phase I Investigation	Activity 3a-1—review available hydrogeologic information
		Activity 3a-2—well inventory
		Activity 3a-3—spring and seep survey
		Activity 3a-4—spring and dump seep flow characterization
		Activity 3a-5—sampling existing mine and domestic wells, springs and seeps
		Activity 3a-6—revise conceptual hydrogeologic site model
	Subtask 3b—Phase II Investigation	Activity 3b-1—well installations, as necessary based on data gaps in conceptual model or to confirm components of the model
		Activity 3b-2—sampling of new and existing wells, springs, seeps, as appropriate
Task 4—Soil Investigation	Subtask 4a—Water balance investigation	
	Subtask 4b—Characterization of extent of riparian zone soil contamination at streams, ponds, seeps, springs, and wetlands	
	Subtask 4c—Characterization of waste rock dump extent of soil contamination	
	Subtask 4d—Agronomic testing of unreclaimed, poorly reclaimed, and well reclaimed land	
Task 5—Aquatic Ecological Investigation	Subtask 5a—Stream habitat assessment	
	Subtask 5b—Fish tissue quality investigation	
Task 6—Terrestrial Ecological Investigation	Subtask 6a—Habitat assessment of ponds, wetlands, and non-fish-bearing streams	
	Subtask 6b—Characterization of extent of riparian zone vegetation contamination at streams, ponds, seeps, springs, and wetlands	
	Subtask 6c—Evaluate potential replacements for alfalfa in reclamation seed mix	
	Subtask 6d—Identification and location of known selenium absorber species	
	Subtask 6e—Veterinary toxicology panel on livestock utilization of reclaimed land	
	Subtask 6f—Characterization of waste rock dump extent of vegetation contamination	
	Subtask 6g—Performance monitoring of non-seleniferous cap	
Task 7—Facilities Investigation		
Task 8—Data Validation	Subtask 8a—Surface water	
	Subtask 8b—Sediment	
	Subtask 8c—Groundwater	
	Subtask 8d—Soil	
	Subtask 8e—Fish	

TABLE 3-1 PROGRAM WORK BREAKDOWN STRUCTURE TASKS, SUBTASKS, AND ACTIVITIES		
	Subtask 8f—Vegetation	
Task 9—Data Evaluation	Subtask 9a—Surface water	
	Subtask 9b—Sediment	
	Subtask 9c—Groundwater	
	Subtask 9d—Soil	
	Subtask 9e—Fish	
	Subtask 9f—Vegetation	
Task 16*—Reporting		
Task 17—Project and Program Management		
Task 18—Meetings		

*Tasks 10–15 are reserved for the EE/CAs.

4.0 SAMPLING LOCATIONS, FREQUENCY, AND SCHEDULE

This section describes the program sampling and habitat assessment locations and frequencies for various media for the comprehensive SI. The sampling locations and frequencies are summarized programmatically below in Table 4-1, *Program Sampling Locations, Frequency, and Schedule*. Program tasks involving field sampling are discussed below; a complete task list may be found in Table 3-1, *Program Work Breakdown Structure Tasks, Subtasks, and Activities* of this PgmFSP.

The locations of sampling stations are shown in Figure 2-1, *Program Sampling Locations*.

Project-specific or mine-specific sampling locations, frequency, and schedule, and the project-specific or mine-specific work breakdown structure can be found in the respective mine-specific PjtFSP.

TABLE 4 - 1
PROGRAM SAMPLING LOCATIONS, FREQUENCY, AND SCHEDULE

Feature	Sampling Station†	Location		Station Number	May					June	July		September		
		Latitude	Longitude		SW	SE	FI/FF	GW	AH	TH	SO	VE	SO	VE	GW
Blackfoot River	Above Blackfoot Reservoir	42 49 17.80	111 33 10.58	MST232	X	X	X		X				X	X	
	Below Woodall Mountain Creek	42 48 34.86	111 33 06.61	MST231	X	X	X		X				X	X	
	Below Ballard Creek	42 48 49.28	111 30 21.52	MST019	X	X	X		X				X	X	
	Below State Land Creek	42 48 31.97	111 30 06.28	MST020	X	X	X		X				X	X	
	Above State Land Creek	42 48 15.40	111 29 47.32	MST230	X	X	X		X				X	X	
	Below Trail Creek	42 47 24.65	111 28 05.96	MST021	X	X	X		X				X	X	
	Below Wooley Valley Creek	42 46 04.24	111 26 44.41	MST022	X	X	X		X				X	X	
	Below Dry Valley Creek, (1997 #20)	42 47 05.00	111 23 07.00	MST023[2]	X	X	X		X				X	X	
	Above Dry Valley Creek, (1997 #19)	42 47 10.00	111 23 07.00	MST024[2]	X	X	X		X				X	X	
	Below Wooley Range Ridge Creek	42 47 33.00	111 22 24.00	MST025[2]	X	X	X		X				X	X	
	Above Wooley Range Ridge Creek	42 47 40.00	111 22 05.00	MST026[2]	X	X	X		X				X	X	
	Below Angus Creek	42 49 42.00	111 20 49.00	MST027[2]	X	X	X		X				X	X	
	Above Diamond Creek Rd.	42 49 27.30	111 19 20.30	MST028[2]	X	X	X		X				X	X	
	Below Spring Creek	42 49 29.00	111 18 44.00	MST229[2]	X	X	X		X				X	X	
	Above Spring Creek	42 49 32.50	111 18 39.90	MST029[2]	X	X	X		X				X	X	
Meadow Creek	Above Blackfoot Reservoir	42 55 28.00	111 30 53.00	MST235[1]	X	X	X		X	TBD			X	X	
Little Blackfoot River	Above Blackfoot Reservoir	42 49 32.50	111 18 39.90	MST234	X	X	X		X	TBD			X	X	
	Below Long Valley Creek	42 54 11.60	111 31 14.30	MST043	X	X	X		X	TBD			X	X	
	Immediately below Henry Mine (1997 #24)	42 53 50.60	111 29 24.80	MST044	X	X	X		X	TBD			X	X	
	Above Henry Creek (1997 #23)	42 54 10.70	111 29 30.10	MST045	X	X	X		X	TBD			X	X	
	Below Lone Pine Creek	42 54 34.20	111 28 42.70	MST046	X	X	X		X	TBD			X	X	
	Above Lone Pine Creek	42 54 34.40	111 28 35.10	MST047[2]	X	X	X		X	TBD			X	X	
	Below Reese Creek	42 55 09.65	111 26 30.56	MST048[2]	X	X	X		X	TBD			X	X	
	Above Reese Creek	42 55 18.26	111 26 25.24	MST049[1]	X	X	X		X	TBD			X	X	
	Upstream of Henry cutoff road	42 55 41.01	111 26 33.49	MST254[1]	X	X	X		X	TBD			X	X	
Lone Pine Creek	Above Little Blackfoot River	42 54 26.10	111 28 32.70	MST053	X	X	X		X	TBD			X	X	
	Above spring-fed creek	42 53 50.40	111 27 17.40	MST054	X	X	X		X	TBD			X	X	
	Below Strip Mine Creek	42 53 13.60	111 26 38.30	MST055	X	X	X		X	TBD			X	X	
	Above Strip Mine Creek	42 52 59.34	111 26 25.41	MST056	X	X	X		X	TBD			X	X	
	Above West Fork Lone Pine Creek	42 51 55.00	111 26 18.00	MST058[2]	X	X	X	X	X	TBD			X	X	X
East Fork Lone Pine Creek	Below Wooley Valley Mine	42 51 42.27	111 25 55.16	*MST226*[2]	X	X	X	X	X	TBD			X	X	X

TABLE 4 - 1 (Continued)
PROGRAM SAMPLING LOCATIONS, FREQUENCY, AND SCHEDULE

Feature	Sampling Station†	Location		Station Number	May					June	July		September		
		Latitude	Longitude		SW	SE	FI/FF	GW	AH	TH	SO	VE	SO	VE	GW
West Fork Lone Pine Creek	Above tributary to West Fork Lone Pine Creek	42 51 55.77	111 26 26.18	*MST064*[2]	X	X	X	X	X	TBD			X	X	X
	Above Lone Pine Creek	42 51 59.49	111 26 21.78	*MST057*[2]	X	X	X		X	TBD			X	X	
Tributary to West Fork Lone Pine Creek	Above West Fork Lone Pine Creek	42 51 57.85	111 26 17.01	*MST276*	X	X	X	X	X	TBD			X	X	X
North Fork Lone Pine Creek	Northeast and above East Fork Lone Pine Creek	42 51 56.33	111 25 04.24	*MST275*[2]	X	X	X	X	X	TBD			X	X	X
West Rasmussen Ridge Creek #1	Above Lone Pine Creek	42 53 42.39	111 26 15.30	*MST059*[2]	X	X	X	X	X	TBD			X	X	X
West Rasmussen Ridge Creek #2	Above Lone Pine Creek	42 53 36.35	111 26 19.33	*MST060*[2]	X	X	X	X	X	TBD			X	X	X
West Rasmussen Ridge Creek #3	Above Lone Pine Creek	42 53 31.92	111 26 23.67	*MST061*[2]	X	X	X	X	X	TBD			X	X	X
Strip Mine Creek	Above Lone Pine Creek	42 52 50.00	111 26 39.00	*MST062*[2]	X	X	X		X	TBD			X	X	
	Below Henry Mine	42 52 02.40	111 27 04.60	*MST063*[2]	X	X	X		X	TBD			X	X	
Angus Creek	Above Blackfoot River	42 49 42.00	111 20 16.00	MST126	X	X	X		X	TBD			X	X	
	Below No Name Creek	42 50 48.00	111 22 15.00	MST127	X	X	X		X	TBD			X	X	
	Above No Name Creek and below Rasmussen Creek	42 51 07.00	111 22 29.00	MST132	X	X	X		X	TBD			X	X	
	Above Rasmussen Creek	42 51 08.00	111 22 32.00	MST128[2]	X	X	X		X	TBD			X	X	
	R-B&M-10, below Wooley Valley Mine	42 51 16.50	111 23 50.80	MST129[2]	X	X	X		X	TBD			X	X	
	R-B&M-12, below Upper Angus Creek Reservoir	42 49 38.00	111 23 58.00	MST130[2]	X	X	X		X	TBD			X	X	
West Fork Rasmussen Creek	Above Rasmussen Creek	42 51 31.00	111 23 34.00	*MST274*[2]	X	X	X	X	X	TBD			X	X	X
Rasmussen Creek	Above Angus Creek	42 51 08.00	111 22 31.00	*MST131*	X	X	X		X	TBD			X	X	
	M-B&M-1, below Enoch Valley Mine (1997 #38)	42 51 48.00	111 23 50.00	*MST133*	X	X	X		X	TBD			X	X	
	Below West Pond Creek	42 52 05.00	111 24 12.00	*MST134*	X	X	X		X	TBD			X	X	
	Above West Pond Creek	42 52 10.00	111 24 21.00	*MST135*	X	X	X		X	TBD			X	X	
	Headwaters near Enoch Valley Mine Shop Pond	42 52 34.00	111 25 03.00	*MST136*	X	X	X	X	X	TBD			X	X	X
East Fork Rasmussen Creek	Above Rasmussen Creek	42 51 33.00	111 23 03.00	*MST143*	X	X	X		X	TBD			X	X	
	Headwaters	42 52 16.57	111 23 41.69	*MST269*	X	X	X	X	X	TBD			X	X	X
West Pond Creek	Headwaters, below West Pond	42 52 16.07	111 24 18.67	*MST144*	X	X	X	X	X	TBD			X	X	X
Long Valley Creek	Downstream of station MST050	42 51 52.20	111 29 58.69	*MST270*[2]	X	X	X		X	TBD			X	X	
	Above Little Blackfoot River and Below East Fork Long Valley Creek	42 53 03.26	111 29 56.90	*MST271*	X	X	X		X	TBD			X	X	
	Below Ballard Mine, (ponded area)	42 50 54.00	111 29 49.00	*MST050*[2]	X	X	X		X	TBD			X	X	
East Fork Long Valley Creek	Below Henry Mine	42 52 18.23	111 28 58.49	*MST051*	X	X	X		X	TBD			X	X	
Henry Creek	Above Little Blackfoot River	42 53 49.69	111 29 15.31	*MST052*	X	X	X		X	TBD			X	X	
Ballard Creek	Above Blackfoot River	42 48 56.30	111 30 07.32	*MST066*	X	X	X		X	TBD			X	X	

TABLE 4 - 1 (Continued) PROGRAM SAMPLING LOCATIONS, FREQUENCY, AND SCHEDULE															
		Location			May					June	July		September		
	Headwaters	42 49 23.79	111 29 36.31	*MST067*	**X**	**X**	**X**	**X**	**X**	**TBD**			**X**	**X**	**X**

TABLE 4 - 1 (Continued)
PROGRAM SAMPLING LOCATIONS, FREQUENCY, AND SCHEDULE

Feature	Sampling Station†	Location		Station Number	May					June	July		September		
		Latitude	Longitude		SW	SE	FI/FF	GW	AH	TH	SO	VE	SO	VE	GW
West Fork Ballard Creek	Headwaters	42 49 34.06	111 29 50.84	*MST068*	X	X	X	X	X	TBD			X	X	X
Short Creek	Below Ballard Mine	42 49 11.23	111 29 19.75	*MST069*	X	X	X	X	X	TBD			X	X	X
Wooley Valley Creek	Above Blackfoot River	42 47 15.18	111 24 53.08	*MST088*	X	X	X		X	TBD			X	X	
	Above Loadout Creek at road	42 48 04.00	111 24 41.00	*MST272*	X	X	X		X	TBD			X	X	
	Above ponding and below MST089	42 49 08.00	111 25 41.00	*MST273*	X	X	X		X	TBD			X	X	
	Below North Fork Wooley Valley Creek	42 49 28.99	111 26 20.00	*MST089*	X	X	X		X	TBD			X	X	
	Above North Fork Wooley Valley Creek	42 49 28.00	111 26 49.00	*MST090*	X	X	X		X	TBD			X	X	
North Fork Wooley Valley Creek	Above Wooley Valley Creek	42 49 40.00	111 27 04.00	*MST092*	X	X	X		X	TBD			X	X	
	Above Ballard Mine	42 50 28.00	111 28 34.00	*MST093*[1]	X	X	X		X	TBD			X	X	
Spring-fed tributary #1 of North Fork Wooley Valley Creek	Below Ballard Mine	42 49 56.00	111 28 10.00	*MST094*	X	X	X	X	X	TBD			X	X	X
Spring-fed tributary #2 of North Fork Wooley Valley Creek	Below Ballard Mine	42 49 39.00	111 28 05.00	*MST095*	X	X	X	X	X	TBD			X	X	X
Tributary of North Fork Wooley Valley Creek	Below Ballard Mine	42 49 30.00	111 27 45.00	*MST096*	X	X	X	X	X	TBD			X	X	X
Caldwell Creek	Below Phosphoria Formation outcrop (1997 #62)	42 44 10.80	111 22 12.74	*MST101*[1]	X	X	X		X	TBD			X	X	
Stewart Creek	Above Diamond Creek	42 41 32.15	111 12 50.64	*MST236*[1]	X	X	X		X	TBD			X	X	
Timber Creek	Above Diamond Creek	42 41 55.52	111 11 47.35	MST237[1]	X	X	X		X	TBD			X	X	
Blackfoot Reservoir Delta	At Blackfoot River	42 49 48.76	111 33 21.95	MRV011	X	X	X		X				X	X	
	At Little Blackfoot River	42 54 42.39	111 32 02.34	MRV016	X	X	X		X				X	X	
	At Meadow Creek	42 55 25.86	111 31 17.64	MRV017[1]	X	X	X		X				X	X	
Springs	*Hedin Spring*	42 52 55.70	111 25 41.70	*MSG001*	X	X		X		X			X	X	X
	Taylor Spring	42 52 02.40	111 27 04.60	*MSG002*	X	X		X		X			X	X	X
	Garden Hose Spring	42 49 41.00	111 29 18.00	*MSG003*	X	X		X		X			X	X	X
	Holmgren Spring	42 49 17.46	111 28 16.67	*MSG004*	X	X		X		X			X	X	X
	Cattle Spring	42 49 20.45	111 28 01.60	*MSG005*	X	X		X		X			X	X	X

TABLE 4 - 1 (Continued) PROGRAM SAMPLING LOCATIONS, FREQUENCY, AND SCHEDULE																
Feature	Sampling Station†	Location		Station Number	May					June	July		September		
		Latitude	Longitude		SW	SE	FI/FF	GW	AH	TH	SO	VE	SO	VE	GW
Ponds	*Henry Mine Henry Pond*	42 52 17.28	111 27 37.49	*MSP014*	X	X				X			X	X	
	Henry Mine Smith Pond	42 53 10.88	111 28 39.48	*MSP015*	X	X				X			X	X	
	Henry Mine Center Henry Pond	42 53 21.69	111 28 56.71	*MSP016*	X	X				X			X	X	
	Henry Mine South Pit Pond	42 51 35.37	111 27 05.63	*MSP055*	X	X				X			X	X	
	Ballard Mine Dredge Pond	42 50 00.57	111 29 44.51	*MSP010*	X	X				X			X	X	
	Ballard Mine Upper Elk Pond	42 49 28.12	111 28 53.33	*MSP011*	X	X				X			X	X	
	Ballard Mine Lower Elk Pond	42 49 38.93	111 28 50.58	*MSP012*	X	X				X			X	X	
	Ballard Mine Northeast Pond	42 50 07.38	111 28 24.56	*MSP013*	X	X				X			X	X	
	Ballard Mine Pit #4 Stock Pond	42 49 12.23	111 28 52.85	*MSP059*	X	X				X			X	X	
	Enoch Valley Mine South Pond	42 52 01.95	111 23 28.00	*MSP017*	X	X				X			X	X	
	Enoch Valley Mine Keyhole Pond	42 52 08.05	111 23 52.00	*MSP018*	X	X				X			X	X	
	Enoch Valley Mine Bat Cave Pond	42 52 23.94	111 24 06.02	*MSP019*	X	X				X			X	X	
	Enoch Valley Mine West Pond	42 52 22.00	111 24 27.00	*MSP020*	X	X				X			X	X	
	Enoch Valley Mine Stock Pond	42 52 10.00	111 24 21.00	*MSP021*	X	X				X			X	X	
	Enoch Valley Mine Tipple Pond	42 52 40.53	111 25 08.69	*MSP022*	X	X				X			X	X	
	Enoch Valley Mine Haul Road Pond	42 52 45.02	111 25 19.01	*MSP023*	X	X				X			X	X	
	Enoch Valley Mine Shop Pond	42 52 31.01	111 25 11.11	*MSP031*	X	X				X			X	X	
Seeps	*Enoch Valley Mine West Dump Seep*	42 52 13.00	111 24 11.00	*MDS025*	X	X		X		X			X	X	X
	Enoch Valley Mine South Dump Seep	42 51 48.80	111 23 36.00	*MDS026*	X	X		X		X			X	X	X
	Henry Mine South Pit Overburden Dump Seep (1997 #28)	42 51 37.81	111 26 39.24	*MDS016*	X	X		X		X			X	X	X
	Henry Mine South Pit Overburden Dump Limestone Drain (formerly FD002) (1997 #29)	42 51 58.60	111 27 05.90	*MDS022*	X	X	X	X	X	X			X	X	X
Agronomic Testing	Ballard Mine Waste Dump	TBD		TBD							X				
Domestic Wells	Unnamed	TBD		TBD				X							X
Production Wells	*Rasmussen Ridge Mine Dust Control Well #1*	42 51 39.31	111 23 23.94	*PW006*				X							X
	Rasmussen Ridge Mine Dust Control Well #1	42 51 36.95	111 22 56.33	*PW007*				X							X
	Enoch Valley Shop/Office Well	42 52 37.40	111 25 16.53	*PW019*				X							X
	Enoch Valley Mine Dust Control Well	42 53 01.90	111 25 01.57	*PW020*				X							X

TABLE 4 - 1 (Continued)
PROGRAM SAMPLING LOCATIONS, FREQUENCY, AND SCHEDULE

Feature	Sampling Station†	Location		Station Number	May					June	July		September		
		Latitude	Longitude		SW	SE	FI/FF	GW	AH	TH	SO	VE	SO	VE	GW
Waste Rock	TBD	TBD		TBD							X	X			
Isolated, newly identified wetlands	Unnamed	TBD		TBD	X	X				X			X	X	

Notes:
SW—Surface water
SE—Sediment
FI—Salmonids
FF—Forage fishes
GW—Groundwater
AH—Aquatic habitat Assessment
TH—Terrestrial habitat assessment: This investigation will occur at only those stream stations where, in the May fish tissue investigation, fish are absent due to non-Se factors. Non-fish bearing streams will be determined after the May fish tissue quality investigation.
SO—Surface soil
VE—Vegetation
TBD—To be determined
†Station identification for those sampled in September 1997 is provided parenthetically.
[1]Stations are programmatic background and hence are not impacted by any phosphate mine.
[2]Stations are project specific background and hence are not impacted by any P_4 Production mine.
Stations identified for sampling of both SW and GW represent stations previously sampled as SW. These locations are typically 100 yards or less from the source (spring or seep) and will be used to fulfill GW characterization needs, additionally.
GPS coordinates use the NAD27 datum and are presented in ddd mm ss.ss format (degrees minutes seconds).
Stream names in *italics* were assigned by either IMA or P_4 Production as these streams are unnamed on USGS maps or, as far as is known, are unnamed by common usage of local inhabitants. The reason for this is that most such streams are small with intermittent or ephemeral flows.

4.1 TASK 1: SURFACE WATER AND SEDIMENT INVESTIGATION

This task includes two subtasks. Subtask 1b, discussed below, involves field sampling.

4.1.1 Subtask 1b—Surface Water and Sediment Sampling

For this SI, surface water and sediment will be collected once in May 2004. Surface water and sediment sampling will occur at all stream, spring, dump seep, stock pond, isolated, newly identified wetlands, and reservoir delta sampling stations related to the P_4 Production Southeast Idaho Mine-Specific Selenium Program encompassing Enoch Valley, Henry, and Ballard mines as presented in Table 4-1, *Program Sampling Locations, Frequency, and Schedule*.

4.2 TASK 3: GEOLOGY AND GROUNDWATER INVESTIGATION

This task includes two subtasks. Subtask 3a and 3b, discussed below, involve field sampling. The geology and groundwater investigation will be conducted in two phases.

4.2.1 Subtask 3a—Phase 1 Investigation

Phase 1 of the groundwater investigation will consist of the following:

- A well inventory within a 3-mile radius of Enoch Valley, Henry, and Ballard Mine will be conducted prior to the May 2004 sampling event.

- A spring and seep survey on each mine will be conducted in May 2004.

- Existing mine wells, springs, and dump seeps will be sampled twice, in May and September 2004. Applicable agricultural- and domestic-wells will be sampled once during the 2004 field season. New springs and/or dump seeps identified during the spring and seep survey will also be sampled. Streams originating as springs or dump seeps will also be sampled and will be utilized for both the surface water and sediment investigation and for the groundwater investigation. The existing wells, springs, and dump seeps are identified above in Table 4–1, *Program Sampling Locations, Frequency, and Schedule*.

- Spring flow characterization will be conducted from approximately May 2004 through November 30, 2004 on select springs or dump seeps to be determined.

4.2.2 Subtask 3b—Phase II Investigation

Assuming the Phase 1 fieldwork is completed by November 30, 2004, results of the Phase 1 field work will be reported in an Interim Phase 1 SI Evaluation Summary. A Phase II Supplemental SI Work Plan will be prepared detailing any additional groundwater work required (i.e., additional monitoring well installations or sampling, as necessary) for specific mines. Monitoring well installation and sampling

locations, frequency, and schedule will also be detailed in the Phase II Supplemental SI Work Plan, if applicable. The Phase II groundwater investigation is anticipated to be performed during 2005.

For the geology investigation, geology will be documented during any applicable monitoring well installation through logging boreholes.

4.3 TASK 4: SOIL INVESTIGATION

This task includes four subtasks. Three subtasks, 4b, 4c, and 4d discussed below, involve field sampling.

4.3.1 Subtask 4b—Characterization of Extent of Riparian Zone Soil Contamination at Streams, Ponds, Seeps, Springs, and Wetlands

Surface soil sampling along riparian zones will be performed once, in September 2004, at all streams, ponds, seeps, springs, and isolated, newly identified wetlands related to the P_4 Production Southeast Idaho Mine-Specific Selenium Program as presented in Table 4-1, *P_4 Production Sampling Locations, Frequency, and Schedule*. Background stations will also be sampled for riparian soil as is noted in the table. Surface soil samples will be collected concurrently with vegetation samples, discussed in Section 4.5.2 below. P_4 Production has decided to sample all stream, pond, seep, and spring stations, whether contaminated or not, to obtain a comprehensive data set.

4.3.2 Subtask 4c—Characterization of Waste Rock Dump Extent of Soil Contamination

The surface soil sampling on and near a waste rock dump at Enoch Valley, Henry, and Ballard mines will be conducted as a one time sampling event in July 2004. Specific locations will be determined in the field using the protocols described in Section 6.0 of this PgmFSP.

4.3.3 Subtask 4d—Agronomic Testing of Unreclaimed, Poorly Reclaimed, and Well Reclaimed Land

The agronomic soil testing/sampling at Ballard Mine will be conducted as a one time sampling event in July 2004. Specific locations will be determined in the field using the protocols described in Section 6.0 of this PgmFSP.

4.4 TASK 5: AQUATIC ECOLOGY

This task includes two subtasks. Both Subtask 5a and 5b, discussed below, involve field sampling and will be performed concurrently.

4.4.1 Subtask 5a—Stream Habitat Assessment

The aquatic habitat assessment for fish will be conducted once, in May 2004, on all stream and reservoir delta sampling stations related to the P_4 Production Southeast Idaho Mine-Specific Selenium Program. Additionally, one dump seep (MDS022) will be included as it forms the headwaters for Strip Mine Creek. The stations to be assessed are presented in Table 4-1, *Program Sampling Locations, Frequency, and Schedule*. One assessment will be conducted per station.

4.4.2 Subtask 5b—Fish Tissue Quality Investigation

Fish sampling, both forage and salmonid, will be conducted once, in May 2004, from all stream, and reservoir delta sampling stations related to the P_4 Production Southeast Idaho Mine-Specific Selenium Program as presented in Table 4-1, *Program Sampling Locations, Frequency, and Schedule*. Additionally, one dump seep (MDS022) will be included as it forms the headwaters for Strip Mine Creek.

4.5 TASK 6: TERRESTRIAL ECOLOGICAL INVESTIGATION

This task includes five subtasks. Three Subtasks, 6a, 6b, and 6f discussed below, involve field sampling.

4.5.1 Subtask 6a—Habitat Assessment of Ponds, Wetlands, and Non-Fish Bearing Streams

The terrestrial habitat assessments will be performed once, in June 2004, on all ponds and springs related to the P_4 Production Southeast Idaho Mine-Specific Selenium Program as presented in Table 4-1, *Program Sampling Locations, Frequency, And Schedule*, on any isolated, newly identified wetlands, and on non-fish bearing streams as determined by the results of Subtask 5a and 5b.

4.5.2 Subtask 6b—Characterization of Extent of Riparian Zone Vegetation Contamination at Streams, Ponds, Seeps, Springs, and Wetlands

Vegetation sampling along riparian zones will be performed once, in September 2004, at all streams, ponds, seeps, springs, and isolated, newly identified wetlands related the P_4 Production Southeast Idaho Mine-Specific Selenium Program as presented in Table 4-1, *P_4 Production Sampling Locations, Frequency, And Schedule*. Background stations will also be sampled for riparian vegetation as is noted in the table. Vegetation samples will be collected concurrently with surface soil samples, discussed in Section 4.3.1 above. P_4 Production has decided to sample all stream, pond, seep, and spring stations, whether contaminated or not, to obtain a comprehensive data set.

4.5.3 Subtask 6f—Characterization of Waste Rock Dump Extent of Vegetation Contamination

The vegetation sampling on and near a waste rock dump at Enoch Valley, Henry, and Ballard mines will be conducted as a one time sampling event in July 2004. Specific locations will be determined in the field using the protocols described in Section 6.0 of this PgmFSP.

4.6 TASK 7: FACILITIES INVESTIGATION

Verification of facility locations, mine pits, waste rock dumps, stock ponds, dump seeps, and springs, will be completed during 2004 field events in May, June, July, and September. In addition, in June 2004 a circum-dump reconnaissance of waste rock dumps at each mine will be performed to identify and map mass wasting, potential mass wasting, and control areas along dump boundaries. Sampling locations for *Subtask 4c—Characterization of Waste Rock Dump Extent of Soil Contamination* will be identified from these areas. A reconnaissance of Ballard Mine will be performed in June 2004 to identify the different types of reclaimed areas for agronomic soil sampling. Existing maps will be compiled, verified, and revised as necessary to finalize a facility map for the mine. No other sampling locations or frequencies are required for this task.

5.0 SAMPLE DESIGNATION

Samples will be labeled with all necessary information on laboratory supplied labels using waterproof ink. At a minimum, each sample label shall contain the following information:

- site location;
- sample identification;
- date and time of sample collection, with sampler's initials;
- analyses required;
- method of preservation, if used; and,
- sample matrix.

Each sample shall be assigned a unique identification number. This number shall be coded according to sample location and date according to the following format:

MMDDyyXXMYYaaa-b-c

where:

- **MM** denotes the month the sample is collected (for example, May is "05").

- **DD** denotes the day the sample is collected (for example, "20" is the 20th day of the month).

- **yy** denotes the year the sample is collected (for example, 2004 is "04").

- **XX** denotes the medium sampled; medium codes are as follows:

  FF: Forage Fish (fish less-than 6 inches long for whole-body analysis)
  FI: Salmonid (fish greater than 6 inches long for skin-on fillet (e.g., muscle) analysis)
  GW: Groundwater
  SE: Sediment
  SS: Surface Soil
  SW: Surface water
  VE: Vegetation

- **M** designates that the sample station was identified by MWH for the mine-specific investigations of the P_4 Production Southeast Idaho Mine-Specific Selenium Program.

- **YY** denotes the station type; station types are as follows:

  AW: Agricultural well
  DW: Domestic well
  DS: Dump seeps
  MW: Monitoring well

PW: Production well located at a mine
RV: Reservoir
SG: Springs
SP: Stock ponds
ST: Streams

- **aaa** denotes the specific station number/location (ascending order starting at 001).

- **b** denotes the replicate number (0 shall indicate no replicate samples; if there are replicate samples, then 1, 2 and 3 represent the primary samples; and 4 signifies that the sample is a QA/QC sample).

- **c** denotes whether the sample involved special field handling or is to be handled in a specific manner; handling codes are as follows:

C(i): Composited (i indicates the number of samples)
EQ: Equipment blank
F: Filtered
U: Unfiltered
B: Water blank
QA: Quality assurance solid sample to be prepared and split at the lab

As an example, sample number **052002SWMST058-0-F** describes a non-replicated, filtered surface water sample collected at MWH stream monitoring station MST058 on May 20, 2002 for the P_4 Production Southeast Idaho Mine-Specific Selenium Program.

6.0 SAMPLE COLLECTION AND ANALYSIS

This section presents the equipment and procedures for the collection, handling, and analysis of each sampled medium. Where applicable, references to Standard Operating Procedures (SOPs) are provided.

6.1 STATION ACCESS REQUIREMENTS

Safety procedures for the site investigation are described in the PgmHSP. P_4 Production's Enoch Valley Mine has its own safety requirements that will be followed by field personnel when working in active areas of the site. The mine-specific safety requirements involve a short training orientation for hazard recognition and avoidance. In the event that P_4 Production's corporate policy is more strict than the requirements of the PgmHSP, those corporate safety requirements will take precedence.

The MWH field team leader will notify the P_4 Production program or project manager at least one day prior to sampling at a mine. Such notification is necessary to arrange for any company-specific safety training, and if necessary, to arrange for a company representative to accompany the crew to provide access through locked gates. Relevant company and agency contacts are presented below in Table 6-1, *Field Contacts.*

TABLE 6-1
FIELD CONTACTS

Company or Agency	Contact	Title	Telephone
P_4 Production	Bob Geddes	P_4 Production Program Manager	208-547-1234
	Mike Vice	Mine Reclamation Specialist	208-574-6132
Degerstrom	Bob Nelson	Equipment Superintendent	208-574-6110
Idaho Department of Environmental Quality	Rick Clegg	IDEQ Program Manager	208-547-1940
MWH	Bill Wright	MWH Program Manager	425-896-6938
	Beth Dolan	Enoch Valley Mine Project Manager	425-896-6933
	Mark Rettmann	Ballard Mine Project Manager	425-896-6934
	Paul Stenhouse	Henry Mine Project Manager	425-896-6930
ACZ Laboratory	Scott Habermehl	Laboratory Program Manager Contact	800-334-5493, x101
University of Idaho Analytical Sciences Laboratory	Steve McGeehan	Laboratory Program Manager Contact	208-885-7900
	Janet Snow	Sample Receiving Contact	208-885-7081

MWH's field equipment and samples will be stored at the office building located at Ballard Mine north of Soda Springs. Equipment, supplies, and samples will be shipped and received from the Degerstrom maintenance facility at Enoch Valley Mine. If samples are not able to be picked up at Degerstrom by FedEx, samples can be dropped off for shipping at the P_4 Production elemental phosphorus plant on Highway 34 north of Soda Springs. The equipment superintendent of the Degerstrom shop office is Bob Nelson, and his telephone number is listed above.

6.2 TASK 1: SURFACE WATER AND SEDIMENT INVESTIGATION

This section describes the collection procedures, quality assurance/quality control, required laboratory analyses, and applicable field and flow measurements for surface water and sediment sampling.

6.2.1 Surface Water Collection

Surface water samples will be collected using the protocols outlined in SOP-NW-9.1, *Collection of Surface Water Samples*. This SOP is located in Appendix B of the PgmQAP.

Water samples will be collected from streams and reservoir deltas using a Kemmerer horizontal water bottle sampler. Water samples will be collected from ponds using a swing sampler. Samples will be collected from small streams, seeps, and springs using a suitable polyethylene container, i.e., the bottle from the swing sampler or a suitable pitcher. Water samples will be transferred to appropriate sample containers after collection and any required filtering.

Unfiltered, acidified samples will, as needed, be collected and analyzed for total metals. Filtered, acidified samples will, as needed, be collected and analyzed for "dissolved" metals. Filtered samples will be filtered in the field using a new 0.45-micron disposable filter at each sample location. Unfiltered, unacidified samples will also be collected for major ions, and alkalinity. Parameters to be analyzed for are described below in Section 6.2.5. Refer to Table 2-2, *Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times*, in the PgmQAP for analyte sample container requirements. Water samples will be collected first to ensure high-quality, undisturbed samples that may result from field crews entering the surface water feature to take water quality measurements or sediment samples.

6.2.2 Surface Water Quality Assurance/Quality Control

The following quality assurance/quality control (QA/QC) procedures will be followed during surface water sampling:

- Collection of QA/QC samples will occur at a minimum rate of 10 percent of total stations.
- A QA/QC sample will consist of three primary replicates, a field duplicate (essentially a fourth replicate), an equipment rinseate, and an equipment rinseate blank. All samples will be analyzed by the primary laboratory, ACZ Laboratory, Inc. in Steamboat Springs, Colorado, except for the field duplicate, which will be analyzed by the QA laboratory, University of Idaho Analytical Sciences Laboratory in Moscow, Idaho.
- One of the three primary replicate samples will be used for matrix spike analysis.
- The equipment rinseate sample will be collected by rinsing decontaminated sampling equipment with deionized water in a manner similar to actual sample collection.

- The equipment rinseate blank will be a sample of the distilled water used for the equipment rinseate sample.

- All sampling equipment will be decontaminated prior to sample collection.

Refer to the PgmQAP for further details regarding surface water sampling QA/QC procedures.

6.2.3 Surface Water Field Parameter Measurements

Field parameter measurements will be made in-situ whenever possible after the collection of surface water samples. If an in-situ measurement is not possible, then the measurement will be made streamside from a 5-Liter pitcher. Field parameter values will be recorded on field data forms and in the field notebooks. The following field water quality parameters will be measured:

- pH;
- Conductivity;
- Specific conductivity;
- Temperature;
- Dissolved oxygen;
- Turbidity; and,
- Oxygen-reduction potential.

Field meters will be used in accordance with the manufacturer's instructions. Conductivity meter performance will be checked and turbidimeters will be calibrated each morning prior to field sampling. Dissolved oxygen and pH meters will be calibrated at each station. At the QA/QC monitoring stations, all measurements will be taken three times, with re-calibration or a performance check, whichever is appropriate, between each measurement.

6.2.4 Surface Water Flow Measurements

Surface water flow rate measurements or estimates, if applicable, will be made from all streams, springs, and dump seeps listed programmatically in Table 4-1, *P_4 Production Sampling Locations, Frequency, and Schedule* of this PgmFSP in conjunction with the collection of the water quality sample. Flow measurements will always be recorded after the stream/seep water quality sample and field parameters have been collected to prevent potential contamination. Flow measurements will be typically measured with current meters using the velocity-area method (Rantz, 1982). For streams less than 0.2 feet deep, flow will be measured using a volumetric method, if possible. If a stream is too fast or deep to safely measure, then the flow will be estimated using an estimate of the stream cross-sectional area and the stream velocity. Details of surface water flow measurement methods are presented in SOP-NW-9.2a, *Surface Water Flow Measurements Using Man-Portable Devices or Estimation Techniques*, which is located in Appendix B of the PgmQAP.

6.2.5 Surface Water Analyses

In May 2004, samples will be analyzed for the surface water parameters presented in Table 6-2, *Surface Water, Sediment, and Fish (Forage & Salmonid) Analytes*. Both ACZ Laboratories and the University of Idaho Analytical Sciences Laboratory will analyze for all parameters listed.

TABLE 6-2
SURFACE WATER, SEDIMENT, AND FISH (Forage & Salmonid)
ANALYTES

Parameter	SURFACE WATER			SEDIMENT			FISH (Forage & Salmonid)			Holding Times
	Method	EDL	Reporting Units	Method	EDL	Reporting Units	Method	EDL	Reporting Units	
alkalinity	SM2320B (total)	2	mg/L	NA	NA	NA	NA	NA	NA	14 days
cadmium	M200.8–ICP/MS (dissolved)	0.0001	mg/L	M6020–ICP/MS (total, M3050B)	0.01	mg/kg dw	M6020–ICP/MS (total, M3050B)	0.01	mg/kg ww	180 days
chromium	NA	NA	NA	M6020–ICP/MS (total, M3050B)	1.0	mg/kg dw	NA	NA	NA	180 days
calcium	M200.7–ICP (dissolved)	0.2	mg/L	NA	NA	NA	NA	NA	NA	180 days
chloride	M300.0	0.5	mg/L	NA	NA	NA	NA	NA	NA	28 days
magnesium	M200.7–ICP (dissolved)	0.2	mg/L	NA	NA	NA	NA	NA	NA	180 days
nickel	M200.8–ICP/MS (dissolved)	0.0002	mg/L	M6020–ICP/MS (total, M3050B)	0.02	mg/kg dw	M6020–ICP/MS (total, M3050B)	0.02	mg/kg ww	180 days
pH	NA	NA	NA	USDA No.60 (21a)	0.1	pH units	NA	NA	NA	ASAP
potassium	M200.7–ICP (dissolved)	0.3	mg/L	NA	NA	NA	NA	NA	NA	180 days
selenium, total	SM3114-Se B, AA-Hydride	0.001	mg/L	M7742 modified AA-Hydride	0.1	mg/kg dw	M7742 modified AA-Hydride	0.1	mg/kg ww	180 days
sodium	M200.7–ICP (dissolved)	0.3	mg/L	NA	NA	NA	NA	NA	NA	180 days
sulfate	M300.0	0.5	mg/L	NA	NA	NA	NA	NA	NA	28 days
total organic carbon	NA	NA	NA	ASA No.9 29-2.2.4 Combustion/IR	0.1	%	NA	NA	NA	28 days
vanadium	M200.8–ICP/MS (dissolved)	0.00005	mg/L	M6020–ICP/MS (total, M3050B)	0.005	mg/kg dw	M6020–ICP/MS (total, M3050B)	0.005	mg/kg ww	180 days
zinc	M200.8–ICP/MS (dissolved)	0.002	mg/L	M6020–ICP/MS (total, M3050B)	0.2	mg/kg dw	M6020–ICP/MS (total, M3050B)	0.2	mg/kg ww	180 days
percent solids	NA	NA	NA	CLPSOW390, PART F, D-98	0.1	%	CLPSOW390, PART F, D-98	0.1	%	NA

Notes:
EDL – Estimated Detection Limit
NA – Not Applicable
Holding Times are based on surface water. There are no established holding times for sediment or fish, however, an attempt will be made to meet the surface water holding times.
Fish Reporting Units are mg/kg ww or as received, mg/kg dw will be calculated using percent solids.
Methods are for media (non-blank) samples. Blanks will be analyzed for total results when analyte methods allow.

6.2.6 Sediment Collection

Sediment samples will be collected following instructions presented in SOP-NW-9.3, *Collection of Sediment Samples*, which is located in Appendix B of the PgmQAP. Sediment sampling will occur following surface water collection and field parameter measurements. Sediment samples will be collected differently depending on the type of sampling station being sampled. For sediment collection, there are three categories: one−seep, spring, and stream stations; two−stock pond stations; and, three−reservoir delta stations.

For seep, spring and stream monitoring stations, three samples will be collected at each station, at ¼, ½, and ¾ distance across the width of the seep, spring, or stream, with a stainless steel or polyethylene scoop.

For stock pond monitoring stations, three samples will be collected in close proximity to the location of the water sample. All three sediment samples will be collected within a 6-ft radius using a stainless steel or polyethylene scoop.

For reservoir delta stations, three sediment samples will be collected using a mini-Ponar dredge from a boat. Three Ponar dredge samples will be collected in close proximity, within 10 feet of one another. The top 4 inches of each Ponar dredge sample will be removed and placed in a polyethylene bag for compositing. If the reservoir delta is sufficiently shallow to wade, the sediment samples will be collected using either the stream or stock pond monitoring station procedure described above. The procedure utilized will be documented on the field forms and in the field notebook.

Samples will be collected along the top 4 inches of sediment using any one of the collection methods described above. Once the samples have been collected, the three samples will be composited into one polyethylene bag and overlying water will be poured off. To help prevent bags from ripping, large debris will be shaken lightly to dislodge adhered sediment and removed from the bag. These samples, at a minimum, will be double bagged to prevent leakage and excess air will be purged from the bags to prevent bursting during transport.

Samples will be sieved with a 2 mm screen, weighed, homogenized, dried, and ground at the analytical laboratory prior to analysis.

6.2.7 Sediment Quality Assurance/Quality Control

The following quality assurance/quality control (QA/QC) procedures will be followed during sediment sampling:

- Collection of QA/QC samples will occur at a minimum rate of 10 percent of total stations.

- All sediment QA/QC samples shall be sent to ACZ, which will prepare and submit splits to the U of I for independent QA analyses. ACZ will prepare splits consisting of three primary

replicates and a field duplicate (essentially a fourth replicate) and will submit the field duplicate to U of I. In addition to the replicate samples, an equipment rinseate, and an equipment rinseate blank will be collected along with the sample to be split. All samples will be analyzed by the primary laboratory, ACZ Laboratory, except for the field duplicate which will be analyzed by the QA laboratory, University of Idaho Analytical Sciences Laboratory.

- One of the three primary replicate samples will be used for matrix spike analysis.
- The equipment rinseate will be collected by rinsing decontaminated sampling equipment with deionized or distilled water in a manner similar to actual sample collection.
- The equipment rinseate blank will be a sample of the distilled water used for the equipment rinseate sample.
- All sampling equipment will be decontaminated prior to sample collection, including collection of the equipment blank.

6.2.8 Sediment Analyses

Sediment samples will be analyzed for the sediment parameters listed in Table 6-2, *Surface Water, Sediment, and Fish (Forage & Salmonid) Analytes*. Both ACZ Laboratories and the University of Idaho Analytical Sciences Laboratory will analyze for all parameters listed.

6.3 TASK 3: GEOLOGY AND GROUNDWATER INVESTIGATION

As indicated previously, this task will be conducted in two phases, Subtask 3a–Phase I Investigation and Subtask 3b–Phase II Investigation. Phase I involves one inventory activity, one field survey activity, and one groundwater sampling activity. Phase II will potentially have a well installation activity and a groundwater sampling activity.

This section describes the inventory, and survey procedures to be used during Phase I. This section also describes the collection procedures, quality assurance/quality control, required laboratory analyses, and applicable field measurements for the groundwater sampling for Phase I and potentially for Phase II. In addition, potential well installation procedures for Phase II are discussed. References to applicable SOPs are made where appropriate.

6.3.1 Well Inventory for Phase I, Activity 3a-2

No physical samples will be collected during this activity. The well inventory will be conducted as a desktop exercise. A list of existing wells (i.e., monitoring, agricultural, domestic wells) will be obtained from the Idaho Department of Water Resources for a 3-mile radius of each mine. Property owners will be contacted to obtain further details of the well and to obtain access permission for sampling. If necessary, the list will be shortened and only applicable wells will be sampled (i.e., proper construction,

depth, working pump, accessible). The wells retained during this activity will be sampled during Activity 3a-5 discussed below.

6.3.2 Spring and Seep Survey for Phase I, Activity 3a-3

No physical samples will be collected during this activity. The field spring and seep survey will be conducted by walking or driving the mine sites, specifically, waste rock dumps, where springs and seeps are likely to occur based on geology or topography. Any springs or seeps identified during the survey will be located with a handheld GPS, marked on a map, photographed, and noted in the field notebook.

Springs or seeps identified during this activity will be sampled during Activity 3a-5 discussed below.

6.3.3 Spring and Dump Seep Flow Characterization for Phase I, Activity 3a-4

Historical analytical data and flow data for springs and dump seeps will be reviewed and appropriate springs or dump seeps for flow characterization will be selected. An appropriately sized weir box and containment area will be constructed at the selected springs and/or dump seeps. A gauge will be installed and calibrated to determine flow.

A gauge reading will be performed periodically at each selected location. In addition, water quality parameters may be measured in the field concurrent with the gauge reading. The schedule for gauge readings is discussed in Section 6.2.1.

6.3.4 Groundwater Collection for Phase I, Activity 3a-5, and Phase II, Activity 3b-2

All mine, monitoring, production, and selected domestic wells will be sampled according to SOP-NW-5.3, *Collection of Groundwater Quality Samples*, which is located in Appendix B of the PgmQAP. In general, the mine wells, production wells, and other monitoring wells identified and retained during the well survey, Activity 3a-2, will be sampled depending on their construction. If pumps are present in the well they will be used to purge and sample the well. If pumps are not present or operable, the well will be sampled using a disposable bailer. Domestic wells will be sampled at the tap closest to the well, if possible. Owners will be interviewed to determine if the water is softened or filtered prior to the tap, in which case, the sample will be collected just prior to any filtering or softening.

Springs and seeps will be sampled as part of the surface water and sediment investigation. The collection of water samples is described above in Section 4.2.

Any necessary groundwater sampling in Phase II, Activity 3b-2 for wells, springs, and/or seeps will be conducted as described above. The necessity and location of such sampling will be determined in the Interim Phase I Evaluation Summary and/or the Phase II Supplemental SI Work Plan.

Quality assurance/quality control is discussed below in Section 6.3.6, and groundwater analyses are discussed in Section 6.3.7.

6.3.5 Monitoring Well Installation for Phase II, Activity 3b-1

Any necessary monitoring well installation in Phase II, Activity 3b-1 will be conducted in 2005. The necessity and location of such well installation will be determined in the Interim Phase I Evaluation Summary and/or the Phase II Supplemental SI Work Plan. Monitoring well installation procedures and well construction details will be outlined in the Phase II Supplemental SI Work Plan.

6.3.6 Groundwater Quality Assurance/Quality Control

The following quality assurance/quality control (QA/QC) procedures will be followed during groundwater sampling:

- Collection of QA/QC samples will occur at a minimum rate of 10 percent of total stations.
- A QA/QC sample will consist of three primary replicates, a field duplicate (essentially a fourth replicate), an equipment rinseate, and an equipment rinseate blank. All samples will be analyzed by the primary laboratory, ACZ Laboratory, Inc. in Steamboat Springs, Colorado, except for the field duplicate, which will be analyzed by the QA laboratory, University of Idaho Analytical Sciences Laboratory in Moscow, Idaho.
- One of the three primary replicate samples will be used for matrix spike analysis.
- The equipment rinseate sample will be collected by rinsing decontaminated non-disposable sampling equipment with deionized water in a manner similar to actual sample collection.
- The equipment rinseate blank will be a sample of the distilled water used for the equipment rinseate sample, as necessary.
- All sampling equipment that is not disposable will be decontaminated prior to sample collection.

Refer to the PgmQAP for further details regarding groundwater sampling QA/QC procedures.

6.3.7 Groundwater Analyses

Groundwater samples will be analyzed for the parameters listed in Table 6–3, *Groundwater, Analytes*. Depending on the type of groundwater sample, receptor or monitoring sample type, the contaminants of potential concern will be analyzed on a dissolved basis or a total basis. Groundwater samples evaluating receptor impacts (i.e., domestic wells, agricultural wells) will be analyzed on a total basis, whereas, groundwater samples for groundwater monitoring purposes (i.e., monitoring wells, springs, and seeps) will be analyzed on a dissolved basis. Springs and seeps will be analyzed on a dissolved

basis, including dissolved selenium, and will also be analyzed for total selenium as part of the surface water and sediment investigation.

Both ACZ Laboratories and the University of Idaho Analytical Sciences Laboratory will analyze for all parameters listed.

TABLE 6 - 3
GROUNDWATER ANALYTES

Parameter		Method	EDL	Reporting Units	Holding Time
Monitoring Sample	**Receptor Sample**				
alkalinity, total	alkalinity, total	SM2320B	2	mg/L	14 days
cadmium, dissolved	cadmium, total	M200.8 ICP/MS	0.0001	mg/L	180 days
calcium, dissolved	calcium, dissolved	M200.7 ICP	0.2	mg/L	180 days
chloride, dissolved	chloride, dissolved	M300.0	0.5	mg/L	28 days
chromium, dissolved	chromium, total	M200.8 ICP/MS	0.0001	mg/L	180 days
magnesium, dissolved	magnesium, dissolved	M200.7 ICP	0.2	mg/L	180 days
nickel, dissolved	nickel, total	M200.8 ICP/MS	0.0002	mg/L	180 days
potassium, dissolved	potassium, dissolved	M200.7 ICP	0.3	mg/L	180 days
selenium, dissolved*	selenium, total	SM3114 B, AA-Hydride	0.001	mg/L	180 days
sodium, dissolved	sodium, dissolved	M200.7 ICP	0.3	mg/L	180 days
sulfate, dissolved	sulfate, dissolved	M300.0	0.5	mg/L	28 days
vanadium, dissolved	vanadium, total	M200.8 ICP/MS	0.00005	mg/L	180 days
zinc, dissolved	zinc, total	M200.8 ICP/MS	0.002	mg/L	180 days

Note:
"Monitoring Sample" refers to monitoring wells, springs, seeps, and other groundwater point monitoring locations.
"Receptor Sample" refers to domestic wells or agricultural wells, and other potential receptor groundwater sources.
EDL – Estimated Detection Limit
*Springs and seeps will also be sampled for total selenium for surface water monitoring.
Methods are for media (non-blank) samples. Blanks will be analyzed for total results when analyte methods allow.

6.4 TASK 4: SOIL INVESTIGATION

This task includes four subtasks. Three subtasks, 4b, 4c, and 4d discussed below, involve field sampling. This section describes the collection procedures, quality assurance/quality control, and required laboratory analyses for soil sampling under the three subtasks. Soil samples will be collected according to SOP-NW-7.2, *Collection of Soil Samples*, which is located in Appendix B of the PgmQAP. Sampling depth for all tasks will be 2 inches.

6.4.1 Soil Collection at Riparian Areas for Subtask 4b

Riparian soil samples will be collected concurrently with riparian vegetation samples. At each riparian soil sampling station, a 2,500-ft^2 quadrat will be established. Different quadrat dimensions will be used for different types of sampling stations.

For streams, seeps, and springs (excluding the Blackfoot River), a 10 ft by 125 ft area will be identified along both sides of the water channel to obtain a 2,500-ft^2 quadrat. The areas will be identified from the edge of the water, not the center of the water channel.

For the Blackfoot River, a 20 ft by 125 ft area will be identified along one side of the water channel to obtain a 2,500-ft^2 quadrat. The areas will be identified from the edge of the water, not the center of the water channel. The quadrat is located on one side of the Blackfoot River because the opposite side of the river may not be accessible, i.e., the river will not be wadeable.
For ponds less than 40 ft across, an area 20 ft wide encompassing or encircling the pond will be utilized to represent a 2,500-ft^2 quadrat.

For ponds greater than 40 ft across, an area 10 ft wide encompassing or encircling the pond will be utilized to represent a 2,500-ft^2 quadrat.

For wetlands, an area 50 ft by 50 ft will be identified within the wetland to obtain a 2,500-ft^2 quadrat.

Within each quadrat, five randomly selected co-located soil and vegetation samples will be collected. A consistent volume of soil will be collected for each of the five samples and all of the vegetation within 1-ft^2 at each of the five sampling points will be clipped at the ground surface and collected.

Once the soil samples have been collected from each of the five sampling points within the quadrat, they will be composited into one sample in a stainless steel or polyethylene bowl. Large debris will be removed and shaken lightly to dislodge adhered particles, then discarded before the soil is placed into sample containers.

After compositing, the sample will be placed in a heavy duty, 1-gallon ziploc storage bag. These composited samples, at a minimum, will be double bagged to prevent leakage and excess air will be purged from the bags to prevent bursting during transport. The five vegetation samples from the quadrat will be composited directly into a ziploc storage bag.

If after the five vegetation samples from the quadrat have been collected and composited and the sample does not meet the minimum weight required by ACZ, further co-located vegetation and soil samples within the quadrat will be randomly collected and composited with the original composite of five samples until the minimum sample weight for vegetation is achieved.

The composited soil and vegetation samples will be sent to ACZ in separate coolers for analysis. Soil samples will be sieved, weighed, homogenized, dried, and ground at the analytical laboratory prior to analysis. Vegetation samples will be weighed, homogenized, dried, and ground at the analytical laboratory prior to analysis.

Soil quality assurance/quality control is discussed below in Section 6.4.4, and soil analyses are discussed in Section 6.4.5. Vegetation quality assurance/quality control is discussed below in Section 6.6.4, and vegetation analyses are discussed in Section 6.6.5.

6.4.2 Soil Collection at Waste Rock Dump Transects for Subtask 4c

Waste rock dump transect soil samples will be collected concurrently with waste rock dump transect vegetation samples. A circum-dump reconnaissance of waste rock dumps at each mine will be performed in June 2004. The reconnaissance will identify and map mass wasting areas and potential mass wasting areas along dump boundaries and locate potential sampling areas for this subtask. Potential mass wasting areas will be identified through field observation and slope measurements. Mass wasting does not only refer to dump failure as in slumps, but includes erosion and percolation as in mineral particles being transported down slope and of the dump.

Based on the results of the circum-dump reconnaissance, three mass wasting areas and two control areas will be randomly selected as sampling locations for this subtask. Control areas will be an area on the dump that has no potential for mass wasting to occur (i.e., the dump has close to zero slope off of the dump). Preferentially, one mass wasting area will be selected from each of the three mines and the two control areas will be randomly selected from two of the three mines. If a representative mass wasting area for sampling cannot be found at a mine, then the mass-wasting area for that mine will be relocated randomly to one of the remaining mines with representative areas.

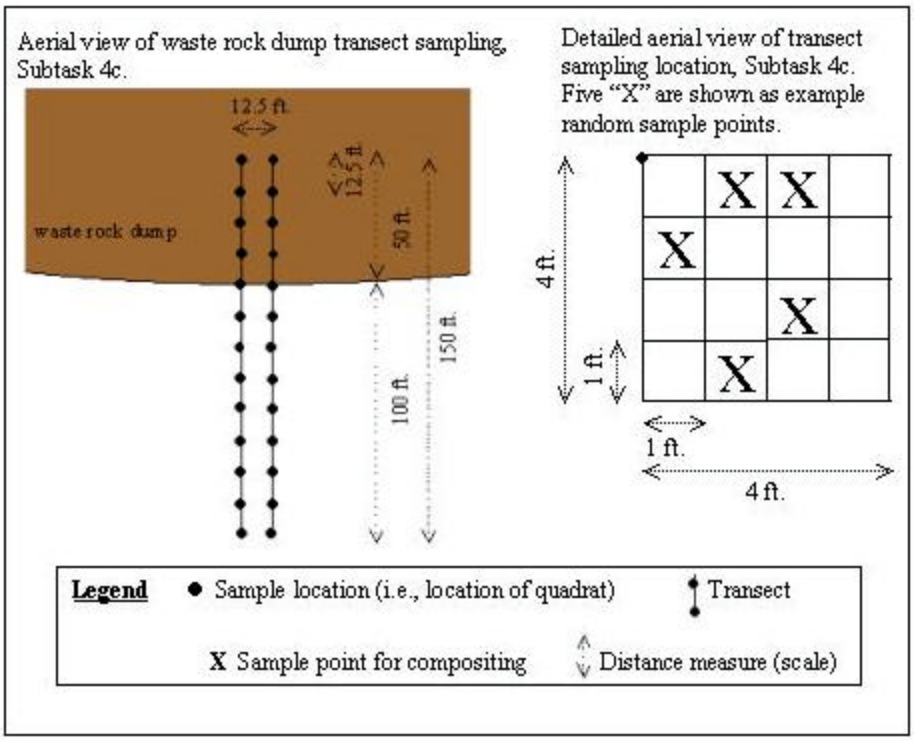
At each selected sampling area for mass wasting areas and control areas, two 150-ft transects will be identified and staked 12.5 ft apart (Figure 6-1). Each transect will be identified as such: the first 50 ft of transect will lie on the dump, and the next 100 ft will extend off the dump. The two transects will parallel each other and be oriented in the predominant perpendicular direction to the visual border of the dump. The visual border of the dump will be determined by field personnel and should be located at the transition between dump material and native material. Thus, using the visual border of the dump as point 0 (zero), 0 to 50 ft will extend onto the dump, and 0 to 100 ft will extend off the dump.

Individual sampling locations will then be identified and staked every 12.5 ft on each transects. Thus, sampling locations will be located at 12.5, 25, 37.5, and 50 ft on the portion of the transect extending onto the dump, and at 0, 12.5, 25, 37.5, 50, 62.5, 75, 87.5, and 100 ft on the transect extending off the dump.

At each sampling location, a 16 ft^2 quadrat (4 by 4 ft) with 16 grids (1 ft^2 grids) or 16 possible sampling points will be identified. Within each quadrat, five randomly selected co-located soil and vegetation samples will be collected from the grid, with vegetation being collected first. A consistent volume of soil will be collected from each of the five randomly selected sampling points and all of the vegetation within 1 ft^2 at each of the five sampling points will be clipped at the ground surface and collected.

Once the five soil samples have been collected within the quadrat, they will be composited into one sample in a stainless steel or polyethylene bowl. Large debris will be removed and shaken lightly to dislodge adhered particles, then discarded before the soil is placed into soil sample containers.

Figure 6-1 Waste Rock Dump Sampling Transects



After compositing, the sample will be placed in a heavy duty, 1-gallon ziploc storage bag. These samples, at a minimum, will be double bagged to prevent leakage and excess air will be purged from the bags to prevent bursting during transport.

The five vegetation samples will be composited directly into the vegetation ziploc storage bag.

If after the five vegetation samples have been collected and composited and the sample does not meet the minimum weight required by ACZ (200 grams), further co-located vegetation and soil samples will be randomly collected within the quadrat. Additional samples will be composited with the original composite of five soil or vegetation samples, respectively, until the minimum sample weight is achieved.

Soil and vegetation samples will be sent to ACZ in separate coolers for analysis. Soil samples will be sieved, weighed, homogenized, dried, and ground at the analytical laboratory prior to analysis. Vegetation samples will be weighed, homogenized, dried, and ground at the analytical laboratory prior to analysis.

Quality assurance/quality control is discussed below in Section 6.4.4, and the soil analyses are discussed in Section 6.4.5. Vegetation quality assurance/quality control is discussed below in Section 6.6.4, and vegetation analyses are discussed in Section 6.6.5.

6.4.3 Soil Collection for Agronomic Testing at Ballard Mine for Subtask 4d

A reconnaissance of Ballard Mine, specifically waste rock dumps, will be performed in June 2004. The purpose of the reconnaissance will be to visually identify and roughly map three types of reclaimed areas, unreclaimed, poorly-reclaimed, and well-reclaimed areas, and locate potential sampling locations for this subtask. Aerial photos will also be reviewed to help identify and map the areas.

The unreclaimed area will be characterized by little to no vegetation cover, the poorly-reclaimed area will be characterized by below average vegetation cover, and the well-reclaimed area will be characterized by average to above average vegetation cover.

Based on the results of the reconnaissance and aerial photo review, three sampling locations will be randomly selected from each type of reclaimed area for a total of nine sampling locations. At each sampling location, an area 50 ft by 50 ft will be identified within the reclaimed area type to obtain a 2,500-ft^2 quadrat.

Within each quadrat five randomly selected soil samples will be collected. A consistent volume of soil will be collected for each of the five samples.

Once the five soil samples have been collected they will be composited into one sample in a stainless steel or polyethylene bowl.

After compositing, the sample will be placed in a heavy duty, 1-gallon ziploc storage bag. These samples, at a minimum, will be double bagged to prevent leakage and excess air will be purged from the bags to prevent bursting during transport.

Soil samples will be sent to ACZ for analysis. Soil samples will be sieved, weighed, homogenized, dried, and ground at the analytical laboratory prior to analysis.

Quality assurance/quality control is discussed below in Section 6.4.4, and the soil analyses are discussed in Section 6.4.5.

The percent cover of vegetation within the quadrat will be determined. At each of the five soil sampling points, a 1 ft^2 grid will be placed on the ground and the percent cover will be visually estimated by comparing the amount of bare ground to covered ground. The percent cover will be recorded for each of the five sampling points and then the five percent cover estimates will be averaged to determine the percent cover for the quadrat.

In addition to soil collection and percent cover determination, soil and vegetation physical parameters and visual observations of the sample location or quadrat will be made. See the agronomic field sheet (appended to the PgmQAP) for specific observations. Photographs of the quadrat and the larger area will be taken and documented.

6.4.4 Soil Quality Assurance/Quality Control

The following quality assurance/quality control (QA/QC) procedures will be followed during surface soil sampling:

- Collection of soil QA/QC samples will occur at a minimum rate of 10 percent of total stations.

- All soil QA/QC samples shall be sent to ACZ, which will prepare and submit splits to the U of I for independent QA analyses. ACZ will prepare splits consisting of three primary replicates and a field duplicate (essentially a fourth replicate) and will submit the field duplicate to U of I. In addition to the replicate samples, an equipment rinseate, and an equipment rinseate blank will be collected along with the sample to be split. All samples will be analyzed by the primary laboratory, ACZ Laboratory, except for the field duplicate which will be analyzed by the QA laboratory, University of Idaho Analytical Sciences Laboratory.

- One of the three primary replicate samples will be used for matrix spike analysis.

- The equipment rinseate will be collected by rinsing decontaminated sampling equipment with deionized or distilled water in a manner similar to actual sample collection.

- The equipment rinseate blank will be a sample of the distilled water used for the equipment rinseate sample.

- All sampling equipment will be decontaminated prior to sample collection, including collection of the equipment blank.

6.4.5 Soil Analyses

Surface soil will be collected under three subtasks, Subtask 4b, 4c, and 4d. The analyte list for characterizing soil contamination in Subtask 4b and 4c is the same, whereas, the analyte list for agronomic (fertility) soil testing at Ballard Mine is different.

Soil samples collected under Subtask 4b and 4c will be analyzed for the surface soil parameters listed below in Table 6-4, *Surface Soil and Vegetation Analytes*.

TABLE 6-4 SURFACE SOIL AND VEGETATION ANALYTES							
Parameter	**SURFACE SOIL**			**VEGETATION**			**Holding Times**
	Method	**EDL**	**Reporting Units**	**Method**	**EDL**	**Reporting Units**	
cadmium	M6020–ICP/MS (total, M3050B)	0.01	mg/kg dw	M6020–ICP/MS (total, M3050B)	0.01	mg/kg dw	180 days
chromium	M6020–ICP/MS (total, M3050B)	0.05	mg/kg dw	NA	NA	NA	180 days
copper	M6020–ICP/MS (total, M3050B)	0.05	mg/kg dw	M6020–ICP/MS (total, M3050B)	0.05	mg/kg dw	180 days
conductivity at 25C	M120.1–Meter with Saturated Paste Prep.	0.001	mmhos/cm	NA	NA	NA	ASAP
molybdenum	M6020–ICP/MS (total, M3050B)	0.01	mg/kg dw	M6020–ICP/MS (total, M3050B)	0.01	mg/kg dw	180 days
nickel	M6020–ICP/MS (total, M3050B)	0.02	mg/kg dw	NA	NA	NA	180 days
total organic carbon	ASA No.9 29-2.2.4 Combustion/IR	0.1	% dw	NA	NA	NA	28 days
pH	USDA No.60 (21a)	0.1	pH units	NA	NA	NA	ASAP
selenium	M7742 modified, AA-Hydride (total, M3050B)	0.1	mg/kg dw	M7742 modified, AA-Hydride (total, M3050B)	0.1	mg/kg dw	180 days
texture (particle size)	ASTM D 422 Hydrometer	0.1	%	NA	NA	NA	NA
vanadium	M6020–ICP/MS (total, M3050B)	0.005	mg/kg dw	NA	NA	NA	180 days
zinc	M6020–ICP/MS (total, M3050B)	0.2	mg/kg dw	M6020–ICP/MS (total, M3050B)	0.2	mg/kg dw	180 days
percent solids/moisture content	CLPSOW390, PART F, D-98	0.1	% solids	M209F, Gravimetric-105C	0.1	% moisture	NA

EDL – Estimated Detection Limit
NA – Not Applicable

Soil samples collected under Subtask 4d will be analyzed for the agronomic soil parameters listed below in Table 6-5, *Ballard Mine - Agronomic Soil Analytes*.

TABLE 6-5
BALLARD MINE—AGRONOMIC SOIL ANALYTES

Analyte	Method	Detection Limit	Units
Cadmium, extractable	M6010B ICP	0.005	mg/Kg
Calcium, soluble	M6010B ICP	0.2	meq/L
Cation Exchange Capacity	USDA No. 60 (19)	0.3 meq/ 100 g	-
Chromium, extractable	M6010B ICP	0.01	mg/Kg
Copper, extractable	M6010B ICP	0.01	mg/Kg
Conductivity at 25C	M120.1 – Meter with Saturation Paste Prep	0.001	mmhos/cm
Iron, extractable	M6010B ICP	0.01	mg/Kg
Magnesium, soluble	M6010B ICP	0.2	meq/L
Manganese, extractable	M6010B ICP	0.005	mg/Kg
Molybdenum, extractable	M6010B ICP	0.01	mg/Kg
Nickel, extractable	M6010B ICP	0.01	mg/Kg
Nitrate/Nitrite as N, (KCl)	M353.2 – Automated Cadmium Reduction	0.1	mg/Kg
Nitrite as N, (KCl)	M353.2 – Automated Cadmium Reduction	0.05	mg/Kg
Nitrogen, ammonia (KCl)	M350.1 – Automated Phenate	0.1	mg/Kg
pH, saturated paste	USDA No. 60 (21A)	0.1	standard units
Phosphorus, extractable	M365.1 – Automated Ascorbic Acid	0.01	mg/Kg
Potassium, soluble	M6010B ICP	0.3	meq/L
Selenium, extractable	SM3114 B, AA Hydride	0.001	mg/Kg
Sodium, soluble	M6010B ICP	0.3	meq/L
Sulfate, soluble	M375.3 Gravimetric	50	mg/Kg
Texture (particle size)	ASTM D 422 Hydrometer	0.1	%
Total organic carbon	ASA No.9 29-2.2.4 Combustion/IR	0.1	%
Vanadium, extractable	M6010B ICP	0.005	mg/Kg
Percent Solids	CLPSOW390, PART F, D-98	0.1	% solids
Zinc, extractable	M6010B ICP	0.01	mg/Kg

Note:
Agronomic soil samples will be air dried at 34C (USDA No.1, 1972) and sieved–2.0mm, or 0.5mm for Organic Matter analysis (ASA No.9, 15-4.2.2) and the appropriate extraction performed according to the analysis method.
"Extractable" refers to the AB-DPTA Extraction (ASA No.9, 3-5.2.3)
"Soluble" refers to the water extraction (ASA No.9 10-2.3.2)
"KCl" refers to the potassium chloride extraction (ASA No.9 33-3.2.2)
"Saturated paste" refers to a preparation method (USDA No.9, 60 [2])

Both ACZ Laboratories and the University of Idaho Analytical Sciences Laboratory will analyze the appropriate samples for all parameters listed in both tables.

6.5 TASK 5: AQUATIC ECOLOGY

This section describes the collection procedures, quality assurance/quality control, required laboratory analyses, and applicable field measurements and habitat assessments for sampling of forage fish and salmonids.

6.5.1 Stream Habitat Assessment for Subtask 5a

No physical sample collection or laboratory analyses will occur under this task. The habitat assessment will follow the USEPA *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Macroinvertebrates, and Fish, Second Edition* for either high-, or low-gradient streams, as appropriate. The habitat assessment will use visual techniques to estimate the quality of fish habitat. One assessment will be conducted per station. The stations to be assessed are discussed in Section 4.4.1. Refer to the protocol for further details.

6.5.2 Fish Collection for Subtask 5b

Habitat assessment verification will consist of electrofishing, using boat- or backpack-mounted equipment and will follow SOP-45, *Collection of Fish Samples: Electrofishing and Netting*. Fish collection and sampling will be in accordance with the provisions outlined in the Scientific Collecting Permit (Appendix A), and will be used as a tool to verify the presence or absence of local fish populations. If fishes are present, MWH will collect, at a maximum, 6 fishes, consisting of three trout (salmonids) $\geq$ 6 inches, and three fishes of any species (forage fishes) < 6 inches, total length. Field crews will take care to collect fishes in a manner such that fishes outside the target population are not harmed. Fishes that are collected will be measured for total length, identified to the species level, bagged in polyethylene bags, and labeled in accordance with Section 5.0 of this PgmFSP. Samples will be stored on ice in coolers and transferred to a freezer at the end of the day.

6.5.3 Fish Quality Assurance/Quality Control

The following quality assurance/quality control (QA/QC) procedures will be followed during fish sampling:

- Collection of QA/QC samples will occur at a minimum rate of 10 percent per station sampled for each type of fish (Salmonid or Forage Fish), not per fish sampled. One fish per QA/QC station will be designated as a QA/QC sample.

- All fish QA/QC samples shall be sent to ACZ, which will prepare and submit splits to the U of I for independent QA analyses for forage fish and salmonid-whole body only. Split samples of salmonid-fillet will not be performed. ACZ will prepare splits consisting of three primary replicates and a field duplicate (essentially a fourth replicate) and will submit the field duplicate to U of I. All samples will be analyzed by the primary laboratory, ACZ Laboratory, except for the field duplicate which will be analyzed by the QA laboratory, University of Idaho Analytical Sciences Laboratory.

- One of the three primary replicate samples will be used for matrix spike analysis.

6.5.4 Fish Analyses

Fish tissue samples will be analyzed for the parameters listed in Table 6-2, *Surface Water, Sediment, and Fish (Forage & Salmonid) Analytes*. Both ACZ Laboratories and the University of Idaho Analytical Sciences Laboratory will analyze for all parameters listed. Salmonids will be analyzed as fillets (muscle tissue with skin on) and on a whole body basis. Samples will be weighed and prepared by ACZ in a manner that will allow the fillet portion to be calculated back into the whole body result. Forage fishes will be processed for whole body analysis only.

6.6 TASK 6: TERRESTRIAL ECOLOGICAL INVESTIGATION

This task includes five subtasks. Three Subtasks, 6a, 6b, and 6f discussed below, involve field sampling. This section describes the collection procedures, quality assurance/quality control, and required laboratory analyses for vegetation sampling under the three subtasks. Vegetation samples will be collected according to SOP-NW-19.0, *Collection of Vegetation Samples*, which is located in Appendix B of the PgmQAP.

6.6.1 Habitat Assessment for Subtask 6a

No physical sample collection or laboratory analyses will occur under this task. The terrestrial habitat assessments will follow standard protocols. The habitat assessment will use visual techniques to estimate the quality of habitat for agricultural, wildlife, or bird use. In addition, the assessments will include usage by amphibians. One assessment will be conducted per station. The stations to be assessed are discussed in Section 4.5.1.

6.6.2 Vegetation Collection at Riparian Areas for Subtask 6b

Riparian vegetation samples will be collected concurrently with riparian soil samples. Collection procedures for vegetation sampling are discussed above in Section 6.4.1 along with riparian soil collection.

Quality assurance/quality control is discussed below in Section 6.6.4, and vegetation analyses are discussed in Section 6.6.5.

6.6.3 Vegetation Collection at Waste Rock Dump Transects for Subtask 6f

Waste rock dump transect vegetation samples will be collected concurrently with waste rock dump transect soil samples. Collection procedures for vegetation sampling are discussed above in Section 6.4.2 along with waste rock dump transect soil collection.

Quality assurance/quality control is discussed below in Section 6.6.4, and vegetation analyses are discussed in Section 6.6.5.

6.6.4 Vegetation Quality Assurance/Quality Control

The following quality assurance/quality control (QA/QC) procedures will be followed during vegetation sampling:

- Collection of vegetation QA/QC samples will occur at a minimum rate of 10 percent of total stations.

- All vegetation QA/QC samples shall be sent to ACZ, which will prepare and submit splits to the U of I for independent QA analyses. ACZ will prepare splits consisting of three primary replicates and a field duplicate (essentially a fourth replicate) and will submit the field duplicate to U of I. In addition to the replicate samples, an equipment rinseate, and an equipment rinseate blank will be collected along with the sample to be split. All samples will be analyzed by the primary laboratory, ACZ Laboratory, except for the field duplicate which will be analyzed by the QA laboratory, University of Idaho Analytical Sciences Laboratory.

- One of the three primary replicate samples will be used for matrix spike analysis.

- The equipment rinseate will be collected by rinsing decontaminated sampling equipment with deionized or distilled water in a manner similar to actual sample collection.

- The equipment rinseate blank will be a sample of the distilled water used for the equipment rinseate sample.

- All sampling equipment will be decontaminated prior to sample collection, including collection of the equipment blank.

6.6.5 Vegetation Analyses

Vegetation samples will be analyzed for the parameters listed in Table 6-4, *Surface Soil and Vegetation Analytes*. Both ACZ Laboratories and the University of Idaho Analytical Sciences Laboratory will analyze for all parameters listed.

6.7 TASK 7: FACILITIES INVESTIGATION

No physical sample collection or laboratory analyses will occur under this task.

This task involves the field verification and collection of, facilities information, including GPS coordinates. The facilities investigation will consist of visual observations, interviews of local residents, when possible, and discussions with mine personnel to determine if previously undocumented facilities

exist, or known facilities require position updates. Field crews will use maps, and hand-held GPS devices to assist in documenting the locations of any facilities that may require revision.

Certain facilities, such as well locations, may become new sampling locations and will require documentation by field crews to adequately record their positions. Field crews will record these locations in field books, using a latitude/longitude coordinate system and the NAD27 datum.

In addition, in June 2004 a circum-dump reconnaissance of waste rock dumps at each mine will be performed to identify and map mass wasting, potential mass wasting, and control areas along dump boundaries. Sampling locations for *Subtask 4c—Characterization of Waste Rock Dump Extent of Soil Contamination* will be identified from these areas.

A reconnaissance of Ballard Mine will also be performed in June 2004 to identify the different types 0of reclaimed areas for agronomic soil sampling for *Subtask 4d- Agronomic testing of unreclaimed, poorly reclaimed, and well reclaimed land*. Existing maps will be compiled, verified, and revised as necessary to finalize a facility map for the mine.

6.8 SAMPLE HANDLING AND SHIPPING

Sample handling, including labeling, storage, chain-of-custody, and holding time considerations, is covered in Section 2.3 of the PgmQAP. Sample labeling is also discussed in Section 5.0 of this PgmFSP. All samples will be stored on wet ice in coolers until the end of the day when all of the samples except for fish samples will be placed in a locked refrigerator at the Ballard Mine office. Fish samples (forage fishes and salmonids) will be placed in a locked freezer at the end of the day.

Sample containers shall be sealed in ziplock plastic bags or plastic bags with wire ties supplied by ACZ and immediately placed on ice or "blue ice" in an insulated cooler chilled to at least 4°C. Insulated coolers shall be provided by the contract laboratories or purchased locally.

Samples will be shipped to the laboratories with blue ice or bagged wet ice in coolers secured with packing tape, via overnight Federal Express service to the appropriate laboratory. If possible, only one type of medium will be shipped in each cooler. MWH will fill out appropriate chain-of-custody forms supplied by the respective laboratory. The chain-of-custody will be included with the sample shipment, and copies of all chains-of-custody along with Federal Express waybills will be kept by MWH field personnel. MWH's FedEx account number is 237-076-389.

Samples will be sent to:

ACZ Laboratories, Inc.
c/o Scott Habermehl
2773 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493.

Duplicate QC samples will be sent to:

University of Idaho Analytical Sciences Laboratory
Holm Research Center
c/o Janet Snow
Moscow, ID 83844
(208) 885-7081.

Supplies and sample containers will be sent to the Degerstrom shop office at Enoch Valley Mine:

Degerstrom
Attention: MWH-Paul Stenhouse
3268 Blackfoot River Rd.
Soda Springs, ID 83276
(208) 574-6110.

Barbour, M. T., Gerritsen, J., Snyder, B. D., and Stribling, J. B., 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers:* Periphyton, Benthic Macroinvertebrates, and Fish, Second Edition. EPA 841-B-99-002. Prepared for USEPA Office of Water, Washington D.C.

IDEQ, 2000. *Interagency Memorandum of Understanding between USDA-Forest Service Region 4, Environmental Protection Agency Region 10, USDOI (Bureau of Land Management, Bureau of Indian Affairs and Fish and Wildlife Service), the Shoshone-Bannock Tribes and State of Idaho Department of Environmental Quality concerning Contamination from Phosphate Mining Operations in Southeastern Idaho*, July.

IDEQ, 2002, *Final Area Wide Human Health and Ecological Risk Assessment, Selenium Project Southeast Idaho Phosphate Mining Resource Area*. Prepared for the IDEQ by TtEMI, December.

IDEQ, 2003. *Final Draft Area Wide Risk Management Plan, Remedial Action Goals and Objectives, and Risk-Based Action Levels For Addressing Releases From Historic Phosphate Mining Operations in Southeast Idaho*, Soda Springs, Idaho, April.

MWH, 2002a. *Interim Surface Water and Sediment Investigation, Sampling and Analysis Plan – Final, P_4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P_4 Production, May.

MWH, 2002b. *Interim Surface Water and Sediment Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan & Field Sampling Plan–Final, P_4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P_4 Production, May.

MWH, 2003. *Summary of Work Performed to Date Under Various Southeast Idaho Selenium Programs*, Prepared for the P_4 Production, September.

MWH, 2004a. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan - Final, P_4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P_4 Production, March.

MWH, 2004b. *Engineering Evaluation/Cost Analysis, Enoch Valley (Henry or Ballard) Mine Work Plan - Final, P_4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P_4 Production, March.

MWH, 2004c. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Project Field Sampling Plan - Draft, P_4 Production's Southeast Idaho Mine-Specific Selenium*

Program. Prepared for P_4 Production, To be published in March 2004 concurrent with the SAP.

MWH, 2004d. *Comprehensive Site Investigation, Sampling and Analysis Plan - Draft, P_4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P_4 Production, To be published in March 2004 concurrent with the PjtFSP.

Appendix A
Scientific Collecting Permit

STATE OF IDAHO
DEPARTMENT OF FISH AND GAME

SCIENTIFIC COLLECTING PERMIT

NAME: PAUL STENHOUSE
ADDRESS: MONSANTO
2353 130TH AVE NE, STE 200
BELLEVUE WASHINGTON 98005

PERMIT NO. F-07-04

REVISED: APRIL 26, 2004

EXPIRES: DECEMBER 31, 2004

Affiliated with MONSANTO, is hereby granted permission to collect fish in Idaho under the following terms and conditions:

Purpose of collecting or banding: SPECIMEN COLLECTION, PRESENCE/ABSENCE FOR TRACE METAL ANALYSIS

Target species: ALL UTILIZING THE ATTACHED CRITERIA.

Methods and equipment to be used (METHODS NOT LISTED ARE ABSOLUTELY PROHIBITED)
ELECTROFISHING, NETS

Geographic area(s) or waters: BLACKFOOT RESERVOIR DELTAS, UPPER BLACKFOOT RIVER AND TRIBUTARIES, LITTLE BLACKFOOT RIVER AND TRIBUTARIES, MEADOW CREEK

Depository or disposition of specimens: EXCESS FISH RETURNED TO WATER ALIVE. UP TO SIX SAMPLES FROM EACH LOCATION TO BE SACRIFICED FOR TISSUE ANALYSIS. IN ADDITION TO THE COLLECTIONS FOR ANALYSIS, VOUCHER SPECIMENS OF SCULPIN AND DACE WILL BE REQUIRED FOR IDENTIFICATION PURPOSES IF THEY ARE ENCOUNTERED. IF ENCOUNTERED, IN SUFFICIENT NUMBERS, SIX DACE AND SIX SCULPIN ARE REQUIRED TO BE COLLECTED USING THE ATTACHED VOUCHERING PROCEDURES. THE VOUCHER SPECIMENS AND INCIDENTAL MORTALITIES TO BE PROVIDED TO THE IDAHO DEPARTMENT OF FISH AND GAME. CONTACT RICHARD SCULLY AT 208-232-4703 IF YOU DO NOT HAVE FORMALIN.

Federal permit number, if any: N/A

Permit provisions:

1. This permit is not transferable, nor may its authority be delegated. It shall be produced for inspection upon request of any conservation officer or other authorized representative of the Idaho Department of Fish and Game. Any abuse or misuse of privileges granted by this permit shall be grounds for revocation.

2. Upon completion of work or upon expiration of this permit and/or prior to any request for renewal, a report shall be submitted within 30 days, to Idaho Department of Fish and Game, Bureau of Fisheries, 600 S. Walnut, P.O. Box 25, Boise, ID 83707, providing useful and comparable information on fish collected or waters sampled. Forms are included to assist in providing information.

3. All stationary equipment used to collect fish and wildlife (nets, traps, etc.) will have an attached metal tag bearing, in legible English, the name and current address of the permit holder.

4. NO COLLECTIONS SHALL BE MADE UNDER THIS PERMIT UNTIL THE LOCAL CONSERVATION OFFICER OR THE SOUTHEAST REGIONAL OFFICE IS NOTIFIED WHERE AND WHEN THE COLLECTION IS TO BE MADE. A record of dates, times and persons notified shall be kept and submitted at the end of the year as part of the collecting report.

Additional information and/or stipulations: N/A

cc: SOUTHEAST REGION

Regional Telephone Number:208-232-4703
Fax:208-233-6430

Steven M. Huffaker
Steven M. Huffaker, Director

April 26, 2004
Date Issued

** TOTAL PAGE.02 **

Category	Salmonids (14"> Fish > 6")	Forage Fishes (6" > Fish)
Cutthroat	Maximum 1 cutthroat per Station.	Maximum 1 cutthroat, Preference for other Species.
Other trout	Any; prefer varied species.	Any amount.
Other fish	N/A	Any amount.
Number	3 Salmonids.	3 Forage Fishes.

Notes:

1) Preference will be given to other salmonids besides cutthroat for the collection of salmonids and forage fishes.
2) A maximum of 1 cutthroat each, at each station, should be retained for salmonids and for forage fishes (2 total) unless at the end of the reach, all fishes collected were cutthroat.
3) Other species of trout may be retained for analyses in either the salmonid or forage fish category. These include rainbow and brook trout and will be given preference over cutthroat.
4) All fish sampled at each reach will be collected and retained for population counts, measurement, and identification. Preference for other fishes (not cutthroat) will be given for retention and analyses.
5) All spawning cutthroat will be released at the end of the reach after measurement.

INSTRUCTIONS FOR RECORDING SAMPLING SITE LOCATIONS

Due to the increased availability of inexpensive hand held Global Positioning System (GPS) units and the development of Geographic Information System (GIS) databases, we are requesting that site locations be recorded in GPS formats instead of township, range and section formats.

The following are some guidelines, which will result in fewer errors and more useful information for all.

1) Check which Datum is listed on your map. Most USGS topographic maps use North American Datum 1927 (NAD27), some newer maps maybe WGS83. Set your GPS unit to the correct Datum. The GPS unit may have NAD27 CONUS as it's format for NAD27. Most units will have a large number of datums in their menus for use with a variety of types of maps or locations around the world. Most units do not come with correct datum in use. If you use a different datum between your GPS unit and map, your readings and actual site locations may be off by several hundred meters or more.

   a) Record the datum you use on the data sheet you send in. If necessary, we can convert to the standard datum. This could also benefit your records in the future if you use a different unit or datum.

2) Units:
   a) Universal Transverse Mercator (UTM) units (each unit is one meter) are preferred but not mandatory. If you use UTM, record the full number (six numbers E, seven numbers N). Also include the Zone (Z) used by your GPS unit. Units will overlap the map Zones. The two standard zones in Idaho are 11 for western Idaho (west of longitude 114) and 12 for eastern Idaho.
   b) Latitude and Longitude are acceptable. If used, be consistent throughout your records. Don't change from decimal format to degree, minute, seconds format or vice versa. Use the full number needed to pinpoint your location within 100 m.

3) Locations:
   a) Streams – Use the GPS location of the lower (downstream) end of your sample reach. You should also include reach length and a few widths. It does not matter if you use feet, meters, yards, miles, etc as long as you clearly state which unit you are using for length and width.
   b) Lakes – Use the GPS location at the outlet for consistency. If you need site locations in a lake, you can record those locations but note they are specific site locations i.e. Gill net site – xxx,xxx E, x,xxx,xxx N, Z xx.
   c) Accuracy – When taking readings, take a couple of minutes and allow the reading to stabilize before recording.

4) Consistency – Periodically check the menu on your GPS unit to make sure that the datum is the correct one. Datums can be inadvertently changed. Also it would be worthwhile to have an established accurate reference point such as the corner of your sidewalk out side of your office to occasionally check the accuracy of your GPS units.

5) If you do not have a GPS unit or your sites are in narrow canyons – If you can find yourself on a USGS topo map, UTM locations can be easily be determined within 100 m from the map. If you have questions about this procedure, contact Fred Partridge at 208-334-3791.

State of Idaho
Department of Fish and Game
Boise, ID 83707

February 23, 1996

MEMORANDUM

TO: Fisheries Professionals

FROM: Clark Shackelford, Bill Horton

SUBJECT: Collecting Voucher Samples

For the past two years, Idaho Department of Fish & Game (Department) has been asking some fisheries professionals to collect incidental fishing mortalities and properly preserve, label, and send them to either a Department office or the Orma J. Smith Museum of Natural History at Albertsons College of Idaho in Caldwell Idaho. This requirement has been questioned by some workers, thus the reason for this memo. We feel that for large scale scientific knowledge to be gained, the inconvenience and expense of providing and carrying preservation agents to aid in collection of these samples, comes at a small price.

Taking voucher samples of incidental mortalities, or a few live fish if they are abundant, is an excellent way to document species distribution. Eight sculpin and six sucker species have been identified in Idaho and their range (in general) is poorly defined. Sadly, many fisheries professionals do not or cannot identify them to species when they are collected (a good reason for vouchering fish). Your field work may be taking you into areas where faunal history is limited or unknown and, therefore, you are in an excellent position to enhance the knowledge of fisheries science. We are using the scientific collecting permit process to advance that knowledge. You and your field staff will be doing important work; please assist in a cooperative spirit. If you are receiving this memo, it is because we hope you can assist us in expanding that knowledge base.

The curator of the Orma J. Smith Museum provided us with standard techniques for preserving fish. *The Fish Vouchering Procedures for Idaho Department of Fish & Game Scientific Collecting Permits* identifies the proper steps for long-term archiving of collected specimens. We hope these techniques will be used, and that receiving them now will allow you to proceed with acquiring the needed supplies to do the job properly.

e:\...\memorand\vouchr96

FISH VOUCHERING PROCEDURES
FOR IDAHO DEPARTMENT OF FISH & GAME
SCIENTIFIC COLLECTING PERMITS

Vouchering of fish specimens is a quality assurance procedure and is a routine step in "good biological science". Vouchered specimens are used for taxonomic quality control, faunal history, public education, staff training, research and evidence in beneficial use attainability, status and environmental investigations. To serve these purposes, enough specimens of each species from each site should be vouchered to document the range of size and individual characteristics of each species at a site. This documentation can normally be accomplished by collecting five or six specimens of each species from the site.

If preserved specimens are to have maximum utility, please start with live specimens and use a 10% formaldehyde formalin solution as the initial fixing agent. The most commonly available formalin mixture is 37% formaldehyde. Mix one part of the 37% formaldehyde to three parts water to obtain the 10% formalin solution (actually 9.3%).

Vouchering fish specimens must comply with any applicable scientific collection regulations and restrictions. A photocopy of the collecting permit is also needed by the museum to document legal possession of vouchered materials.

Vouchering Procedures:

Step 1: Place live specimens in the 10% formalin solution. Using live specimens allows the formalin solution to be ingested and respirated into the interior organs and tissues of the fish. Specimens over 300 mm in total length must have a small incision, approximately 25mm, made in the abdominal cavity and/or have formalin injected into the large muscles.

Step 2: Allow the fixed specimens to remain in the formalin solution for 24-72 hours depending upon their size. 24 hours is normally sufficient for live specimens less than 150 mm. If in doubt, or unsure, or the fish were dead prior to placement in the formalin, leave the fish in the formalin longer. Be sure all the specimens are totally covered with formalin.

Step 3: Completely fill out two (2) fish specimen labels with a No. 2 pencil or an alcohol/formalin proof pen such as the Sakura Micron Pigma. Let any ink dry completely before placing label in the sample container. Make an initial field identification of the specimens being vouchered. Place one label in with the vouchered fish. Tape the other label to the outside of the sample container.

Labels must have: collection date, collectors name, Scientific Collecting Permit #, stream name, legal description of location where collected to the quarter section, and species.

Step 4: Note on field data sheet which specimens or species are being vouchered.

Step 5: Once the fish are fixed, drain off and reuse if possible, or properly dispose of the formalin, rinse the specimens with clean water (may use stream water) and replace it with 70% ethanol alcohol. Again, be sure to completely cover the specimens with liquid.

Step 6: Within 30 days of the expiration of the Collecting Permit, please send a legible copy of the field data sheets, a copy of the collection permit, and the specimens to Idaho Department of Fish & Game, Bureau of Fisheries, 600 South Walnut, Boise Idaho, 83707. Idaho Department of Fish & Game will transfer specimens to an appropriate repository for cataloging.

Idaho Department of Fish and Game
Scientific Collecting Permit
Mandatory Report Form

Permit Number:_____

Permit Holder:_____ Affiliation: _____

A standard inventory data set will be required for any fish community or presence/absence sampling survey within the state. Additional data is welcomed; however, this minimum amount of information must be collected for each transect (site), and the form(s) returned as part of the required report. **DO NOT COMBINE TRANSECTS ONTO ONE FORM EVEN IF IN THE SAME STREAM.** If your report/data is compatible with the requirements of this form, they will be accepted. Please write legibly. **FAILURE TO COMPLETE THIS FORM AS REQUIRED MAY BE GROUNDS FOR FUTURE PERMIT DENIAL.**

Stream Name: _____ Transect (Sample Site) No.: Collection Date:

Location: _____
(DO NOT LEAVE BLANK)
(GPS Coordinates of lower end of sampling reach – Latitude, Longitude, or UTM with zone datum)

Estimator (√): Direct observation (Snorkeling) ☐ Mark/Recapture ☐ Presence/Absence ☐
Depletion (one or more electrofish passes) ☐
Water Temp. (C°): _____

Transect Length (M): _____ Transact Width (M): _____
(At least one pool/riffle/run complex.) (At least 4 measurements for an average.)

Optional information on permanent fish barriers:
Location: _____ Height:_____ if manmade – type: _____

NOTICE OF COLLECTION:

IDFG Person Contacted: _____ Date & Time of Contact: _____

Disposition of Fish: _____

Report densities/CPUE in the table below. Indicate type of gear used. Record fishing effort and age class by species.

Fish Species	Gear Type Used	Time Fished	#fish/100m^2 or CPUE	Age Class (specify column)	
				No. of 0 year	No. of ≥ 1 year

NUMBERS OF NON-GAME FISH OBSERVATIONS SHOULD BE RECORDED ON ELECTROFISHING DATA SHEET

Idaho Department of Fish and Game
Scientific Collecting Permit
Mandatory Report Form

Stream Name: _____ Transect (Sample Site) No.: _____ Collection Date: _____

Location: _____ Crew Leader: _____ Permit No.

Length Range	Species					Species			
(mm)					(mm)				
					310-319				
					320-329				
					330-339				
50-59					340-349				
60-69					350-359				
70-79					360-369				
80-89					370-379				
90-99					380-389				
100-109					390-399				
110-119					400-409				
120-129					410-419				
130-139					420-429				
140-149					430-439				
150-159					440-449				
160-169					450-459				
170-179					460-469				
180-189					470-479				
190-199					480-489				
200-209					490-499				
210-219					500-509				
220-229					510-519				
230-239					520-529				
240-249					530-539				
250-259					540-549				
260-269									
270-279									
280-289					Total Each Species				
290-299									
300-309									

Density estimates are to be calculated and entered on the front page table.

Other species sampled/observed: _____

P_4 Production, LLC

A Joint Venture of

MONSANTO imagine™

SOLUTIA™ Applied Chemistry, Creative Solutions™

SOUTHEAST IDAHO MINE-SPECIFIC SELENIUM PROGRAM

Comprehensive Site Investigation

Program Quality Assurance Plan—Final

April 2004

Prepared by

MWH

2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005

Approved by:

_____ _____

Program Manager
MWH

Date

_____ _____

Quality Manager
MWH

Date

_____ _____

Program Manager
P_4 Production

Date

TABLE OF CONTENTS

1.0 PROGRAM MANAGEMENT 1-1

1.1 INTRODUCTION 1-1
1.2 PROGRAM ORGANIZATION 1-1
1.3 PROGRAM DESCRIPTION 1-4
1.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA 1-4
1.4.1 Purpose of PgmQAP 1-4
1.4.2 Data Quality Objectives 1-4
1.4.3 Measurement Performance Criteria 1-4
1.4.4 Goals 1-7
1.5 TRAINING REQUIREMENTS 1-8
1.6 DOCUMENTATION AND RECORDS REQUIREMENTS 1-8
1.6.1 Field Logbooks 1-8
1.6.2 Field Forms 1-9
1.6.3 COC Records 1-9
1.6.4 Analytical Laboratory Records 1-12
1.6.5 Program Quality Records 1-13
1.6.6 Field Change Request Forms 1-13

2.0 MEASUREMENT/DATA ACQUISITION 2-15

2.1 SAMPLING PROCESS 2-15
2.1.1 Sampling Design 2-15
2.1.2 Sampling and Analytical Methods – General Considerations 2-15
2.2 SAMPLING ACTIVITIES 2-16
2.2.1 Sampling Activity Summary 2-16
2.2.2 Sample Collection and Preparation Protocols 2-17
2.2.3 Sampling Equipment Requirements 2-17
2.2.4 Sample Routing Requirements 2-17
2.2.5 Sample Preservation Requirements 2-17
2.2.6 Decontamination Procedures 2-20
2.2.7 In-Process Sampling Data Review and Change Control 2-20
2.3 SAMPLE CUSTODY REQUIREMENTS 2-20
2.3.1 Sample Labeling and Handling 2-20
2.3.2 Chain of Custody 2-23
2.3.3 Holding Time Considerations 2-23
2.3.4 Laboratory Operations 2-24
2.3.5 Sample Storage and Security 2-25
2.3.6 Sample Tracking 2-25
2.3.7 Sample Custody Records 2-25
2.4 ANALYTICAL METHOD REQUIREMENTS 2-26

2.4.1 Sample Preparation 2-26
2.4.2 Analytical Methods and Target Analyses 2-26
2.5 QUALITY CONTROL REQUIREMENTS 2-26
2.5.1 Field Quality Control Samples 2-26
2.5.2 Laboratory Quality Control Samples 2-27
2.6 INSTRUMENT/EQUIPMENT CALIBRATION AND MAINTENANCE REQUIREMENTS 2-31
2.6.1 Field Equipment 2-31
2.6.2 Laboratory Equipment 2-31
2.7 DATA ACQUISITION, VALIDATION, REVIEW AND REPORTING 2-37
2.7.1 Field Data 2-37
2.7.2 Analytical Data Validation 2-39
2.7.3 Data Analysis and Reporting 2-40
2.7.4 Data Storage and Retrieval 2-41

3.0 ASSESSMENT/OVERSIGHT 3-42

3.1 FIELD AUDIT 3-42
3.2 LABORATORY AUDITS 3-42
3.3 INDEPENDENT TECHNICAL REVIEW 3-42
3.4 CORRECTIVE AND PREVENTIVE ACTION 3-42

4.0 REFERENCES 4-43

LIST OF TABLES

Table 1-1 Data Quality Characteristics Formulae
Table 2-1 P_4 Production Sampling Activities Summary
Table 2-2 Requirements for Containers, Preservation Techniques, Sample Volumes and Holding Times
Table 2-3 Quality Control Sample Summary
Table 2-4 Calibration and Maintenance Requirements for Field Equipment
Table 2-5 Laboratory Quality Control and Response Action Procedures

LIST OF FIGURES

Figure 1-1 Program Organization Chart
Figure 1-2 ACZ Laboratory Chain of Custody Form
Figure 1-3 Field Change Request Form
Figure 2-1 Data Acquisition and Data Management Flow Diagram

APPENDICES

Appendix A Consent Order/Administrative Order on Consent
Appendix B Standard Operating Procedures
Appendix C Quality Management Procedures
Appendix D Laboratory Quality Assurance Plan (ACZ)

Appendix E Laboratory Quality Assurance Plan (University of Idaho Analytical Sciences Laboratory)
Appendix F Aquatic Habitat Assessment Protocol Rapid Bioassessment Protocol Appendix A-1
Appendix G A Functional Upper Bound of Background

ACRONYMS AND ABBREVIATIONS

ACZ	ACZ Laboratories, Inc.
AOC	Administrative Order on Consent
ASTM	American Society for Testing and Materials
CD	compact disk
COC	chain of custody
CRDL	contract required detection limit
DO	dissolved oxygen
DQOs	data quality objectives
EDD	electronic data deliverable
USEPA	U. S. Environmental Protection Agency
FCR	Field Change Request
FSP	Field Sampling Plan
GPS	global positioning system
IDEQ	Idaho Department of Environmental Quality
LCS	laboratory control sample
MP	Management Procedure
MS	matrix spike
MSD	matrix spike duplicate
NTU	nephelometric turbidity unit
ORP	oxygen reduction potential
P_4 Production	P_4 Production, LLC
PARCC	precision, accuracy, representativeness, completeness, and comparability
PgmFSP	Program Field Sampling Plan
PgmHSP	Program Health and Safety Plan
PgmQAP	Program Quality Assurance Plan
PjtWP	Project Work Plan
PjtFSP	Project Field Sampling Plan
QA	quality assurance
QC	quality control
RPD	relative percent difference
RSD	relative standard deviation
SAP	Sampling and Analysis Plan
SI	site investigation
SOP	standard operating procedure
U of I	University of Idaho

1.0 PROGRAM MANAGEMENT

1.1 INTRODUCTION

This PgmQAP is one part of the three-part P_4 Production's comprehensive site investigation (SI) programmatic Sampling and Analysis Plan, prepared in support of continuing investigations conducted by P_4 Production in the Southeast Idaho Phosphate Resource Area. This PgmQAP is applicable to three Monsanto mine sites, Enoch Valley, Henry, and Ballard mines, as part of the AOC. The SAP is comprised of a Program Field Sampling Plan (PgmFSP), this PgmQAP, and a Program Health and Safety Plan (PgmHSP). The PgmQAP describes the measures that shall be employed during the mine-specific SIs to assure that data generated are of a known and defensible quality in relation to the overall objectives of the investigation. The various plans and procedures cited in this document govern the program sample acquisition efforts, sample handling and chain-of-custody protocols, laboratory and field analyses, data handling and data management, field documentation, management, quality auditing of field operations, corrective/preventive action processes, and the management of program quality record.

1.2 PROGRAM ORGANIZATION

The project team for the comprehensive mine-specific site investigations consist of MWH personnel and two subcontracted analytical laboratories:

- ACZ Laboratory, Steamboat Springs, CO, which is the primary laboratory for the investigations; and,

- Analytical Sciences Laboratory at the Holm Research Center in the University of Idaho, Moscow, Idaho, which will perform QC analyses of split samples from ACZ.

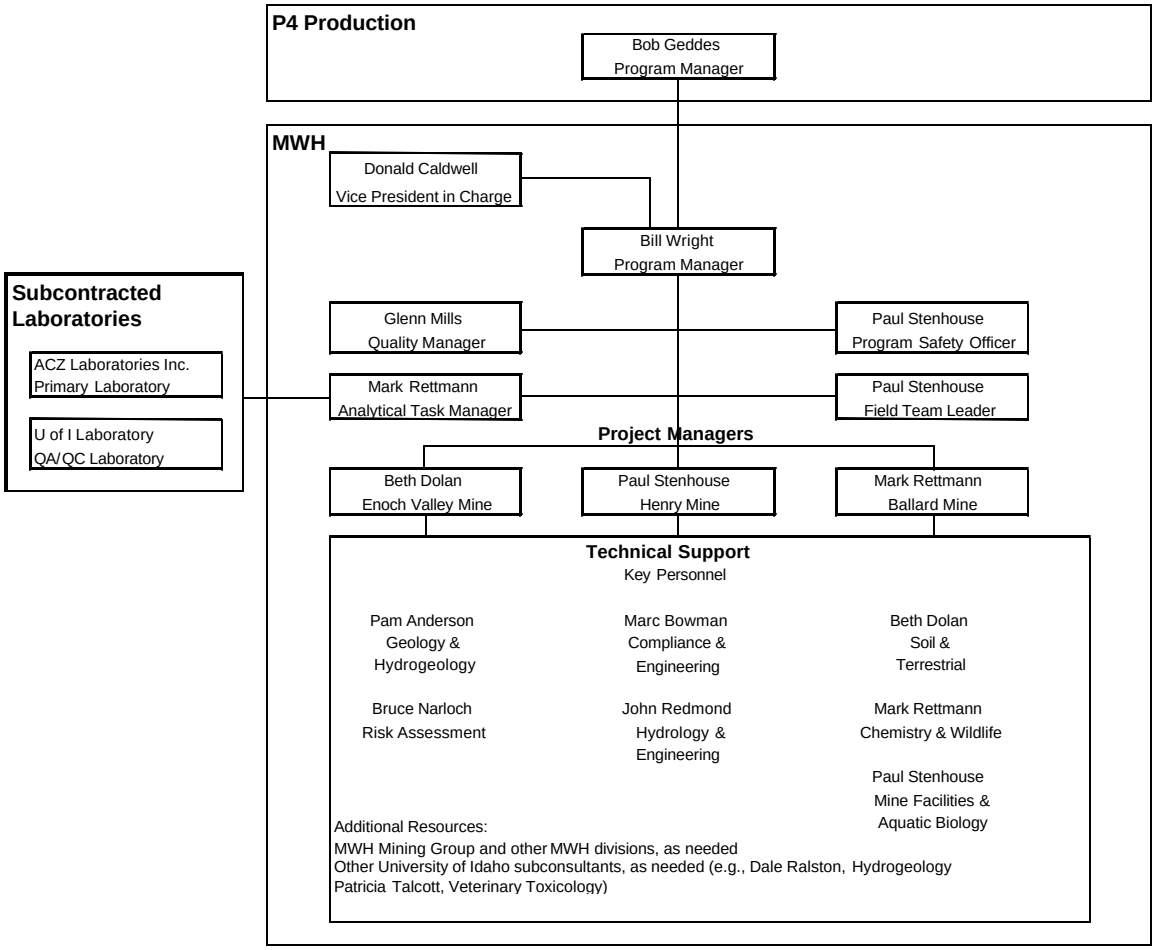
Professors from the University of Idaho are being accessed by subcontract as needed. For example, Dr. Dale Ralston and Dr. Patricia Talcott are providing expertise in hydrogeology and veterinary toxicology, respectively.

The overall organization of the program team is depicted in Figure 1-1. The primary responsibilities of key personnel are described as follows:

- **P_4 Production Program Manager:** The P_4 Production Program Manager is Bob Geddes. Mr. Geddes is the company's point of contact with IDEQ for all technical and administrative matters associated with implementation of the AOC. He is also the manager of all contracts used by P_4 Production to implement the AOC.

- **Vice President in Charge:** MWH's Vice President in charge of the SI & EE/CA program is Donald Caldwell. Mr. Caldwell is ultimately responsible to P_4 Production for the technical and quality performance of the program, and is responsible for ensuring that MWH's program and project managers are provided the technical and administrative resources to ensure the satisfactory program and project completion.

Figure 1-1. Program Organization Chart



- **Program Manager:** The MWH Program Manager is Bill Wright; Mr. Wright is responsible for ensuring that the sampling methods and data analyses reflected in the WP and the SAP meet the objectives of the comprehensive SIs. The Program Manager is responsible for the review and approval of program and project plans, for training program personnel, for monitoring the progress of the investigation, for review and approval of all program deliverables, and for overseeing the project managers. The Program Manager also serves as MWH's primary liaison with P_4 Production and the regulatory community, and is responsible to the vice president in charge for the overall technical and quality performance of the program.

- **Mine-Specific Project Managers:** MWH's Project Managers are Beth Dolan for Enoch Valley Mine, Mark Rettmann for Ballard Mine, and Paul Stenhouse for Henry Mine. The project managers are responsible for assisting the program manager as necessary to ensure that sampling methods and data analyses reflected in the work plan and SAP meet the objectives of the site investigation at their respective mine. The project managers also assist the program

manager in the training of project personnel and in monitoring the progress of the investigations, and shall review and approve all project deliverables.

- **Quality Manager**: Glenn Mills is MWH's program Quality Manager. He is responsible for coordinating the development and approval of the PgmQAP and its supporting procedures, and shall participate in the review and approval of all program deliverables. He will also direct field and laboratory audit activities and coordinate any subsequent corrective and preventive action processes, as necessary.

- **Program Safety Officer**: Paul Stenhouse will serve as MWH's Program Safety Officer in addition to other assigned duties. Mr. Stenhouse will be responsible for ensuring that the PgmHSP for field sampling activities complies with applicable state and federal health and safety regulations and guidelines, as well as relevant P_4 Production and MWH corporate policies. He will be responsible for delivering appropriate health and safety training to all field personnel in accordance with the requirements of the approved PgmHSP, and for maintaining all necessary program health and safety records.

- **Field Team Leader:** Paul Stenhouse will serve as MWH's Field Team Leader and is responsible to the MWH Program Manager for managing the day-to-day implementation of the field sampling activities, QA/QC measures, and health and safety program requirements defined in the SAP. Mr. Stenhouse will be responsible for supervising the day-to-day activities of the field team; for ensuring that all necessary training activities are conducted; for ensuring that all field equipment is properly calibrated, maintained, and/or decontaminated prior to use, as described in the PgmFSP and this PgmQAP; for ensuring that field logs, sample acquisition/chain of custody records, and photographic records are properly identified, maintained, and protected from damage or loss; and for periodically reporting field progress to the MWH Program Manager and other project managers. Mr. Stenhouse will also be responsible for coordinating sample delivery to the subcontractor laboratories.

- **Analytical Task Manager:** Mark Rettmann will manage the laboratory subcontracts and be responsible for day-to-day liaison with both the primary and quality assurance laboratories, and for periodically reporting analytical progress to the MWH Program Manager. Mr. Rettmann will also communicate with the Field Team Leader regarding sample shipment and receipt by the analytical laboratories. He will also manage MWH's data validation efforts, and will coordinate the resolution of any necessary corrective actions resulting from data validation activities, including notifying the Field Team Leader and Program Manager of any sample quality issues that may be resolved during field activities (i.e., resampling of unusable samples).

Changes in program staff may be made as circumstances dictate. The MWH Program Manager will advise the P_4 Production Program Manager in advance of any such changes in the key personnel.

1.3 PROGRAM DESCRIPTION

The overall scope and purpose of the comprehensive SI is discussed in Section 3.0 of each mine-specific PjtWP, and Section 3.0 of the PgmFSP. At the discretion of the MWH Program Manager and the P_4 Production Program Manager, any required scope modifications or additions may be accommodated either by revisions to the SAP documents or through the use of the field change request (FCR) process described in Section 1.5.6.

1.4 QUALITY OBJECTIVES AND CRITERIA FOR MEASUREMENT DATA

1.4.1 Purpose of PgmQAP

The primary objective of this PgmQAP is to assure that the precision and accuracy of program data are known and documented, that sample collection, analysis, and reporting are complete, and that samples are representative of tested environmental media. This plan also provides guidance for documentation of information collected in the field, sample custody, and the collection of appropriate field QC samples.

1.4.2 Data Quality Objectives

The DQOs for this program are described in Section 3 of each applicable PjtWP. These DQOs are consistent with USEPA guidelines (USEPA, 1994), which describe the systematic planning of data collection activities to assure that the proper type, quality, and quantity of data are collected. The DQOs shall be fulfilled by following specific procedures and requirements for sampling; sample handling and COC; field and laboratory QC samples; a laboratory-specific preventative maintenance measures; data review and reduction by the destination laboratories; data validation and analysis by MWH; and reporting; and quality auditing and corrective/preventive action processes, as described in the PgmFSP and this PgmQAP.

1.4.3 Measurement Performance Criteria

DQOs may be expressed in terms of PARCC parameters. The PARCC parameters are established as a benchmark for evaluating the attainment of the program objectives. PARCC parameters are summarized in the following subsections and presented in Table 1-1.

1.4.3.1 Precision

Precision is the mutual agreement among individual measurements of the same property and is a measure of uncertainty. There are two general forms of uncertainty. The first is lack of knowledge, and includes the random error component of the data collection process. Given the availability of appropriate resources and the absences of other constraints, such uncertainty can be potentially be reduced or eliminated. The second form of uncertainty is inherent stochastic variability. For example, even if it were possible to sample and analyze for selenium with no error, different concentrations in different water bodies would be observed along with and different concentrations over space and time in even one given water body. Variability is irreducible, that is to say, even with no time, resource, or other constraints, variability can not be eliminated, and can only be described. The overall random error component of precision is a function of the sampling and analytical precision, and is assessed by the analysis of field replicates. The analytical precision is determined by the analysis of field duplicates by different laboratories.

Precision can be measured as relative percent difference (RPD), or as relative standard deviation (RSD), which is also known as a coefficient of variation. Formulae for both are presented in Table 1-1.

1.4.3.2 Accuracy

Accuracy is defined as the degree of agreement between the true or expected value and the measured value for a given measurement. It is a measure of the bias or systematic error of the entire data collection process. Potential sources of systematic errors include:

- sample collection methods;
- physical or chemical instability of the samples;
- interference effects;
- calibration of the measurement system; and,
- contamination.

Accuracy can either be evaluated without a background level of an analyte or with the introduction of a known quantity of analyte. The evaluation of laboratory standard control samples shall use the former method as presented on Table 1-1; the evaluation of laboratory spiked samples shall use the latter method.

TABLE 1-1: DATA QUALITY CHARACTERISTICS FORMULAE

Characteristic	Formula	Symbols
Precision (as relative percent difference, RPD)	$RPD = \frac{\left\lvert x_i - x_j \right\rvert}{\left(\frac{x_i + x_j}{2}\right)} \times 100$	x_i, x_j: replicate values of x
Precision (as relative standard deviation, RSD, otherwise known as coefficient of variation)	$RSD = \frac{s}{\bar{x}} \times 100$	s: sample standard deviation $\bar{x}$: sample mean
Characteristic	**Formula**	**Symbols**

Accuracy (as percent recovery, R, for samples without a background level of the analyte, such as reference materials, laboratory control samples, and performance evaluation samples)	$R = \frac{x}{t} \times 100$	x: sample value t: true or assumed value
Accuracy (as percent recovery, R, for measurements in which a known amount of analyte, a spike, is added to an environmental sample)	$R = \frac{x_s - x}{t} \times 100$	x_s: value of spiked sample x: value of unspiked sample t: true or assumed value
Completeness (as a percentage, C)	$C = \frac{n}{N} \times 100$	n: number of valid data points produced N: total number of samples taken

1.4.3.3 Representativeness

Data representativeness is defined as the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or environmental conditions. Representativeness is a qualitative parameter that is most concerned with the proper design of the sampling program. Representativeness of samples shall be achieved through the careful selection of sampling locations and methods. The sampling program has been designed so that the samples collected are representative of the medium being sampled and that a sufficient number of samples shall be collected to meet the DQOs.

1.4.3.4 Completeness

Completeness refers to the amount of useable data produced during a program. The procedures established in this PgmQAP are designed to ensure, to the extent possible, that data shall be valid and usable. To achieve this objective, every effort shall be made to collect each required sample and to avoid sample loss.

1.4.3.5 Comparability

Data comparability is defined as the measure of the confidence with which one data set can be compared to another. Comparability is an qualitative parameter, but must be considered in the design of the sampling plan and selection of analytical methods, quality control protocols, and data reporting requirements.

1.4.4 Goals

This section identifies numerical goals for precision and accuracy for the various environmental media. The completeness goal for measurements is 90 percent. Failure to meet these goals shall be considered in the data validation process described in
Section 3.0. If data are unusable, as defined by the validation procedure, the data shall be qualified as rejected. Further evaluations shall be made and resampling or other appropriate actions initiated.

1.4.4.1 Precision

Precision shall be determined on field data and laboratory analysis data by the analysis of field duplicates, laboratory replicate, matrix spike and matrix spike duplicate results and evaluation of the RPD. The RPD goals shall be less than or equal to 20 percent. At least three replicate samples shall be collected at each designated quality assurance sample location. Precision of field measurements and laboratory results of these samples shall be evaluated by means of RSD, or the coefficient of variation. The RSD is calculated as shown in Table 1-1. The RSD goal for samples shall be less than or equal to 20 percent.

1.4.4.2 Accuracy

Sample accuracy shall be determined by the collection and analysis of field blanks and shall include at least one trip blank and equipment rinsate blank for every 10-field samples collected or at least one per sample area. Laboratory accuracy is determined by the analysis of calibration and method blanks, calibration verification samples, laboratory control samples, and matrix spike samples. Method blank goals shall be that blanks contain less than the contract required detection limit (CRDL) for each target parameter. The accuracy goals shall be the same as the precision goals.

1.4.4.3 Representativeness

Representativeness is addressed by the description of the sampling techniques and the rationale used to select the sampling locations. Sampling methods are established by the SOPs and MPs contained Appendices B and C. Representativeness is also evaluated using RSD between the multiple samples of samples, as well as field duplicates and by a review of the results of field blanks: ambient blanks (water matrices only), equipment blanks, and trip blanks (water matrices only).

Laboratory representativeness shall be evaluated by reviewing chain of custody (COC) forms, sample receipt forms, and sample preparation documentation to ensure that samples are stored, processed, and reported properly.

1.4.4.4 Completeness

The completeness goal of this program shall be 90 percent for each of the samples collected. Care shall be taken to provide duplicate samples from areas determined to be of particular concern during the course of the program, or from areas to which access may be limited.

1.4.4.5 Comparability

Comparability shall be ensured by analyzing water samples obtained in accordance with appropriate SOPs. Data shall be reported in the units specified in the governing analytical methods, generally in mg/L for water matrices and mg/kg(with the moisture basis specified) for solid matrices.

Laboratory data shall be validated in compliance with SOP-NW-18.1, "Data Validation." Final program deliverables shall be subject to independent technical review in compliance with MP-9.2, "Technical Review", prior to submittal.

1.5 TRAINING REQUIREMENTS

MWH field personnel shall be trained in the requirements of the SAP in a program meeting prior to the initiation of field activity. All personnel shall read the SAP documents prior to the start of field work, and shall acknowledge completion of reading training at the time of the program meeting. Meeting notes and attendance sheets shall be kept and forwarded to the program records in accordance with MP-16.1, "Management of Quality Records." In addition, prior to conducting each day's sampling activities, the Field Team Leader, or designee shall conduct a "tailgate" meeting with field staff to review field procedures and sampling requirements, in order to better ensure that samples are collected and handled according to PgmFSP and PgmQAP requirements. Tailgate meeting discussion subjects and attendees shall be documented in the Field Logbook as noted in Section 1.5.

One hard copy of the current approved version of the entire SAP shall be maintained by the Field Team Leader for ready-reference purposes, in the field vehicle or field office. All field team members shall have access to .pdf format files of the complete SAP through their personal laptop computers.

1.6 DOCUMENTATION AND RECORDS REQUIREMENTS

1.6.1 Field Logbooks

Sample collection activities shall be documented in permanently bound, page-numbered, weather-resistant field logbooks assigned to the Field Team Leader, or, if multiple sampling teams are used, to a designee in charge of each team. Each notebook shall be identified to the program, task, and to the individual assigned custody of the logbook. For all sampling to be performed, the appropriate SOP, appended to this PgmQAP shall also be employed. If logbook custody is transferred to another individual, such transfer shall be noted in the logbook and signed and dated by both parties. All entries shall be made in indelible ink; errors shall be corrected by one single line through the text being revised, and all such corrections shall be initialed and dated.

With the exception of the information contained in the appropriate SOP, governing the media to be sampled, bound field logbooks shall be used to record the following information, as appropriate for the type of sampling being performed:

- date, time, subjects, and attendees of daily tailgate training sessions;
- sample date, time, types, numbers, and quantities;
- sample container preservation steps performed;
- sample locations, including global positioning system (GPS) coordinates;
- numbers of associated photographs, with appropriate cross-references to the affected camera;
- sampling equipment used;
- decontamination steps performed;
- calibration information for field equipment (e.g., turbidity meters, conductivity meters), cross-referenced to equipment identification number, model/manufacturer, serial number, or other unique identifier; and,
- acknowledgements that COC forms and express shipment information (see Figure 1-2) were properly completed.

In addition, other ancillary information shall be recorded, including:

- time of arrivals/departures of MWH personnel and/or other visitors to the sampling site(s);
- weather conditions;
- presence of livestock or wild game;
- time and subject of any incoming our outgoing telephone/radio contacts; and,
- any unusual events.

The logbooks shall be kept up to date on a daily basis; backup copies of each day's entries shall be made on a weekly basis and forwarded separately to the program quality records in accordance with MP-16.1, "Management of Quality Records", in addition to copies of all Surface Water Sample Collection Forms, outgoing COCs, and sample shipping documents.

1.6.2 Field Forms

In addition to the field logbooks, field forms will be required to be filled out by the sampling team conducting the sampling. All efforts will be made to fill out the information at the sampling location. Field forms for various media include sampling of surface water, surface water flow, groundwater, fish tissue, sediment, soil, and vegetation. These forms are used as a supplement to the field logbooks. The appropriate forms for sampling of various media are located in the applicable SOP, appended to this QAP.

1.6.3 COC Records

Documentation of sample custody must be maintained from the time the samples are collected through: receipt at the destination laboratory; sample homogenization, preparation, and analysis; data recording and reduction; data validation; and final release of laboratory analytical data. Initial information concerning sample collection shall be recorded in the field logbook as described in Section 1.5.1.

Information on the custody, transfer, handling, and shipping of samples shall be recorded by field personnel on an ACZ COC form as shown in Figure 1-2. A COC form shall be completed for each set of samples collected daily and shall contain the following information:

- sampler's signature and affiliation;
- program name and identification number;
- date and time of collection;
- sample identification number and matrix;
- analyses requested;
- number of containers;
- signature of persons relinquishing custody, dates, and times;
- signature of persons accepting custody, dates, and times;
- method of shipment; and,
- shipping papers/waybill identification number (as appropriate).

A copy of each as-transmitted COC form shall be retained in the program records in accordance with MP-16.1, "Management of Quality Records."

ACZ Laboratories, Inc.

2773 Downhill Drive Steamboat Springs, CO 80487 (800) 334-5493

CHAIN of CUSTODY

Report to:

Name:	Address:
Company:	
E-mail:	Telephone:

Copy of Report to:

Name:	E-mail:
Company:	Telephone:

Invoice to:

Name:	Address:
Company:	
E-mail:	Telephone:

If sample(s) received past holding time (HT), or if insufficient HT remains to complete analysis before expiration, shall ACZ proceed with requested short HT analyses? YES ☐ NO ☐

If "NO" then ACZ will contact client for further instruction. If neither "YES" nor "NO" is indicated, ACZ will proceed with the requested analyses, even if HT is expired, and data will be qualified.

PROJECT INFORMATION

Quote #:

Project/PO #:

Shipping Co.:

Tracking #:

Reporting state for compliance testing:

Are any samples NRC licensable material?

ANALYSES REQUESTED *(attach list or use quote number)*

SAMPLE IDENTIFICATION	DATE:TIME	Matrix	# of Containers								

Matrix: SW (Surface Water) · GW (Ground Water) · WW (Waste Water) · DW (Drinking Water) · SL (Sludge) · SO (Soil) · OL (Oil) · Other (Specify)

REMARKS

RELINQUISHED BY:	DATE:TIME	RECEIVED BY:	DATE:TIME	Page
				Of

FRMQA021.12.03.06 White - Return with sample. Yellow - Retain for your records.

Figure 1-2
ACZ Laboratories, Inc.
Chain of Custody Form

1.6.4 Analytical Laboratory Records

Subcontractor analytical laboratories shall be responsible for preparing analytical laboratory reports that are reviewed and approved by the laboratory's QA manager prior to submittal to MWH, as noted in the QA plans provided by each laboratory (See Appendices D and E). Such reports shall summarize the results of the analysis each sample delivery group, and shall include a detailed data package that, at a minimum, shall include the following:

- title page;
- a cover letter, which shall briefly summarize the contents of the package;
- completed COC forms;
- a QC summary (which shall address potential or actual laboratory procedural problems) and documentation of any discrepancies affecting measurement systems in use during the analyses;
- sample data report forms;
- sampling and analysis dates;
- test method references;
- raw analytical data;
- reduced data;
- data outliers;
- reduction formulae;
- recovery percentages;
- supporting spectrograms and, if required, chromatograms;
- equipment calibration data;
- laboratory logs including standards logs, extraction logs, sample preparation logs, instrument logs, and internal review checklist;
- raw QC data including method blank data, matrix spike data, matrix spike duplicate data, and laboratory control sample data; and,

- other data, including electronic data deliverable (EDD) files in IBM-compatible compact disk (CD) or 3.5-inch diameter diskette format.

1.6.5 Program Quality Records

Program quality records are defined as completed, legible documents which furnish objective evidence of the quality of items or services, activities affecting quality or the completeness and quality of data, and which are maintained for the specific program. These records shall be organized and managed in MWH's Bellevue, Washington program office as described in MP-16.1, "Management of Quality Records", and at a minimum shall include:

- original and backup copies of all bound field logbooks, as described in Section 1.5.1;
- copies of all completed Surface Water Sample Collection Forms;
- field copies and original (laboratory) copies of all COC forms (see Section 1.5.2);
- personnel training records (except that any medical monitoring program shall be maintained in MWH's personnel files);
- incoming and outgoing program correspondence (letters, telephone conversation records, faxes, and hard copies of e-mail messages);
- copies of all laboratory agreements and amendments thereto;
- purchasing records for program supplies;
- as-received laboratory data packages (hard copy and EDDs) as noted in Section 1.5;
- validated laboratory data packages (see Section 1.5.3);
- all approved field change request (FCR) forms; see Section 1.5.4;
- draft and final versions of all reports and any associated presentation materials; and,
- draft and final delivered versions of the SI reports and its supporting procedures.

1.6.6 Field Change Request Forms

Due to the conditions associated with field sampling activities, unexpected situations may occur that will require deviations or modifications to the requirements of the SAP. Other changes may be required by P_4 Production during the course of this program. In such situations, the Program Manager may authorize the Field Team Leader or designee to undertake SAP modifications, provided that the scope

of such modifications is discussed with the program Quality Manager and approved beforehand and documented on a FCR form as shown in Figure 1-3. Each FCR shall be uniquely numbered and shall identify the program and task, the affected sections of the SAP or its supporting procedures, the scope of the requested variation, and the justification for its acceptance. At the Program Manager's discretion, the FCR may be forwarded to appropriate P_4 Production representatives for review purposes prior to implementation.

FIELD CHANGE REQUEST	
Project Reference:	FCR No.:
Task description:	
Affected plan or procedures:	
Requested variation(s):	
Justification:	
Requested by:	Date:
Field change authorized by:	Date:
Approved by:	Date:
Approved by:	Date:
Comments:	MWH

Figure 1-3:
Field Change Request Form

2.0 MEASUREMENT/DATA ACQUISITION

2.1 SAMPLING PROCESS

2.1.1 Sampling Design

The number and type of samples that shall be collected and general sampling locations are summarized in Table 4-1 of the PgmFSP; further direction and lists of the specific analytes of interest are also provided in each mine-specific PjtWP, and the PgmFSP for the comprehensive SI.

2.1.2 Sampling and Analytical Methods – General Considerations

The SOPs invoked for the field sampling activities were developed from standard American Society for Testing and Materials (ASTM) methods. ACZ and U of I analytical procedures conform to standard EPA methods, with the exception (as in previous years' investigations) of selenium analyses on non-water matrices at the U of I (project quality assurance laboratory). These methods were developed at UC-Davis and the U of I, and have been previously validated under the purview of the IMA Selenium Project to ensure these methods meet appropriate recovery, accuracy, and precision standards.

The selenium method, perchlorate digestion-hydride generation-ICP spectroscopy, used by the U of I (project quality assurance laboratory) is considered the most accurate method. The project primary laboratory, ACZ, uses a different method, sodium hydroxide/hydrogen peroxide-hydride generation-AA-spectroscopy, but in round robin evaluations on water standards and common soil samples conducted by the University of Idaho, ACZ performed very well. The agencies subsequently suggested that ACZ be used as the primary laboratory for the P_4 Production Southeast Idaho Mine-Specific Selenium Program.

Each laboratory's approved selenium procedure is included in their respective laboratory QA plan (see Appendices D and E).

2.2 SAMPLING ACTIVITIES

2.2.1 Sampling Activity Summary

Comprehensive SI sampling activities are summarized in Table 2-1, and consist of surface water, sediment, fish, groundwater, vegetation, and soil sampling at various streams, and mine facility locations.

Table 2-1: P_4 Production Sampling Activities Summary

Sampling Event Description/Matrix	No. of Sample Locations	No. of Mine Sites	General Comments/Notes
Surface Water	106 locations.	3	Analyzed in accordance with the PgmFSP "Surface Water, Sediment, And Fish (Forage & Salmonid) Analytical Suite" (Table 6-2).
Sediment	106 locations.	3	Analyzed in accordance with the PgmFSP "Surface Water, Sediment, And Fish (Forage & Salmonid) Analytical Suite" (Table 6-2).
Fish	80 locations.	3	Analyzed in accordance with the PgmFSP "Surface Water, Sediment, And Fish (Forage & Salmonid) Analytical Suite" (Table 6-2).
Soil	106 locations (waste rock dumps to be determined).	3	Analyzed in accordance with the PgmFSP "Surface Soil And Vegetation Analytical Suite" (Table 6-4).
Groundwater	To be determined.	3	Analyzed in accordance with the PgmFSP "Groundwater Analytical Suite" (Table 6-3).
Vegetation	106 locations.	3	Analyzed in accordance with the PgmFSP "Surface Soil And Vegetation Analytical Suite" (Table 6-4).

2.2.2 Sample Collection and Preparation Protocols

Sampling activities and field parameter measurements shall be performed in accordance with the PgmFSP; and the related surface water, sediment, fish collection, soil, vegetation, and groundwater SOPs to be appended to this PgmQAP.

2.2.3 Sampling Equipment Requirements

Sampling equipment shall be as defined in the governing SOPs or protocols defined in Section 2.2.2. All equipment shall be constructed of appropriate materials to facilitate decontamination; surface water and sediment sampling shall be collected with polyethylene containers, fish samples will be collected using electrofishing and netting, stored in polyethylene bags, groundwater sampling shall be conducted using existing pumps and/or disposable polyethylene bailers, vegetation sampling shall be completed using stainless steel sheers and polyethylene bags, and waste rock sampling shall be accomplished using a spade or trowel and polyethylene or stainless steel containers, at the direction of the Field Team Leader based on site conditions, as appropriate to expose the interval to be sampled and to acquire a representative sample.

Field equipment used for field water quality data collection shall be calibrated using appropriate standards according to the PgmFSP or surface water SOP. Calibration data shall be recorded in the field logbook as noted in Section 1.5 of this PgmQAP. Equipment calibration and maintenance procedures are detailed in Sections 2.6 and 2.7. Field calibration procedures shall follow directions specified in the sampling SOPs and/or manufacturer's instructions.

2.2.4 Sample Routing Requirements

All samples shall be routed directly to ACZ, except for the surface water duplicate samples, which shall be routed to U of I in Moscow, Idaho (QA/QC analysis).

Except in the case of surface water, ACZ shall homogenize and otherwise prepare and submit splits (duplicate samples) for independent analysis by the U of I for those samples identified as QC samples on the COC form. ACZ's duplicate sample homogenization and preparation procedures are defined in their laboratory QA plan (see Appendix D).

2.2.5 Sample Preservation Requirements

Sample containers with the necessary preservative shall be provided by the contract laboratories in accordance with Table 2–2. All samples will be bagged, placed on wet ice, and stored in coolers prior to storage in a locked refrigerator, and subsequent shipping to the appropriate laboratory for analysis.

Nitric acid shall be used as a preservation agent for metal analyses of water samples. Samples shall be maintained at a pH of less than or equal to 2 standard units. As a QA/QC procedure, one preserved surface water sample bottle per sampling event shall be tested for pH to ensure the sample is properly preserved. Results shall be recorded in the field logbook as noted in Section 1.5.

Table 2-2 Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times					
Method & Parameter	**Sample Preparation Method**	**Sample Container**	**Preservative**	**Minimum Sample Volume**	**Maximum Holding Time (Days)**
Solid Matrices (Sediment, Soil, Vegetation, Fish)					
EPA M6020–ICP-MS (Cd, Cu, Cr, Mo, Ni, V, or Zn)*	Total Digestion-hot plate (M3050B)	1 gal HDPE bag	None	5 g	180
M7742 Modified, AA-Hydride (Se)	Total Digestion-hot plate (M3050B)	1 gal HDPE bag	None	5 g	180
USDA No. 60 [21A] (pH)*	Saturated Paste (USDA No. 60 [2])	1 gal HDPE bag	None	20 g	ASAP
M120.1–Meter (Conductivity at 25C)*	Saturated Paste (USDA No. 60 [2])	1 gal HDPE bag	None	20 g	ASAP
ASTM D 422 (Texture or Particle Size Distribution)*	NA	1 gal HDPE bag	None	40g	NA
CLPSOW390, Part F, D-98 (Percent Solids for Soil, Sediment, and Fish)*	NA	1 gal HDPE bag	None	10g	NA
M209F, Gravimetric-105C (Moisture Content for Plants)*	NA	1 gal HDPE bag	None	Sample	NA
ASA No.9 29-2.2.4 Combustion/IR (Total Organic Carbon)*	NA	1 gal HDPE bag	None	20 g	28
Fish Sample Preparation	Fish Tissue Pulverization (EPA 600/4-81-055)	1 gal HDPE bag	None	Sample	NA
Plant Sample Preparation	Plant Tissue Pulverization (USDA #60, Method 53)	1 gal HDPE bag	None	Sample	NA
Sediment Sample Preparation	Air Dry at 34C and Crush & Pulverize (USDA No.1, 1972) Sieve-2.0mm (ASA No.9, 15-4.2.2)	1 gal HDPE bag	None	Sample	NA
Soil Sample Preparation	Air Dry at 34C (USDA No.1, 1972) Sieve-2.0mm (ASA No.9, 15-4.2.2)	1 gal HDPE bag	None	Sample	NA
Solid Matrices (Agronomic Soil)					
M6010B–ICP (Cd, Cu, Cr, Fe, Mn, Mo, Ni, V, and Zn)	Extractable, AB-DTPA (ASA No. 9, 3-5.2.3)	1 gal HDPE bag	None	5 g	180
M6010B–ICP (Ca, Mg, Na) for Sodium Absorption Ratio	Soluble, Saturated Paste (USDA No. 60 [2])	1 gal HDPE bag	None	300 g	180
SM3114B, AA-Hydride (Se)	Extractable, AB-DTPA (ASA No. 9, 3-5.2.3)	1 gal HDPE bag	None	5 g	180
USDA No.60 (19) (Cation Exchange Capacity)	Cation Exchange Capacity Extraction (USDA No.60 [19])	1 gal HDPE bag	None	6 g	NA
Solid Matrices (Agronomic Soil)- Continued					

Table 2-2
Requirements for Containers, Preservation Techniques, Sample Volumes, and Holding Times

Method & Parameter	Sample Preparation Method	Sample Container	Preservative	Minimum Sample Volume	Maximum Holding Time (Days)
M120.1–Meter (Conductivity at 25C)	Saturated Paste (USDA No. 60 [2])	1 gal HDPE bag	None	300 g	ASAP
USDA No. 6–Method 2 (Organic Matter)	NA	1 gal HDPE bag	None	1 g	NA
USDA No. 60 [21A] (pH)*	Saturated Paste (USDA No. 60 [2])	1 gal HDPE bag	None	300 g	ASAP
ASTM D 422 (Texture or Particle Size Distribution)*	NA	1 gal HDPE bag	None	40g	NA
M353.2-Automated Cadmium Reduction (Nitrate, Nitrite)	Soluble, Water Extraction (ASA No. 9 10-2.3.2)	1 gal HDPE bag	None	20g	NA
M350.1-Automated Phenate (Nitrogen, ammonia)	KCl Extraction (ASA No. 9 33-3.2.2)	1 gal HDPE bag	None	10g	NA
M365.1-Automated Asorbic Acid (Phosphorus)	Extractable, AB-DTPA (ASA No. 9, 3-5.2.3)	1 gal HDPE bag	None	5g	NA
M375.3-Gravimetric (Sulfate)	Soluble, Water Extraction (ASA No. 9 10-2.3.2)	1 gal HDPE bag	None	20g	NA
Soil Sample Preparation	Air Dry at 34C (USDA No.1, 1972) Sieve-2.0mm or 0.5mm (ASA No.9, 15-4.2.2)	1 gal HDPE bag	None	Sample	NA
Water Matrices (Surface Water, Groundwater)					
EPA M200.8–ICP-MS (Cd, Cr, Ni, V, Zn)*	Dissolved (Field Filtered)	125 mL HDPE	HNO_3	20 mL	180
	Total Hot Plate Digestion (M200.0 ICP-MS)	250 mL HDPE	HNO_3	20 mL	180
EPA M200.7–ICP (Ca, Mg, K, Na)	Dissolved (Field Filtered)	125 mL HDPE	HNO_3	20 mL	180
EPA M300– Ion Chromatography (Cl, SO_4)	Dissolved (Field Filtered)	250 mL HDPE	None	50 mL	28
SM2320B–Titration (Alkalinity, Bicarbonate Carbonate, Hydroxide)	Total Hot Plate Digestion (M200.0 ICP-MS)	250 mL HDPE	None	50 mL	14
SM3114B, AA-Hydride (Se)*	Dissolved (Field Filtered)	125 mL HDPE	HNO_3	25mL	180
	Total Hot Plate Digestion (M200.0 ICP-MS)	250 mL HDPE	HNO_3	25mL	180

*Specific parameters are media or sample type specific, see appropriate table in PgmFSP.

2.2.6 Decontamination Procedures

Sampling equipment used for collecting samples shall be decontaminated prior to all sample acquisition activities. Hand equipment shall be decontaminated as follows:

- remove excess rock fragments, soil, sediment, and vegetation;
- wash equipment with Crystal White™ (or equivalent) biodegradable soap/deionized water solution;
- rinse with potable water; and,
- rinse three times with deionized or distilled water.

Decontamination of surface water sampling equipment will not normally be required due to the exclusive use of dedicated or disposable equipment. However, water meter probes will be decontaminated with multiple rinsing using distilled water. Non-dedicated water collection equipment shall be decontaminated between each sample by multiple rinsing with water to be sampled (prior to sampling).

All rinsate may be disposed of onsite. Field personnel shall handle field equipment and containers carefully to minimize the potential for cross-contamination. Containers shall be handled in a manner to prevent direct contact with internal surfaces. Sampling personnel shall avoid the wearing of items or clothing that may interfere with dexterity or create a migration route for cross contamination.

2.2.7 In-Process Sampling Data Review and Change Control

Review of field collection data shall be conducted on site by the Field Team Leader on at least a daily basis. Based on this review, the Field Team Leader may request re-sampling or re-analysis of a particular sample or group of samples if omissions or discrepancies are found. Any changes in sampling procedures that may be required in order address unanticipated field situations shall be processed as an FCR as noted in Section 1.5.6. Other discrepancies shall be discussed with program Quality Manager and corrective and preventive action request initiated as appropriate, in accordance with MP-14.1, "Corrective and Preventive Action" (see Appendix C).

2.3 SAMPLE CUSTODY REQUIREMENTS

2.3.1 Sample Labeling and Handling

Samples will be labeled with all necessary information on laboratory supplied labels using waterproof ink. At a minimum, each sample label shall contain the following information:

- site location;
- sample identification;
- date and time of sample collection, with sampler's initials;

- analyses required;
- method of preservation, if used; and,
- sample matrix.

Each sample shall be assigned a unique identification number. This number shall be coded according to sample location and date according to the following format:

MMDDyyXXMYYaaa-b-c

where:

- **MM** denotes the month the sample is collected (for example, May is "05").

- **DD** denotes the day the sample is collected (for example, "20" is the 20th day of the month).

- **yy** denotes the year the sample is collected (for example, 2004 is "04").

- **XX** denotes the medium sampled; medium codes are as follows:

  FF: Forage Fish (fish < 6 inches in length for whole-body analysis)
  FI: Salmonid (fish greater than 6 inches long for skin-on fillet (e.g., muscle) analysis)
  GW: Groundwater
  SE: Sediment
  SS: Surface Soil
  SW: Surface water
  VE: Vegetation

- **M** designates that the sample station was identified by MWH for the mine-specific investigations of the P_4 Production Southeast Idaho Mine-Specific Selenium Program.

- **YY** denotes the station type; station types are as follows:

  AW: Agricultural well
  DW: Domestic well
  DS: Dump seeps
  MW: Monitoring well
  PW: Production well located at a mine
  RV: Reservoir
  SG: Springs
  SP: Stock ponds
  ST: Streams

- **aaa** denotes the specific station number/location (ascending order starting at 001).

- **b** denotes the replicate number (0 shall indicate no replicate samples; if there are replicate samples, then 1, 2 and 3 represent the primary samples; and 4 signifies that the sample is a QA/QC sample). For forage fish and salmonids, 1, 2, and 3 represent different fishes.

- **c** denotes whether the sample involved special field handling or is to be handled in a specific manner; handling codes are as follows:

C(i):	Composited (i indicates the number of samples)
EQ:	Equipment blank
F:	Filtered
U:	Unfiltered
B:	Water blank
QA:	Quality assurance solid sample to be prepared and split at the lab

As an example, sample number **052002SWMST058-0-F** describes a non-replicated, filtered surface water sample collected at MWH stream monitoring station MST058 on May 20, 2002 for the P_4 Production Southeast Idaho Mine-Specific Selenium Program.

Sample containers shall be sealed in ziplock plastic bags or plastic bags with wire ties supplied by ACZ and immediately placed on ice or "blue ice" in an insulated cooler chilled to at least 4°C. Insulated coolers shall be provided by the contract laboratories or purchased locally. All samples will be stored in the coolers until the end of the day when all of the samples except for fish samples will be placed in a locked refrigerator at the Ballard Mine office. Fish samples (forage fishes and salmonids) will be placed in a locked freezer at the end of the day.

Samples will be shipped to the laboratories with blue ice or bagged wet ice in coolers secured with packing tape, via overnight Federal Express service to the appropriate laboratory. If possible, only one type of medium will be shipped in each cooler. MWH will fill out appropriate chain-of-custody forms supplied by the respective laboratory. The chain-of-custody will be included with the sample shipment, and copies of all chains-of-custody along with Federal Express waybills will be kept by MWH field personnel.

Samples will be sent to:

ACZ Laboratories, Inc.
c/o Scott Habermehl
2773 Downhill Drive
Steamboat Springs, CO 80487
(800) 334-5493.

Duplicate QC samples will be sent to:

University of Idaho Analytical Sciences Laboratory
Holm Research Center
c/o Janet Snow
Moscow, ID 83844
(208) 885-7081.

Supplies and sample containers will be sent to the Degerstrom shop office at Enoch Valley Mine:

Degerstrom
Attention: MWH-Paul Stenhouse
3268 Blackfoot River Rd.
Soda Springs, ID 83276
(208) 574-6110.

MWH's FedEx account number is 237-076-389.

2.3.2 Chain of Custody

Field personnel responsible for the collection of samples shall sign and retain a copy of the COC form, document the method of shipment, and send the original with the samples. The original signed COC form shall be sealed in a watertight plastic envelope and attached to the inside lid of the cooler. Coolers shall be secured with strapping tape and a container seal applied that is covered with clear strapping tape. After samples are packed and sealed, coolers shall be transferred from the field to a central, secured area at the Ballard Mine shop office for storage and overnight express carrier pickup. Samples shall be stored in a refrigerator fitted with a keyed lock; the key location shall be made known only to the Field Team Leader or designees.

Primary samples shall be shipped by overnight express carrier for delivery to ACZ in Steamboat Springs, CO, and the Holm Research Center at the University of Idaho in Moscow, Idaho, in time to meet all required holding times. Duplicate samples as required by the governing COC forms shall then be split by ACZ in accordance with the procedures defined in Appendix D and shipped via overnight express carrier for delivery to U of I. A separate U of I COC form shall be shipped with the cooler to confirm transfer; the carrier waybill number shall be recorded on the original (ACZ or U of I) COC. Copies of the COCs and waybills shall be forwarded to the program quality records by the Field Team Leader in accordance with MP-16.1, "Management of Quality Records." Immediately after the sample coolers containers are delivered to the carrier, the Field Team Leader or Analytical Task Manager shall notify the analytical laboratory to expect sample deliveries. Samples shall not be shipped on Friday without making prior arrangements with the destination laboratories.

2.3.3 Holding Time Considerations

Immediately after collection, samples shall be placed in field coolers with wet ice and/or blue ice. If there is no likelihood that a holding time will be violated, samples may be stored in the locked refrigerator at the Ballard Mine shop office for one or more days. Constituent-specific holding times are

presented in Table 2-2. Sample shipment shall be scheduled to prevent the exceedance of any required holding period. Failure to conduct analyses within the required holding times may potentially require the qualification of associated analytical results and shall prompt appropriate corrective and preventive action measures as discussed in Section 4.0.

2.3.4 Laboratory Operations

2.3.4.1 Laboratory Receipt and Logging

Coolers containing samples to be analyzed shall be shipped via overnight express courier to ACZ, in Steamboat Springs, CO, or the U of I Holm Research Center, in Moscow.

When samples arrive at each laboratory, the designated laboratory custodian receiving the sample cooler shall inspect the cooler custody seal. The custodian shall sign the shipping COC and attach the carrier billing. The shipping COC and waybill shall be archived in the laboratory program file; a copy of the shipping COC and waybill shall be forwarded to MWH's Bellevue office for filing in the program quality records in accordance with MP-16.1, "Management of Quality Records." The custodian shall then open the cooler to inspect the samples for integrity and compare the number of containers and label information with the COC form attached to the inside of the cooler lid. Cooler temperatures shall be checked and documented on the COC form. Broken custody seals, damaged sample containers, sample labeling discrepancies between container labels and the COC form, and analytical request discrepancies shall be noted on the COC form. The Analytical Task Manager shall be notified of any such problems; the Program Manager, or Field Team Leader, and the Quality Manager shall be advised in turn if the issue constitutes a nonconformance. In any case, discrepancies or nonconformance shall be resolved and addressed prior to the samples being released to the laboratory for analysis.

Once any discrepancies are resolved, the laboratory custodian shall enter the samples into an analytical custody log and shall assign each sample a unique identification number that is cross-referenced to the sample number assigned in the field. The identification number shall be used by the laboratory in its internal tracking system and the status of any given sample can be checked at any time by referring to the laboratory numbers on the COC form and in the laboratory log books. Both the laboratory and sample numbers shall be cited when the analytical results are reported. The laboratory custodian shall then sign the COC form. The original COC shall be routed to the laboratory's data management group. Copies of the COC forms documenting custody changes and documentation shall be received and kept in the laboratory program files. The original COC forms shall remain with the samples until final disposition of the samples by the laboratory. Samples, extracts, or digestates shall not be sent to another laboratory without the written authorization of the Program Manager. If so authorized, such samples shall be transmitted using a COC form approved by the Program Manager. After sample disposal, a copy of the original COC shall be sent to the Program Manager by the analytical laboratory to be incorporated into the program quality records in accordance with MP-16.1.

2.3.5 Sample Storage and Security

While in the laboratory, the samples and aliquots that require storage at no more than 4°C, but above freezing, shall be kept in a locked refrigerator prior to analysis. At a minimum, the following procedures shall be applied:

- samples and extracts shall be stored in a secure area controlled by the laboratory's designated sample custodian;
- samples shall be removed from the shipping container and stored in their original containers unless damaged; damaged samples shall be disposed in an appropriate manner after notifying the MWH Analytical Task Manager, and authorization to dispose is received and documented;
- whenever samples are removed from storage, removal shall be documented;
- sample transfers shall be documented on internal COC records;
- samples and extracts shall be stored after completion of analyses in accordance with contractual requirements, or until instructed otherwise by the MWH Analytical Task Manager; and,
- samples shall not be stored with standards or sample extracts.

2.3.6 Sample Tracking

Laboratory personnel shall use COC records or databases to generate backlist reports of any unanalyzed samples. The reports shall include the collection times along with the program name and laboratory sample number, and shall include the program name, field sample identifications, and sample matrix. Sample analyses shall be scheduled on the basis of holding time considerations. Analytical assignments shall be reviewed on a daily basis to ensure that holding times are not exceeded. If holding times are exceeded during laboratory custody, the MWH Analytical Task Manager shall be immediately notified.

2.3.7 Sample Custody Records

Minimum requirements for laboratory sample COC controls are as follows:

- samples shall be stored in a secured area;
- access to the laboratory shall be through a monitored area; other outside access doors to the laboratory shall be kept locked in accordance with local fire requirements;
- a visitor's log shall be maintained, and visitors shall be escorted while in the laboratory;
- refrigerators, freezers, and other sample storage areas shall be securely locked or maintained in a secured area;

- only authorized personnel shall have keys to locked sample storage area(s);
- samples shall remain in secure sample storage until removed for preparation or analysis;
- sample transfers into and out of storage shall be documented; and,
- custody records shall be maintained by the laboratory's sample management group.

Samples, extracts, and digestates shall be retained at the laboratory for at least 60 days after the laboratory's final analytical data report has been submitted to MWH, so that any potential analytical problems can be properly addressed. The samples, extracts, and digestates may then be discarded unless in an approved and environmentally safe manner otherwise directed by the Analytical Task Manager.

2.4 ANALYTICAL METHOD REQUIREMENTS

2.4.1 Sample Preparation

Sample preparations shall be in accordance with standard laboratory practices as described in the approved laboratory QA plan (see Appendices D and E). Solid matrices such as sediment, soil, and vegetation shall be homogenized to allow an equal distribution of properties throughout the material prior to analysis. Subsamples shall be obtained for matrix spikes prior to sample preparation and analysis. A subsample shall consist of a proportion of a homogenized liquid sample that is at least equal to the minimum size requirement for the analytical test.

2.4.2 Analytical Methods and Target Analyses

Tables 6–2, 6–3, 6–4, and 6–5 of the PgmFSP reproduce the list of target analytes and analytical methods specified for this investigation by IDEQ via the AOC with P_4 Production

2.5 QUALITY CONTROL REQUIREMENTS

2.5.1 Field Quality Control Samples

2.5.1.1 Equipment Blanks

Blanks are defined as sample material that is free of reportable concentrations of target analytes; the blanks are introduced at various stages of sample handling to monitor possible contamination introduced by various field activities. Only rinsate (or equipment) blanks shall be used for this program. An equipment blank is a sample of the distilled water being used by the field team that is collected using decontaminated sampling equipment. The sample is then submitted to the laboratory as a blind sample.

2.5.1.2 Duplicates

A field duplicate is a subsample that has been divided from the primary sample at some step in the sampling process. The primary and duplicate samples are carried through the remaining steps of the

process by the two laboratories to evaluate analytical performance. Field duplicate samples provide information on the precision of the sampling, transfer, and analytical process. Field duplicates shall be collected for every 10 field samples for all matrices. *It should be noted that the MWH field team will take field duplicates of water samples only; due to the difficulty of achieving appropriate sample homogenization in the field for other sample matrices (especially biota), all other required duplicates shall be prepared by ACZ in accordance with the homogenization and duplicate sample preparation procedures included in their approved laboratory QA plan (Appendix D).

The QA stations shall also have their primary samples taken in triplicate. Triplicate samples shall allow for statistically valid evaluations of sampling and analysis precision, of duplicate analysis performance, and for hypothesis testing.

2.5.2 Laboratory Quality Control Samples

Laboratory quality control samples shall be introduced into the measurement process to evaluate laboratory performance and sample measurement bias. Control samples may be prepared from environmental samples or be generated from standard materials in the laboratory. Laboratory quality control samples used in each analytical method are discussed in the following sections and are summarized in Table 2-3.

TABLE 2-3 QUALITY CONTROL SAMPLE SUMMARY

Quality Control Sample Type	Rationale	Frequency	Description	QC Sample Data Assessment
Field QC Samples				
Rinsate or Equipment Blank	Identify whether target analytes may have been introduced into samples during sample collection.	One per 10 samples for each media.	Sample collected from decontaminated equipment in the same container type as primary sample. Sample is submitted blind to the laboratory.	Assess whether target analyses were introduced into the blanks during sample collection. A measure of accuracy.

TABLE 2-3 QUALITY CONTROL SAMPLE SUMMARY				
Quality Control Sample Type	**Rationale**	**Frequency**	**Description**	**QC Sample Data Assessment**
Field Triplicate	Assess sampling and analytical precision.	One per 10 samples.	Triplicate of a specific performance sample collected in the field and submitted blind to the laboratory.	Quantitative measure of precision in a statistically valid manner.
Field Duplicate	Assess sampling and analytical precision.	One per 10 samples for each media (Note: duplication of non-water sample matrices will be performed by ACZ).	Duplicate of a specific performance sample collected in the field and submitted blind to the laboratory.	Data for the primary sample(s) and the duplicate shall be compared to assess consistency during sampling and analysis. A measure of precision.
Laboratory QC Samples				
Method Blank	Identify target analyses that may have been introduced into the sample during preparation and analysis.	One per 10 samples for each medium.	Reagent-grade water that is carried through the same analytical procedures as the media being analyzed.	Assess whether target analyses were introduced into the blank during the analysis. A measure of accuracy.

TABLE 2-3 QUALITY CONTROL SAMPLE SUMMARY				
Quality Control Sample Type	**Rationale**	**Frequency**	**Description**	**QC Sample Data Assessment**
Matrix Spike (MS)	Identify media interference during analysis.	One per 10 samples for each media.	Two subsamples shall be obtained from primary water or homogenized solid sample. One container shall be labeled for MS analysis; the other for MS duplicate (MSD) analysis. The samples shall be spiked in accordance with lab SOPs.	The percent of recovery and the RPD for each spiked analyte shall be reviewed for compliance with the laboratory QC limits. A measure of precision and accuracy.
Laboratory Control Sample (LCS) Duplicate	Assess laboratory precision and accuracy.	One per 10 samples for each media.	LCS are prepared by the laboratory and consist of samples spiked with analyses specified in the laboratories' SOPs.	The percent recovery and the RPD for each spiked analyte shall be reviewed for compliance with the laboratory QC limits. A measure of precision and accuracy.
Analytical Duplicate	Assess analytical precision.	One per 10 sample for each media.	Duplicate of prepared sample and analyzed and reported by the laboratory.	Data for the sample and its duplicate shall be compared to assess consistency during sample preparation and analysis. A measure of precision.

2.5.2.1 Method Blanks

Method blanks shall be used for the laboratory processes. A method blank is a volume of deionized water that is carried through the entire sample preparation and analysis procedure. The method blank volume or weight shall be approximately equal to the sample volumes or sample weights being processed. Method blanks are used to monitor interference caused by constituents in solvents and reagents and on glassware and other sampling equipment. A method blank is prepared and analyzed with each analytical batch of 10 or fewer samples prepared.

2.5.2.2 Matrix Spikes

A spike is a sample to which is added a known amount of analyte(s) before analysis. From the concentrations of the analyte in the spiked and unspiked samples, a percent recovery is calculated. Many samples show matrix effects in which other sample components interfere with the determination of the analyte. The value of the percent recovery indicates the extent of the interference. A *matrix spike* is prepared by adding an analyte to a subsample of a field sample before sample preparation and analysis. For multianalyte methods, a representative suite of the analytes is used in the matrix spike. An *analytical spike* is prepared by adding analyte to an aliquot of a processed sample prior to analysis, and is used to determine whether the analysis system provides results that are representative of the sample when a matrix spike is outside its limits.

2.5.2.3 Laboratory Control Samples (Verification Solutions)

A laboratory control sample (LCS), or a blank spike, is an aqueous or solid control sample of known composition that is analyzed using the same sample preparation, reagents, and analytical methods employed for the program samples. An LCS is obtained from an outside source or is prepared in the laboratory by spiking reagent water or a clean solid matrix for a stock solution that is different than that used for the calibration standards. The LCS is the primary indicator of process control used to demonstrate whether the sample preparation and analytical steps are in control, apart from sample matrix effects. LCSs contain the target analytes identified in the method.

2.5.2.4 Duplicate Samples

Duplicate samples are samples that have been divided into two portions at some step in the measurement process. Each portion is then carried through the remaining steps of the process. Duplicate samples provide information on the precision of the operations involved. Analytical duplicates are a pair of subsamples from a field sample that are taken through the entire preparation and analysis procedure; any difference between the results indicate the precision of the entire method in the given matrix. Under the laboratory protocols, the matrix spike is duplicated to provide a matrix spike duplicate. Matrix spike duplicates shall be prepared for every analytical batch of at least 10 samples. Analytical duplicates are prepared by taking two aliquots of a process sample and analyzing them in the same manner. Both matrix and analytical spike duplicates are used to monitor the precision of the analytical process.

2.5.2.5 Surrogates

Since surrogates are typically used in chromatographic organic analyses but not in inorganic analyses, surrogates shall not be used.

2.5.2.6 Performance Evaluation Samples

Program-specific laboratory performance evaluations via performance evaluate samples are not anticipated as part of this SI, but may be performed at P_4 Production's option if analytical or validation exercises indicate the presence of potential laboratory QA issues. Field and laboratory audits will be conducted by MWH's Quality Manager, Mr. Mills.

2.6 INSTRUMENT/EQUIPMENT CALIBRATION AND MAINTENANCE REQUIREMENTS

2.6.1 Field Equipment

Water quality parameters to be measured during groundwater and surface water sampling include pH (standard units), temperature (°C), oxidation-reduction potential (ORP) (mV), conductivity and specific-conductance(µS/cm), turbidity (NTU), and dissolved oxygen (DO, mg/L). The temperature, pH, and redox potential shall be recorded using an Orion 260 probe, or equivalent equipment. Specific conductance shall be measured using a YSI 30 meter, or equivalent. Turbidity shall be recorded using a Cole-Parmer turbidity meter or equivalent, and dissolved oxygen shall be measured with a YSI 95 DO meter, or equivalent equipment. Surface water flow measurement shall be recorded using a Swoffer current meter.

Field equipment shall be provided with the manufacturer's calibration instructions and the necessary equipment and standards. The DO probe shall be calibrated atmospherically per the manufacturer's instructions. The temperature probe shall be calibrated in both ice water (0°C) and boiling water (<100°C; the exact temperature shall be dependent upon non-altitude-adjusted barometric pressure). The two-point calibration method shall always be used for pH.

Field equipment shall be calibrated using the standards specified or provided by the equipment manufacturer. Atmospheric oxygen shall be used to calibrate the dissolved oxygen element. Calibration standard usage prior to and after field activities shall be according to the manufacturer instructions.

The frequency of field instrument calibration for each equipment type is listed in Table 2-4. At a minimum, field instrumentation shall be calibrated at the beginning of each day during each sampling period. All calibration activities shall be documented in the field logbook as noted in Section 1.5.

2.6.2 Laboratory Equipment

2.6.2.1 Instrumentation Requiring Calibration

All analytical measurement instruments and equipment used by the laboratories shall be controlled by a formal calibration and preventive maintenance program. At a minimum, each laboratory program shall require that equipment is of the proper type, range, accuracy, and precision to provide data compatible with specified requirements. All instruments and equipment that measure a quantity, or whose performance is expected at a stated level, are subject to calibration. In addition , each laboratory's preventive maintenance program shall include the following, as a minimum:

- a listing of the instruments and equipment that shall be used in the program;
- the frequency of maintenance considering manufacturer's recommendations and previous experience with the equipment; and,
- a file for each instrument containing a list of spare parts maintained, external contracts, and a listing of the items to be checked or serviced during maintenance.

TABLE 2-4 CALIBRATION AND MAINTENANCE REQUIREMENTS FOR FIELD EQUIPMENT

Equipment	Required Procedure	Minimum Frequency	Required Equipment or Calibration Fluids
pH meter	2-point calibration	Each day prior to sampling, and prior to use at each station.	Two pH buffers (7,10)
Temperature	2-point calibration	Before field work	Ice water and boiling water
ORP meter (redox potential)	As per manufacturer's instructions	Each day prior to sampling	Manufacturer's standards
DO meter	Atmospheric calibration	Each day prior to sampling, and prior to use at each station.	Atmospheric oxygen with elevation
Conductivity meter	1-point reference	Each day prior to sampling	1000 µS standard
Turbidity meter	1-point calibration with secondary standard; 2-point calibration with primary standard	Secondary standard calibration each day prior to sampling; primary standard calibration before field work	0 and 10 NTU primary standards; 0, 10, and 40 NTU secondary standards
Current meter	Velocity equivalence and spin test (Price meters) or equivalent	Before sampling (velocity check) and each day prior to sampling (functions)	Stopwatch

Note: Meters used in water quality measurements will be calibrated three times at each QA/QC, prior to the collection of three separate water quality measurements. The meters to be calibrated in this manner include pH, dissolved oxygen, ORP, and conductivity.

2.6.2.2 Calibration Methods

Physical and chemical calibrations shall be performed within each laboratory as described in this subsection. Physical calibration refers to physical measurements that are made on equipment to verify or provide corrections to the observed data. Calibration acceptance criteria for analytical methods are summarized in Table 2-6. Physical calibrations shall be documented on data sheets that are designed for each specific application. At a minimum, the information record shall include the date, analyst, instrument identification, identification of reference standard, expected values, measured values, and correction factors, if applicable.

TABLE 2-5: LABORATORY QUALITY CONTROL AND RESPONSE ACTION PROCEDURES

Quality Control Sample Type	Frequency	Acceptance Criteria	Laboratory Response Action if Acceptance Criteria Not Met
Selenium by SM3114B (Surface Water and Groundwater) or M7742 modified (solids) and Selected Trace Elements – ACZ			
Holding Time	180 days	Digestion and analysis are completed within holding time.	- Contact MWH Analytical Task Manager to determine if resampling is necessary.
Calibration Curve	Established daily, verified every 10 samples.	Initial calibration correlation coefficient equals or exceeds 0.995.	- Validate standard. If standard still exceeds acceptance criteria, obtain fresh, certified standards. - Recalibrate instrument - Document actions taken in the report narrative.
Standard Reference Materials	One per analytical batch for each media	Values are within published limits	- Validate instrument parameters, sensitivity, and linearity. Correct problems and document. - Validate standards. - Validate LCS preparation. - Reanalyze LCS. - If preparation of samples is not possible, qualify data. - Document actions taken in the report narrative.

TABLE 2-5: LABORATORY QUALITY CONTROL AND RESPONSE ACTION PROCEDURES			
Quality Control Sample Type	**Frequency**	**Acceptance Criteria**	**Laboratory Response Action if Acceptance Criteria Not Met**
Method Blanks	One per 10 samples for each media.	Values are within published limits.	- Prepare new blank and QC samples. - Document actions taken in the report narrative.
Matrix Spike (MS)	One per 10 samples for each media.	Values are within method control limits of precision and accuracy.	- Verify that the spike concentration is at least 50 percent of the unspiked concentration. - Verify that correct spiking solutions were used. - Check method blanks and LCS recovery. - Reanalyze samples if laboratory error is suspected. - Document actions taken in the report narrative.
Laboratory Control Sample (LCS) Duplicate	One per 10 samples for each media	Values are within method control limits of precision and accuracy.	- Validate instrument parameters, sensitivity, and linearity. Correct problems and document. - Validate standards. - Validate LCS preparation. - Reanalyze LCS preparation. - Document actions taken in the report narrative.
Trace Elements (Cd, Cr, Ni, V, Zn) - EPA 200 Series by ICP (Surface Water [excluding Cr], and Groundwater) and Media-Specific Trace Elements (Cd, Cu, Cr, Mo, Ni, V, or Zn) by EPA Method 6000 Series (Solids)			
Holding Time	180 days	Digestion and analysis are completed within holding time.	- Contact MWH Analytical Task Manager to determine if resampling is necessary.

TABLE 2-5: LABORATORY QUALITY CONTROL AND RESPONSE ACTION PROCEDURES			
Quality Control Sample Type	**Frequency**	**Acceptance Criteria**	**Laboratory Response Action if Acceptance Criteria Not Met**
Calibration Curve	Established daily verified every 10 samples.	Initial calibration line is within method limits.	- Validate standard. If standard still exceeds acceptance criteria, obtain fresh, certified standards. - Recalibrate instrument. - Document actions taken in the report narrative.
Standard Reference Materials	One per analytical batch for each media.	Values are within published limits.	- Validate instrument parameters, sensitivity, and linearity. Correct problems and document. - Validate standards. - Validate LCS preparation. - Reanalyze LCS. - If preparation of samples is not possible, qualify data. - Document actions taken in the report narrative.
Method Blank	One per 10 samples for each media.	Concentration of analyte is less than CRDL.	- Determine if concentration levels in sample exceed 10 times concentration levels in blank. - If not, prepare new blank and QC samples. - Document actions taken in the report narrative.
Matrix Spike (MS)	One per 10 samples for each media.	Values are within method control limits of precision and accuracy.	- Verify that the spike conc. is at least 50 percent of the unspiked concentration. - Verify that correct spiking solutions and amounts were used. - Check method blanks and LCS recovery. - Reanalyze samples if laboratory error is suspected. - Document action taken in the report narrative.
Laboratory Control Sample	One per 10 samples for	Values are within method control	- Validate instrument parameters, sensitivity, and linearity. Correct problems and

TABLE 2-5: LABORATORY QUALITY CONTROL AND RESPONSE ACTION PROCEDURES			
Quality Control Sample Type	**Frequency**	**Acceptance Criteria**	**Laboratory Response Action if Acceptance Criteria Not Met**
(LCS) Duplicate	each media.	limits of precision and accuracy.	document. - Validate standards. - Validate LCS preparation. - Reanalyze LCS. - If re-preparation of samples is not possible, qualify data. - Document actions taken in the report narrative.
Analytical Duplicate	One per 10 samples for each media.	Values are within method control limits of precision.	- Verify that correct spiking solutions and amounts were used. - Reanalyze for verification. - Re-digest and analyze samples if laboratory error is suspected. - Document actions taken in the report narrative.

Chemical calibration or standardization refers to operations in which instrument response is related to analyzed concentration. The minimum requirements for chemical calibration shall be as specified in the applicable method. Chemical calibrations consist of initial and continuing calibrations, which are documented in several ways depending on the type of instrument. For noncomputerized data systems such as strip chart recorders and meter readouts, the instrument responses shall be transcribed, along with other pertinent information, onto data sheets for each specific analysis. When computerized data systems are used, the data shall be collected and stored in computer files, as well as hard-copy printouts, which may either be included with the data package or kept in a central record. With computerized data systems, the run logs provide a cross-reference to the calibration runs. At a minimum, the information recorded for the calibrations shall include the data, analyst, instrument identification, standard identification and concentrations, raw instrument responses, file descriptor, and calibration parameters such as regression coefficients, correlation coefficients, or response and calibration factors.

Initial calibration consists of the establishment of a calibration or standard curve, which associates instrument response and analyzed concentration. The curve is constructed by measuring the responses of a series of standard solutions containing the analytes of interest at known concentrations. This initial calibration shall be verified each working day by measurement of one or more calibration standards.

2.6.2.3 Calibration Apparatus

The use of calibration apparatus shall be according to the manufacturer's instructions or the laboratories' SOPs.

2.6.2.4 Calibration Standards

Primary standards shall be obtained as either neat materials, which shall be used to prepare stock standard solutions, or as prepared solutions to be used as stock standards. Records shall be maintained on primary standards that include date of receipt, source, purity, composition, storage conditions, and expiration dates. Primary standards shall be traceable to National Institute of Standards and Technology standards, or shall be vendor-certified. The preparation of stock, intermediate, and working standard solutions shall be documented in standards preparation logbooks. Each stock, intermediate, and working standard shall be assigned a number to permit traceability of preparation from stock to working standards and to reference the analysis of the standards. Logbooks shall be completed by the appropriate analysts as they prepare standards and shall be subject to supervisory review. At a minimum, working standards shall be labeled with preparation data, and the number or designation of the logbook where information on the standard is recorded. Measurements made during standards preparation shall also be recorded.

2.6.2.5 Calibration Frequency

The frequency of instrument calibration shall be according to the manufacturer's instructions or the laboratories' SOPs.

2.7 DATA ACQUISITION, VALIDATION, REVIEW AND REPORTING

2.7.1 Field Data

Figure 2-1 provides a flow chart that summarizes all of the data acquisition, data validation, and data management activities of the program. Raw field data shall be entered in field notebooks; and/or sample collection record forms, which shall be reviewed for completeness by the Field Team Leader at the end of each day.

The overall quality of the field data from any given sampling round shall be further evaluated during the process of data validation as described below.

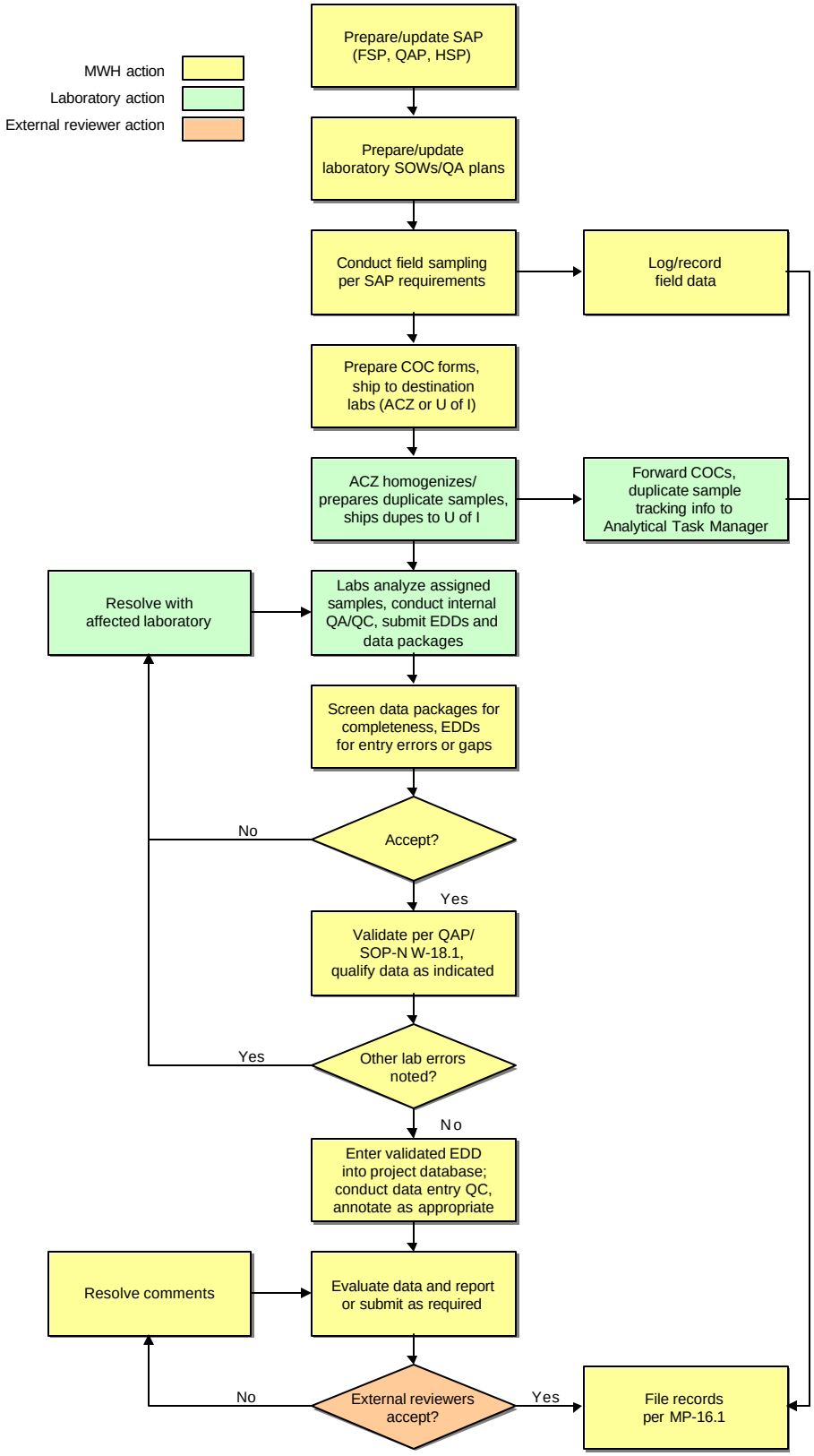


Figure 2-1:
Data Acquisition and Data Management Flow Diagram

2.7.2 Analytical Data Validation

An anomalies or limitations for the use of the data shall be documented as part of the laboratories analytical data packages. The laboratories shall establish calibration curves and calculation of sample concentrations from instrument responses. Raw laboratory data shall be converted to sample concentrations using formulas defined by applicable laboratory SOPs. The calculations shall be performed by computerized data systems interfaced to the instruments, by personnel calculators, or through programs installed on stand-alone personnel computers. Each laboratory analyst shall be responsible for the reduction of the raw data that they generate. At a minimum, such activities shall include:

- reduction of raw data generated to reportable values;
- an initial review of analytical and quality control data;
- performance of manual calculations and transfer of data onto forms, laboratory reports, and laboratory databases;
- preparation of computer files for instrumental calculations;
- generation of data forms for the analytical reports;
- copying of relevant forms and logs for inclusion in the laboratory reports;
- submittal of the laboratory report to a supervisor for a QA/QC review; and,
- resolution of discrepancies noted during the QA/QC review.

For non-instrument methods and for methods using instruments without computerized data systems that require manual calculations, the responsible analyst shall enter bench-generated data into bound laboratory workbooks with form-specific instrument responses, standard and spike concentrations, sample numbers, and other pertinent information. For instruments that are directly coupled to computerized data systems, raw data consist of instrument responses in the form of printer output or computer-generated data files. Printer output shall be filed by sample batch, and the data files archived on disk or magnetic tape. Computer data files shall be identified by unique, sequential descriptors cross-referenced in the run logs to the analysis sequence. At a minimum, strip chart recordings shall be labeled with the following information:

- sample identification number;
- date and time of analysis;
- instrument identification;
- name of analyst(s);

- applicable operational parameters;
- date file identification; and,
- positively identified elements or compounds.

Completed analytical packages for each sampling round shall be routed to the MWH Analytical Task Manager for verification of completeness and validation as described in SOP-NW-18.1, "Data Validation"[1] and this Section. All data shall be screened to ensure that data packages are complete and do not contain any obvious entry errors; any observed problems shall be referred to the affected laboratory for resolution.
Validation shall then be undertaken as described in SOP-NW-18.1. At a minimum the Analytical Task Manager, or designee shall verify:

- COC forms were properly maintained from the field, to the laboratory, and through all analytical procedures;
- laboratory reports are complete and contain no transcription errors or omissions;
- holding time requirements were met;
- method blanks met method requirements; and,
- quantitation limits did not exceed established values.

The data shall be qualified with regard to its usability as noted in Section 8.4 of SOP-NW-18.1, and validation checksheets added to the data package as appropriate. Any other questions that involve the laboratory shall be resolved and the data package annotated as appropriate. The validated EDD information shall then be entered into the program database[2], and the validated data package forwarded to the program quality records pending preparation of final program submittals.

2.7.3 Data Analysis and Reporting

A final program report shall be prepared at the direction of the MWH Program Manager to address the information needs of P_4 Production and affected regulatory agencies, in accordance with Appendix A and other directives that may be provided by P_4 Production and IDEQ. Concentrations in liquid samples shall be expressed in terms of weight per unit volume such as milligram per liter (mg/L). Concentrations of solid matrices shall be expressed in terms of weight per unit weight with the moisture basis specified such as milligram per kilogram (mg/kg ww). In addition, soil, vegetation, fish tissue or

[1] Note: SOP-NW-18.1 is based on the *USEPA Functional Guidelines for Inorganic Data Review*, (EPA 540/R-94-012) and other relevant EPA guidance documents; see Appendix B.
[2] Note: An additional column shall be added, for information purposes only, that records the actual detected values for those parameters determined by the laboratory to be non-detects because the detected value was below CRDLs or minimum reporting limits.

whole-body, and sediment concentrations shall be converted to a dry-weight basis using the percent solids or percent moisture of the sample. The number of significant figures in the field and laboratory data presented in the final report shall be consistent with the limits of uncertainty inherent in the measurement or analytical method. For the derivation of preliminary, risk-based benchmark concentrations, results are reported to one significant figure. Therefore, two significant figures shall be retained for inputs to the risk model to minimize rounding error.
Statistical analyses and other evaluations may be performed that consider the validated data set, as well as the original detected values for parameters with results below the minimum reporting limit. Statistical methods may include published methods found in statistical handbooks, textbooks, and USEPA or other agency statistical guidance documents. The intent is to use standard parametric methods (e.g., analysis of variance) if possible, but resort to non-parametric methods (e.g., Kruskal-Wallis) if parametric assumptions cannot be met. Bootstrapping methods will be utilized when assumptions for parametric and non-parametric methods cannot be met.

Both the regional background and mine-specific (i.e., media and location-specific) background will be determined using the protocol described in Appendix G, *A Functional Upper Bound of Background*.

2.7.4 Data Storage and Retrieval

All field and laboratory records with accompanying data assessment summary forms shall be archived as part of the program quality records in accordance with MP-16.1. All records be shall stored for a minimum of five years. In addition, MWH shall maintain an electronic database to support the hard-copy record system, using Microsoft Access 97™ relational database management program or Microsoft Excel, as needed.

3.0 ASSESSMENT/OVERSIGHT

3.1 FIELD AUDIT

At a minimum, MWH's Quality Manager shall conduct an onsite systems audit of field sampling practices before the end of the first week's sampling activities, in accordance with in MP-10.1, "Surveillance Inspection" (see Appendix C). Any nonconformances observed in the audit shall be documented and resolved as discussed in Section 3.4. Additional systems audits or surveillance may be conducted at the discretion of the Program Manager or Quality Manager, or if specifically required by P_4 Production.

Currently, three field audits are planned to coincide with different field activities. The first field audit is planned to be conducted during sampling activities in May 2004 in order to evaluate the performance of surface water, sediment, fish, and groundwater sampling activities with regard to governing plan/procedure requirements. The second audit is planned to be conducted during sampling activities in July 2004 in order to evaluate the performance of surface soil and vegetation sampling. A third field audit is planned to be conducted during any necessary monitoring well installation, which is expected to be conducted during the 2005 field season.

3.2 LABORATORY AUDITS

As previously noted, laboratory performance audit samples will not be prepared for the comprehensive SI; at least one onsite system audit of ACZ and U of I are anticipated in the first quarter of field activity. A laboratory audit of ACZ is planned to be conducted during the first week of the May 2004 sampling event. The U of I laboratory audit will be performed during one of the sampling activities of the 2004 field season. Any observed nonconformances shall be documented and resolved as discussed in Section 3.4. If the data screening and validation activities addressed in Section 2.7.2 indicate the presence of other potential laboratory quality problems, the Analytical Task Manager shall advise the Quality Manager and Program Manager, and additional systems audits of either laboratory may be subsequently conducted as appropriate for the circumstances, subject to P_4 Production concurrence.

3.3 INDEPENDENT TECHNICAL REVIEW

An independent technical review shall be performed by the Program Manager or his designee for all draft and final program reports, in accordance with MP-9.2, "Technical Review" (see Appendix C). All comments shall be resolved and incorporate prior to any client submittals.

3.4 CORRECTIVE AND PREVENTIVE ACTION

Any nonconformance with approved SAP requirements that may be observed in the systems audit discussed in Section 3.1; the data validation activities discussed in Sections 2.7.2 and 3.2; or that may be reported by MWH personnel or other sources in the course of this program shall be promptly evaluated and resolved as required by MP-14.1, Corrective and Preventive Action" (see Appendix C).

4.0 REFERENCES

Barbour, M.T., J. Gerritsen, B.D. Snyder, and J.B. Stribling, 1999. *Rapid Bioassessment Protocols for Use in Streams and Wadeable Rivers: Periphyton, Benthic Macroinvertebrates and Fish, Second Edition*. EPA 841-B-99-002. Prepared for USEPA.

IDEQ, 2003b. *Statement of Work for Site Investigations (SIs) and Engineering Evaluations/Cost Analyses (EE/CAs) at P4 Production's Enoch Valley, Ballard, and Henry Mine* (SOW), which is Appendix 2 of the *Consent Order/Adminstrative Order On Consent for the Performance of Site Investigations (SIs) and Engineering Evaluations/Cost Analyses (EE/CAs) at P4 Production, L.L.C. Phosphate Mine Sites in Southeastern Idaho*, November.

MWH, 2004a. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Work Plan - Final, P_4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P_4 Production, January.

MWH, 2004b. *Engineering Evaluation/Cost Analysis, Enoch Valley (Henry or Ballard) Mine Work Plan - Final, P_4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P_4 Production, January.

MWH, 2004c. *Comprehensive Site Investigation, Enoch Valley (Henry or Ballard) Mine Project Field Sampling Plan - Draft, P_4 Production's Southeast Idaho Mine-Specific Selenium Program*. Prepared for P_4 Production. To be published in March 2004 concurrent with the SAP.

MWH, 2004e. *Comprehensive Site Investigation, Sampling and Analysis Plan - Draft, P_4 Production's Southeast Idaho Mine-Specific Selenium Program* (the SAP consists of the PgmFSP, PgmHSP, and PgmQAP). Prepared for P_4 Production. To be published in March 2004 concurrent with the PjtFSP.

USEPA, 1994. *Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses*. EPA/540/R/94/083. Prepared for USEPA Hazardous Site Evaluation Division by USEPA Regions II-VII and Viar & Company. December.

APPENDICES

Appendix A
Consent Order/Administrative Order on Consent

Consent Order/Administrative Order on Consent for the Performance of Site Investigations (SIs) and Engineering Evaluation/Cost Analysis (EE/Cas) at P_4 Production, L.L.C. Phosphate Mine Sites in Southeastern Idaho

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
UNITED STATES FOREST SERVICE
IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

IN THE MATTER OF:	)	
	)	
	)	EPA Docket No.
Enoch Valley Mine	)	CERCLA-10-2003-0117
Henry Mine	)	
Ballard Mine	)	
	)	
P4 Production, L.L.C.	)	
Respondent.	)	

CONSENT ORDER/ADMINISTRATIVE ORDER ON CONSENT FOR THE PERFORMANCE OF SITE INVESTIGATIONS (SIs) AND ENGINEERING EVALUATIONS/COST ANALYSIS (EE/CAs) AT P4 PRODUCTION, L.L.C. PHOSPHATE MINE SITES IN SOUTHEASTERN IDAHO

8/20/03

TABLE OF CONTENTS

Section			Section		
I.	Introduction	3	XVIII.	Sampling and Data Availability	23
II.	Jurisdiction	4	XIX.	Work Stoppage	25
III.	Parties Bound	4	XX.	Emergency Response and Notification	25
IV.	Definitions	5	XXI.	Additional Investigation Analysis	26
V.	Findings of Fact	8	XXII.	Dispute Resolution	27
VI.	Collateral Use of this CO/AOC	11	XXIII.	Force Majeure	29
VII.	Order	11	XXIV.	Reimbursement of State Response Costs	30
VIII.	On-Scene Coordinator/Project Manager	11	XXV.	Reimbursement of EPA and FWS Response Costs	31
IX.	Work to be Performed	14	XXVI.	Stipulated Penalties	34
X.	Administrative Record	19	XXVII.	Other Claims	35
XI.	Other Applicable Laws	20	XXVIII.	Enforcement	35
XII.	Record Preservation	20	XXIX.	Reservation of Rights	36
XIII.	Claims Against Third Parties	21	XXX.	Indemnification	38
XIV.	Modification of CO/AOC Plans or Schedules	21	XXXI.	Notice of Completion	39
XV.	Threatened/Endangered Species	21	XXXII	Modification	39
XVI.	Counterparts and Effective Date	21	XXXIII.	Miscellaneous	39
XVII.	Access	22			

Appendix 1	MOU
Appendix 2	SOW
Appendix 3	AWOC
Appendix 4	Site Map

I. INTRODUCTION

1.1 This Consent Order ("CO")/Administrative Order on Consent ("AOC") is entered into voluntarily by the Idaho Department of Environmental Quality ("IDEQ"), the United States Environmental Protection Agency ("EPA"), the United States Department of Agriculture, Forest Service ("Forest Service") and P4 Production, L.L.C. ("P4"), the latter as Respondent (collectively, the "Parties" or alone a "Party"). The mine sites addressed in this CO/AOC are the Enoch Valley Mine, Henry Mine and Ballard Mine (collectively, the "Sites"), located partly on public land and/or private land that is subject to the jurisdiction, custody or control of IDEQ and EPA A portion of the Enoch Valley Mine is subject to the jurisdiction, custody and control of the Forest Service. More detailed descriptions of the Sites are provided in Section IV of this CO/AOC ("Definitions").

1.2 As provided for in the July 17, 2000 Memorandum of Understanding Concerning Contamination from Phosphate Mining Operations in Southeastern Idaho ("MOU"), attached as Appendix 1, the State of Idaho Department of Environmental Quality has been designated as the "Lead Agency" for these Sites and matters related to this CO/AOC. The EPA and the Forest Service shall participate at the Sites as Support Agencies along with the United States Department of Interior's Fish and Wildlife Service ("FWS"), Bureau of Land Management ("BLM") and Bureau of Indian Affairs ("BIA"), and the Shoshone-Bannock Tribes ("Tribes").

1.3 This CO/AOC provides for the performance by P4 of Site Investigations ("SIs") and Engineering Evaluation/Cost Analysis ("EE/CAs") for the Enoch Valley Mine, Henry Mine and Ballard Mine (the Sites). More detailed descriptions of the Sites are provided in Section IV of this CO/AOC ("Definitions"). The work required for performance of SI's and EE/CAs is specified in the Statement of Work ("SOW") attached, and incorporated by reference, as Appendix 2 to this CO/AOC, and is governed by Section IX of this CO/AOC ("Work to be Performed"). Data relevant to the SIs may be available and will continue to be generated from work undertaken by P4 in anticipation of performing the work required under this CO/AOC ("Work") and generated as part of the Area-Wide Investigation contemplated by the MOU and the Area Wide Investigation CO/AOC (July 20, 2001) ("AWAOC"), attached as Appendix 3, as well as from other sources.

This CO/AOC is intended to be implemented consistently with the MOU and AWAOC.

II. JURISDICTION

2.1 This CO/AOC is entered into by IDEQ pursuant to Idaho's Environmental Protection & Health Act, Idaho Code §§ 39-101 to 39-130, the Hazardous Waste Management Act of Idaho, Idaho Code §§ 39-4401 to 39-4432 and Idaho's Water Quality Act, Idaho Code § 39-3601 *et seq., the Rules and Standards promulgated pursuant thereto, and as a delegated Lead Agency pursuant to the MOU.* This CO/AOC is entered into by EPA and the Forest Service under the authority vested in the President of the United States by Sections 104, 122(a), and 122(d)(3) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended ("CERCLA"), 42 U.S.C. §§ 9604, 9622(a), and 9622(d)(3).

2.2 Without admitting any liability, P4 agrees to the terms and conditions of this CO/AOC without the issuance of a Notice of Violation or the holding of a compliance conference under applicable Idaho law.

2.3 In any action to enforce the terms of this CO/AOC, the Parties agree not to contest its validity or the authority and jurisdiction of IDEQ, the Forest Service or EPA to issue and enforce this CO/AOC, except that P4 reserves the right to contest the authority of EPA to enforce this CO/AOC beyond the limitations provided in Section XXVII, and the Parties agree to comply with and be bound by the terms and conditions of this CO/AOC. By signing this CO/AOC, however, P4 does not concede or waive its right to object to the authority of the United States or IDEQ to issue, take, or enforce any other order or action relating to this Site.

III. PARTIES BOUND

3.1 This CO/AOC shall apply to, and be binding upon IDEQ, EPA, the Forest Service and P4 and its officers, employees, agents, successors and assigns. Any change in ownership or corporate status of P4 including, but not limited to, any transfer of assets or real or personal property shall not alter P4's obligation to comply with the requirements of this CO/AOC or to ensure compliance by any successor or assign of P4, regardless of whether P4 continues to exist following such transaction. The signatories to the CO/AOC certify that they are authorized to

execute and legally bind the Parties they represent to this CO/AOC. P4 shall provide a copy of this CO/AOC and all of its Appendices to the Support Agencies, as defined herein.

3.2 P4 shall provide a copy of this CO/AOC and all of its Appendices to each contractor, subcontractor, laboratory, and consultant retained to perform Work under the CO/AOC within fourteen (14) days after the effective date of this CO/AOC or the date of retaining their services, whichever is later, and shall condition all contracts entered into hereunder upon performance of the Work in conformity with the terms of this CO/AOC and its Appendices. Notwithstanding the provisions of any such contract, however, P4 is, and shall remain, responsible for compliance with this CO/AOC.

IV. DEFINITIONS

4.1 Unless otherwise expressly provided herein, terms used in this CO/AOC that are defined in CERCLA or in regulations promulgated under CERCLA shall have the meaning assigned to them in CERCLA or in such regulations. Whenever terms listed below are used in this CO/AOC or in the attached Appendices, the following definitions shall apply:

"CO/AOC" shall mean this Consent Order/Administrative Order on Consent and all attached Appendices. In the event of a conflict between this CO/AOC and any Appendix, this CO/AOC shall control.

"BLM" shall mean the United States Department of the Interior, Bureau of Land Management.

"CERCLA" shall mean the Comprehensive Environmental Response, Compensation and Liability Act of 1980, as amended, 42 U.S.C. § 9601 et seq.

"Day" shall mean a calendar day unless expressly stated to be a working day. "Working day" shall mean a day other than Saturday, Sunday, or a Federal holiday. In computing any period of time under this CO/AOC, where the last day falls on a Saturday, Sunday, or Federal holiday, the period shall run until the close of business of the next working day.

"Deliverable" shall mean the documents identified in paragraph 9.6 that P4 must submit pursuant to this CO/AOC, and any additional documents identified in writing by IDEQ under Section XXI of this CO/AOC. All Deliverables under this CO/AOC are subject to review,

comment, and approval as described in Paragraph 9.7 of this CO/AOC.

"DOI" shall mean the United States Department of the Interior.

"Effective date of this CO/AOC" shall mean the date on which the CO/AOC has been signed by all Parties and concurred in by the United States Department of Justice.

"EPA" shall mean the United States Environmental Protection Agency.

"EPHA" shall mean the Idaho Environmental Protection & Health Act, Idaho Code §§ 39-101 to 39-130.

"Forest Service" shall mean the United States Department of Agriculture, Forest Service.

"FWS" shall mean the United States Department of the Interior, Fish and Wildlife Service.

"Hazardous substances" shall include those substances defined under Idaho Code § 39-7203(3) and CERCLA § 101(14), 42 U.S.C. § 9601(14) and shall also include "pollutants" as defined by Idaho Code § 39-3602(19) and IDAPA 58.01.02.003.82, "deleterious materials" as defined by IDAPA 58.01.02.003.20 and "hazardous material" as defined by IDAPA 58.01.02.003.46.

"HWMA" shall mean the Hazardous Waste Management Act of Idaho, Idaho Code §§ 39-4401 to 39-4432.

"Idaho's Water Quality Act" shall mean Idaho Code §§ 39-3601 *et seq.*

"IDEQ" shall mean the State of Idaho Department of Environmental Quality.

"Lead Agency" shall mean the State of Idaho through IDEQ.

"MOU" shall mean the July 2000 "Memorandum of Understanding Concerning Contamination from Phosphate Mining Operations in Southeastern Idaho" between several federal agencies (Forest Service, EPA, BLM, BIA and FWS), IDEQ and the Shoshone-Bannock Tribes.

"National Contingency Plan" or "NCP" shall mean the National Oil and Hazardous Substances Pollution Contingency Plan promulgated pursuant to Section 105 of CERCLA, 42 U.S.C. § 9605, and codified at 40 C.F.R. Part 300, and amendments thereto.

"Natural Resource Damages" or "NRD" shall mean damages for harm to federal, state or tribal natural resources which the United States, the State and/or the Tribes has the authority to

seek pursuant to common law, state statutory law, or federal statutory law, including CERCLA and the Clean Water Act, 33 U.S.C. § 1251 et seq.

"Sites" shall mean the Enoch Valley, Henry and Ballard Phosphate Mines approximately 20 miles northeast of Soda Springs, Idaho, including the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for response action implementation and materials handling. The Sites occur primarily on State and private lands although the Enoch Valley Mine is partially located on National Forest System land in the Caribou/Targhee National Forest leased to P4 by the United States and the southern tip of the Henry Mine is located on BLM-administered lands. The Sites are further described on the maps attached to this CO/AOC as Appendix 4, which is incorporated by reference into this CO/AOC. Because certain aspects of the Work may proceed separately at each of the three mines, the term "Sites" shall refer to a single mine site, where appropriate. "Site" shall mean one of the Sites.

"State" shall mean the State of Idaho, including its departments, agencies and instrumentalities.

"Statement of Work" or "SOW" shall mean the documents that outline the Work to be performed by P4 to implement these site investigations and to satisfy the requirements of this CO/AOC, as set forth in Appendix 2 of this CO/AOC, and any modifications made thereto in accordance with Section XXI of this CO/AOC.

"Support Agency" means an agency that provides a support agency coordinator or project manager to furnish necessary data to IDEQ, review response data and documents, and/or provide other assistance as requested by the On-Scene Coordinator . The Forest Service has declined Support Agency status for Henry and Ballard Mines but will retain Support Agency status for Enoch Valley. All other federal agencies (EPA, FWS, BLM, BIA) and the Tribes have retained Support Agency status for all three Sites.

"Tribes" shall mean the Shoshone-Bannock Indian Tribes residing on the Fort Hall reservation near Pocatello, Idaho.

"United States" shall mean the United States of America, including its departments, agencies and instrumentalities.

"USDA" shall mean the United States Department of Agriculture.

"Work" shall mean all tasks that P4 is required to perform pursuant to this CO/AOC, and its attached Appendices, and all Deliverables produced pursuant to this CO/AOC.

V. FINDINGS OF FACT

5.1 The Sites are located in Caribou County, Idaho on State and private lands, although the Enoch Valley Mine is located partially on National Forest System land. IDEQ exercises jurisdictional control over environmental issues in the State of Idaho and on State- and privately-owned lands; the Forest Service exercises jurisdiction, custody and control over National Forest System lands on behalf of the United States and BLM exercises jurisdiction, custody and control over Federally-owned public lands. On public lands, the BLM is responsible for the issuance and administration of leases for mineral extraction on behalf of the United States and the Idaho Department of Lands is responsible for State mineral leases.

5.2 Ballard Mine is located in Township 7 South, Range 42-43 East approximately 12 miles north of Soda Springs. Monsanto began production at the Ballard Mine in 1951 under Lease BL-055875 initially issued to J.R. Simplot in December 1948 and reassigned to Monsanto in May 1951. The West Ballard Lease, I-05723, was issued to Monsanto in July 1955. Mining continued under both leases until 1969. The applicable Federal leases were relinquished to the BLM in July 1984. The Ballard Mine Site was used for experimental plantings and reclamation research dating back to approximately 1958.

5.3 Henry Mine is located in Township 6 South, Range 42-43 East, approximately 4 miles southeast of Henry, Idaho. Monsanto began initial production at Henry Mine in Pits I & II in 1969 under BLM leases I-011451 issued in September 1960, and I-013814 issued in December 1965. The South Henry Continuation (Pit III) was mined from 1976-1980, Center Henry Continuation (Pit IV) from 1981-1985, and the North Henry Continuation (Pit V) from 1986-1989. The applicable Federal leases were relinquished to BLM in December 1993.

5.4 Enoch Valley Mine is located in Township 6 South Range 43 East approximately 19 miles northeast of Soda Springs. Mining began in 1989 and is conducted under two State leases and three Federal leases. BLM Lease I-011683 was initially issued to the Ruby Company (later Simplot) in May 1963 and was reassigned to Monsanto in June 1990. BLM Leases I-015033 and I-015122 were issued to FMC Corporation in September 1968 and 1964, respectively, and were both reassigned to Monsanto in April 1981. State Leases E-07957 and E-08379 were issued to Monsanto in May 1978 and April 1981, respectively. All assigned leases were reassigned to P4 Production, L.L.C. in September 1997, and mining activities are still occurring at the Enoch Valley Site.

5.5 Historic mining activities at all three Sites have included the construction of waste rock and overburden piles comprised of middle waste shales which include selenium, as well as metals that are designated as hazardous substances, pollutants or deleterious materials. Sampling results from the Area Wide Investigations performed since 1996 indicate elevated levels of these constituents in waste rock soils, vegetation, surface water units and other various abiotic/biotic media at the Sites.

5.6 Pursuant to the July 2000 MOU between the federal agencies, IDEQ and the Shoshone-Bannock Tribes, and the subsequent Forest Service letter to P4 of 12/20/01 regarding Enoch Valley Mine, IDEQ is the lead agency for conducting response actions at the Sites.

5.7 Selenium and other hazardous substances have been detected above background concentrations in monitoring and sampling conducted at the Sites by P4. Subsequent sampling conducted by the Forest Service, BLM, their contractors, and the University of Idaho indicate that selenium and other hazardous substances are being leached from waste rock at the Sites into the environment, and may be impacting vegetation and surface water.

5.8 As stated in the AWAOC, the Parties intend that Work accomplished in accordance with this site-specific CO/AOC will be closely coordinated with the Area-Wide investigation and shall not be performed in a duplicative or inconsistent manner.

5.9 Subject to paragraph 6.1, and based on the Findings of Fact set forth above in paragraphs 5.1-5.7, and the Administrative Record supporting this removal action, IDEQ, Forest

Service and EPA make the determinations in paragraphs 5.10.1 through 5.10.9.

5.10.1 The Sites are each a "facility" as defined in Section 101(9) of CERCLA, 42 U.S.C. § 9601(9).

5.10.2 The contaminants found at the Sites, including selenium and other hazardous substances, are "hazardous substances" as defined by Section 101(14) of CERCLA, 42 U.S.C. § 9601(14), and are "hazardous and deleterious materials" subject to the provisions of IDAPA 58.01.02.800, or are otherwise "pollutants" as defined by IDAPA 58.01.02.003.78.

5.10.3 There has been actual or threatened "release," as defined in Section 101(22) of CERCLA, 42 U.S.C. § 9601(22), of one or more hazardous substances from the facility.

5.10.4. There has been an actual discharge, as defined in IDAPA 58.01.02.003.25, of one or more pollutants or hazardous or deleterious materials from the facility to waters of the State of Idaho.

5.10.5 P4 is a "person" as defined in Section 101(21) of CERCLA, 42 U.S.C. § 9601(21) and IDAPA 58.01.02.003.74.

5.10.6 P4 is liable under Section 107(a) of CERCLA, 42 U.S.C. § 9607(a), as a past and/or current owner and/or operator of the Sites and/or as a person who arranged for the disposal of hazardous substances at the Sites.

5.10.7 P4 is liable to the State of Idaho under IDAPA 58.01.02.080.01.a-b. as a result of discharge to waters of the State of pollution and/or hazardous and deleterious materials.

5.10.8 The actual or threatened release of pollutants, hazardous substances and/or deleterious materials from the Sites may present an imminent and substantial endangerment to the public health, welfare, or the environment within the meaning of Section 106(a) of CERCLA, 42 U.S.C. § 9606(a) or will otherwise injure designated beneficial uses of waters of the State within the meaning of IDAPA 58.01.02.080.01.b.

5.10.9 The Work to be performed under this CO/AOC is necessary to protect public health, welfare or the environment, will be consistent with CERCLA, the NCP, EPHA, HWMA, and Idaho's Water Quality Act, and will expedite effective response actions, and is in the

public interest.

VI. COLLATERAL USE OF THIS CO/AOC

6.1 Except as set forth in paragraph 2.3, nothing in this CO/AOC shall constitute or be construed as an admission of liability or fact by any of the Parties. Specifically, P4 neither admits nor denies the findings of fact, conclusions of law, or determinations set forth in this CO/AOC, and does not admit any responsibility or liability for any releases or threatened releases of pollutants, hazardous substances, and/or hazardous and deleterious materials from the Sites. Moreover, P4 does not acknowledge or concede that any release or threatened release of hazardous substances at or from the Site constitutes an imminent and substantial endangerment to the public health or welfare or the environment. IDEQ, EPA, and the Forest Service do not admit any liability arising out of or relating to the Sites or otherwise waive any provisions of the MOU relating to liability or jurisdiction.

6.2 None of the provisions of this CO/AOC shall be admissible in evidence in any proceeding, other than in a proceeding to enforce this CO/AOC or any judgment related to it, or for the purpose of demonstrating the consistency of the actions taken under this CO/AOC with the NCP, CERCLA, the EPHA the HWMA, or Idaho's Water Quality Act.

VII. ORDER

7.1 Based upon the foregoing provisions of this CO/AOC, and the Administrative Record for the Sites, it is hereby ordered and agreed that P4 shall comply with the provisions of this CO/AOC, including but not limited to all Appendices to this CO/AOC and documents incorporated by reference into this CO/AOC, and perform the actions required in this CO/AOC.

VIII. ON-SCENE COORDINATOR/PROJECT COORDINATOR

8.1 IDEQ has been designated the Lead Agency for the Sites pursuant to the MOU. IDEQ, as the Lead Agency for the Sites, will coordinate with USFS, USFWS, BLM, BIA, the Tribes and EPA as Support Agencies pursuant to the MOU except to the extent a governmental party has declined Support Agency status as to a particular Site. IDEQ will appoint an On-Scene Coordinator ("OSC"). The initial OSC for the Sites is:

Richard Clegg
Department of Environmental Quality
15 West Center
Soda Springs, Idaho 83276
Phone: (208) 547-1940
FAX: (208) 547-3989
E-Mail: rclegg@deq.state.id.us

P4 has designated as the Project Coordinator for the Site:

Robert L. Geddes
P4 Production, L.L.C.
PO Box 816
Soda Springs, Idaho 83276
Phone: (208) 547-1234
Fax: (208) 547-3312
E-mail: robert.l.geddes@monsanto.com

8.2 The OSC and the Project Coordinator shall be responsible for overseeing implementation of the Work and/or activities required at the Sites under this CO/AOC. All written communications between the Parties concerning implementation of this CO/AOC shall be directed to the OSC or Project Coordinator, by regular or overnight mail or by facsimile, with copies to such other persons as the Parties reasonably designate. IDEQ and/or P4 may change their respective OSC/Project Coordinator and shall notify each other in writing at least five (5) days prior to any such change.

8.3 As specifically described elsewhere in this CO/AOC, deliverables and other written communications transmitted by one of the Parties under this CO/AOC shall be sent to the following persons:

For the IDEQ: the OSC designated in paragraph 8.1.

For the Forest Service: (Enoch Valley Mine Site Only)

Jeff Jones
U.S. Forest Service
421 West 2nd South
Soda Springs, Idaho 83276
Phone: (208) 547-4356
Fax: (208) 547-1112
E-mail: jjones13@fs.fed.us

For the BLM:

Bill Stout

Bureau of Land Management
1111 North 8th Avenue
Pocatello, Idaho 83201
Phone: (208) 478-6367
Fax: (208) 478-6376
e-mail: Bill_Stout@blm.gov

For FWS:

Susan Burch, Contaminants Specialist
USFWS - Idaho Snake River Basin Office
1387 S. Vinnell Way
Room 368
Boise, Idaho 83709
Phone: (208) 378-5243
Fax: (208) 378-5262
E-mail: susan_burch@fws.gov

For EPA:

Dave Tomten
1435 N. Orchard St.
Boise, Idaho 83706
Phone: (208) 378-5763
Fax: (208) 378-5744
E-mail: tomten.dave@epa.gov

For the BIA:

Dean Fox
BIA-Fort Hall Agency
Admin. Bldg. 606 Bannock Ave., Rm. 210
Fort Hall, Idaho 83203
Phone: (208) 238-2312
Fax: (208) 238-1310
E-mail: deanfox@bia.gov

For the Tribes:

Christina Cutler
Shoshone-Bannock Tribes
PO Box 306
Fort Hall, Idaho 83203
Phone: (208) 238-5372
Fax: (208) 237-0797
e-mail: ccutler@shoshonebannocktribes.com

For P4: the Project Coordinator designated in paragraph 8.1.

8.4 The OSC shall have the authority vested in the OSC by the EPHA, the HWMA, and other applicable law. Absence of the OSC from the Site shall not be cause for stoppage of Work unless specifically directed by the OSC.

IX. WORK TO BE PERFORMED

9.1 P4 agrees to perform a Site Investigation ("SI") and an Engineering Evaluation and Cost Analysis ("EE/CA") at each mine Site, consistent with the attached Site Specific SOWs. The Parties agree to use their best efforts to coordinate activities under this CO/AOC with existing and future mining operations to minimize interference between CO/AOC activities and mining activities recognizing that portions of the Sites remain active operating facilities subject to regulatory programs. Investigation and related activities have already been performed that may be relevant to P4 in completing the Work under the SOW, including but not limited to those activities performed in connection with the AWAOC and other activities performed by P4 and various other public and private entities. In 2002 P4 initiated mine specific surface water and sediment investigation work at the request of IDEQ with the agency's assurance that said work could be credited toward the Work required under this CO. IDEQ may, in its discretion, accept work previously performed by P4 in satisfaction of one or more SOW requirements. The SOW shall describe the remaining Work required to complete the SIs.

9.1.1 The general objective of the SI is to determine the scope of any release or threatened release of hazardous substances to the environment at or from each individual Mine Site. Each SI shall consist of sampling and monitoring, including the preparation of reports, as set forth in the SOW.

9.1.2 The general objective of the EE/CA for each Site is to identify and evaluate removal action requirements and alternatives designed to prevent, mitigate, or otherwise respond to or remedy any release or threatened release of hazardous substances from the individual Sites in accordance with the NCP, 40 C.F.R. § 300.415, and applicable state law. P4 shall perform the EE/CA in accordance with the SOW for each Site (Appendix 2). The EE/CAs shall include, but are not limited to, the following:

9.1.2.1 An identification of removal action objectives, as more specifically set forth in the SOW and the relevant and appropriate portions of EPA's Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA, Office of Solid Waste and Emergency Response ("OSWER") Directive No. 9360.0-32, August 1993;

9.1.2.2 An identification and comparative analysis of removal action alternatives, including an analysis of their effectiveness, cost, and ability to be implemented, as more specifically set forth in the SOW and the relevant and appropriate portions of OSWER Directive No. 9360.0-32; and

9.1.2.3 A recommended action alternative identified by IDEQ.

9.2 All Work to be performed under this CO/AOC shall be under the direction and supervision of qualified personnel of P4 or its consultants with experience in CERCLA investigations and response actions. P4 shall notify IDEQ of its qualifications or the name and qualifications of any contractors or subcontractors retained to perform the Work under this CO/AOC at least fifteen (15) days prior to commencement of the portion of the Work proposed to be performed by such contractor or subcontractor and IDEQ retains the right to disapprove of any, or all, such contractors and/or subcontractors retained by P4, or of P4/s choice of itself to do the Work. If IDEQ disapproves a selected contractor or P4's choice of itself, P4 shall retain a different contractor or notify IDEQ that P4 will perform the Work in place of the disapproved contractor, within thirty (30) days following IDEQ's disapproval. P4 shall notify IDEQ of that contractor's name and the qualifications of the contractor or P4 within that same time.

9.3 All samples analyzed shall be analyzed by a laboratory that participates in a Quality Assurance/Quality Control program equivalent to that specified in the guidance documents listed in the SOW.

9.4 All Work under this CO/AOC shall be conducted in accordance with CERCLA, the NCP, EPHA, HWMA, Idaho's Water Quality Act, and applicable guidance documents. The OSC will provide P4 with copies of the relevant guidance documents upon request. All Work performed by and for P4 in compliance with the requirements of this CO/AOC, its Appendices, or the Deliverables specified in paragraph 9.6, infra, and approved by IDEQ, shall be deemed to be necessary and consistent with the EPHA, HWMA and Idaho's Water Quality Act, and to the extent concurred in by the appropriate Support Agency, shall also be deemed consistent with the NCP.

9.5 During performance of the Work required under this CO/AOC, P4 shall provide

IDEQ with data and Deliverables as described below and/or in the SOW. A schedule for submittal of the Deliverables is contained in the attached SOW. Upon the written request of the OSC, P4 shall provide IDEQ with non-validated analytical data within thirty (30) days of receiving such data.

9.6 The documents required under this CO/AOC to be prepared, submitted for approval, and implemented by P4 shall be known as "Deliverables." For the purposes of this CO/AOC, Deliverables shall include the SI/EE/CA Work Plans, the Sampling and Analysis Plans ("SAP"s), the Draft SI Reports, the Final SI Reports, the Draft EE/CA Reports, and the Final EE/CA Reports for each individual Site. These Deliverables are described more fully below:

9.6.1 SI/EE/CA Work Plan. P4 shall submit and implement a complete SI/EE/CA Work Plan that satisfies the SOW.

9.6.2 Sampling and Analysis Plans ("SAP"s). P4 shall submit and implement a SAP for each Site that includes a site health and safety plan ("HASP"), quality assurance project plan ("QAPP") and field sampling plan ("FSP") covering all Work under this CO/AOC. These plans shall be consistent with the NCP, any applicable state regulations, and any applicable EPA guidance including EPA's current Standard Operating Safety Guides (EPA Publication 9285:1-03, PB92-963414, June 1992). In addition, the HASPs shall comply with all applicable occupational safety and health regulations. Also, the FSP and QAPP for each Site will include procedures for collecting, transporting and analyzing all samples collected at the Site, as well as procedures for quality assurance/quality control ("QA/QC"). These procedures shall be consistent with 40 C.F.R. § 300.415(b)(4)(ii) and EPA Requirements for Quality Assurance Project Plans, EPA QA/G 5. The SAP shall identify laboratories to be used during performance of the Work of this CO/AOC.

9.6.3 SI Report. P4 shall submit an SI Report for each Site that describes the implementation and results of the sampling and analysis required in the SI Work Plan, including modifications approved by IDEQ, if any, made during the implementation. The final report shall include: documentation of the conditions encountered during well installation; development logs; a description of the sampling procedures completed; a presentation of the analytical results of all

sampling and analyses performed; and appendices containing all relevant documentation generated during the monitoring, including, without limitation, manifests, chain of custody, sampling data sheets, laboratory results, permits, and pertinent portions of the work performed pursuant to the AWAOC, which may be incorporated by reference into the SI Report.

9.6.4 EE/CA Report. P4 shall submit a report for each Site documenting implementation of the EE/CA Work Plan, including modifications approved by IDEQ, as provided herein, if any, during the implementation. The final report shall contain a detailed analysis of removal alternatives, a recommendation for the selection by IDEQ of a removal alternative, and a detailed justification for the recommendation, as described in paragraph 9.1.2 of this section, the SOW and the EE/CA Work Plan.

9.7 All Deliverables shall be submitted initially by P4 in draft form, in accordance with the schedule provided in the SOW, or as otherwise established by IDEQ OSC, and are subject to review, comment, and written approval or disapproval by IDEQ. IDEQ agrees to consolidate any comments received from Support Agencies and to provide a single set of comments to P4. Within thirty (30) days of P4's receipt of the comment from IDEQ on each draft document, P4 shall amend and submit a revised document to IDEQ that incorporates all comments and corrects all deficiencies identified by IDEQ, unless such comments have been revised or withdrawn in writing. Except as provided in the final sentence of this paragraph, deliverables approved by IDEQ shall be incorporated herein, shall be enforceable as a part of this CO/AOC, and may be modified only upon the written approval of IDEQ. IDEQ may also approve a Deliverable with modifications; once approved, and except as provided in the final sentence of this Paragraph, the Deliverable shall be incorporated herein, shall be enforceable as part of this CO/AOC, and may be modified only upon written approval of IDEQ. In the event P4 disagrees with any IDEQ decision made under this Paragraph, such disagreement shall be resolved under the dispute resolution provisions of this CO/AOC. Upon completion of the dispute resolution process under this CO/AOC, the Deliverable as modified and approved through the dispute resolution process shall be incorporated herein and shall be enforceable as part of this CO/AOC.

9.8 The Deliverables shall be submitted to IDEQ in accordance with the schedule

set forth in the SOW.

9.9 The absence of written comments by IDEQ in response to the submission of any Deliverable by P4 pursuant to the schedules set out under this SOW shall not be construed as IDEQ's approval of the Deliverable under this CO/AOC.

9.10 P4 shall not implement the actions described in a Deliverable in connection with any Work at the Site until it receives written approval of the Deliverable from IDEQ. Each Deliverable approved in writing by IDEQ shall be incorporated by reference into this CO/AOC. All Work performed pursuant to this CO/AOC shall be in accordance with approved Deliverables, unless otherwise authorized in writing by the OSC. Failure to materially comply with any provision of an approved Deliverable shall be considered a violation of this CO/AOC.

9.11 Unless the OSC authorizes a smaller number in writing, P4 shall provide to IDEQ an electronic copy and three (3) paper copies of each draft and final Deliverable, including one unbound copy and shall provide one copy to each Support Agency. Such copies shall be sent to the contacts listed in paragraph 8.3 of this CO/AOC. All reports, maps and supporting information shall be provided in readily reproducible form.

9.12 IDEQ will prepare a Community Relations Plan for the P4 Sites in accordance with applicable EPA guidance and the NCP. P4 shall provide information and otherwise cooperate in support of the preparation and implementation of the Community Relations Plan.

9.13 Upon request by IDEQ or a Support Agency, through the OSC, P4 shall provide copies of plans, task memoranda, field modifications, recommendations for further action, quality assurance memoranda and audits, raw data, field notes, laboratory analytical reports and other documents generated in connection with the Work performed under this CO/AOC; provided, however, that P4 need not disclose such materials if protected from disclosure by a claim of attorney-client privilege or attorney work product, to the extent such protections are not limited by paragraphs 18.3 and 18.4 of this CO/AOC. To the extent P4 contends information proposed for disclosure pursuant to this paragraph is subject to a claim of business confidentiality or trade secret, P4 shall make such claim upon the face of the document. Disclosure of such information to IDEQ shall be governed by the provisions of paragraphs 18.3-4 and the Idaho Public Records

Act, Idaho Code § 9-342.

X. ADMINISTRATIVE RECORD

10.1 IDEQ shall determine the initial contents and location of the administrative record for the Sites and shall provide reasonable notice to P4 of these contents and this location. P4 may submit to IDEQ for consideration for inclusion in the record any records, reports, data, documents, photographs, or other information or materials prepared, discovered, relied on, or otherwise generated or used in connection with P4's performance of Work under this CO/AOC. However, nothing in this paragraph shall be deemed to limit or affect the lawful discretion of IDEQ to determine the contents of the administrative record; provided, however, that if IDEQ refuses to include materials submitted by P4 in the administrative record, such refusal shall be subject to the dispute resolution provisions of this CO/AOC.

10.2 IDEQ retains the responsibility for releasing to the public the one or more EE/CA Reports and any decision documents for the Sites. IDEQ will, after providing opportunity for public comment on any EE/CA Report, consistent with 40 C.F.R. §§ 300.415 and 300.820, select a removal alternative that is appropriate for each Site. The selection of a removal action is governed by State authority and to the extent concurred in by the appropriate federal Support Agency is also governed by Section 113(h) and (j) of CERCLA and shall not be subject to the dispute resolution procedures of this CO/AOC. Nothing in this CO/AOC shall be deemed to obligate P4 to perform or take any action pertaining to the selected removal action.

10.3 Unless instructed otherwise by the OSC, in writing, P4 shall submit to IDEQ upon submission of an EE/CA Report for each Site, any documents developed during the course of the EE/CA; provided, however, that P4 need not disclose such materials if protected from disclosure by a claim of attorney-client privilege or attorney work product, to the extent such protections are not limited under paragraphs 18.3 or 18.4. To the extent P4 contends information proposed for disclosure pursuant to this paragraph is subject to a claim of business confidentiality or trade secret, P4 shall make such claim upon the face of the document. Disclosure of such information shall be governed by the provisions of paragraphs 18.3-4 and, with respect to disclosure of information to IDEQ, the Idaho Public Records Act, Idaho Code § 9-342. Documents developed

during the performance of the EE/CA include, but are not limited to, copies of plans, task memoranda, documentation of field modifications, recommendations for further action, quality assurance memoranda and audits, raw data, field notes, laboratory analytical reports and other reports required pursuant to this CO/AOC. P4 also shall submit any correspondence between P4 and state, local, or other federal authorities concerning the performance of the EE/CA or the selection of the removal action for each Site.

XI. OTHER APPLICABLE LAWS

11.1 All actions required to be taken pursuant to this CO/AOC shall be performed in accordance with the requirements of all applicable local, state, and federal laws and regulations, except that, pursuant to Section 121(e) of CERCLA, 42 U.S.C. § 9621(e), and 40 C.F.R. § 300.400(e), no Federal, State, or local permit shall be required for the portion of the Work conducted entirely on-site, where such Work is carried out in compliance with Section 121 of CERCLA, 42 U.S.C. § 9621(e), and the NCP. Where any portion of the Work performed off-site requires a federal or state permit or approval, P4 shall submit timely and complete applications and take all other actions necessary to obtain all such permits or approvals.

11.2 Compliance by P4 with the terms of this CO/AOC shall not relieve P4 of its obligation to comply with CERCLA, RCRA, EPHA, HWMA, or any other applicable local, state, or federal laws and regulations.

XII. RECORD PRESERVATION

12.1 The original or one copy of all records and documents in the possession, custody or control of P4, excluding internal drafts of Deliverables, that are generated or collected pursuant to this CO/AOC shall be preserved during performance of the Work and for a minimum of ten (10) years after completion of the Work required under this CO/AOC, unless IDEQ with the concurrence of the Support Agencies notifies P4 in writing that these documents may be destroyed earlier. After the expiration of this ten-year period, P4 shall notify IDEQ and all Support Agencies at least sixty (60) days before the documents are scheduled to be destroyed and shall provide IDEQ with the opportunity to take possession of or copy non-privileged material. Such

notice is only required for five years following expiration of the ten-year post-completion period, unless extended by request of IDEQ, in writing.

XIII. CLAIMS AGAINST THIRD PARTIES

13.1 The Parties to this CO/AOC reserve any claims they now have, or may have in the future, against any third party including, but not limited to, claims under Sections 107 and 113 of CERCLA, 42 U.S.C. §§ 9607 and 9613, for recovery of response costs, including oversight or enforcement costs arising out of, or related to, this CO/AOC, and any future and/or past costs incurred in connection with the Site or this CO/AOC. Nothing in this CO/AOC shall constitute or be construed as a release from any claim, cause of action or demand against any person, firm, partnership, or corporation not a signatory to this CO/AOC for any liability it may have arising out of or relating in any way to the generation, storage, treatment, handling, transportation, release, or disposal of any hazardous substances found at, taken to, or taken from the Site, or from the ownership or operation of the Site or any portion thereof.

XIV. MODIFICATION OF CO/AOC PLANS OR SCHEDULES

14.1 The terms of this CO/AOC may be modified only by the written agreement of the Parties; provided, modifications to any plan or schedule may be made, in writing, by the OSC or at the OSC's direction, as provided in paragraph 32.1.

XV. THREATENED/ENDANGERED SPECIES

15.1 P4 shall immediately notify the OSC of any and all threatened or endangered species encountered on the Site in the course of performing activities under this CO/AOC.

XVI. COUNTERPARTS AND EFFECTIVE DATE

16.1 This CO/AOC may be executed in counterparts, each of which shall be deemed to be an original, but such counterparts shall together constitute a single, integrated document. This CO/AOC shall be effective on the date it has been signed by all Parties and approved by the United States Attorney General or his or her designee.

XVII. ACCESS

17.1 Beginning on the effective date of this CO/AOC, the Forest Service shall permit access to the portions of the Sites located on National Forest System land to P4 and its authorized representatives, as necessary to perform the Work required under this CO/AOC. P4 shall provide access for IDEQ and Support Agency personnel accompanied or authorized by the OSC to the Sites and to off-Site areas under the ownership and/or control of P4 as may be needed to implement this CO/AOC, and shall provide access to all records and documentation related to the conditions at the Sites and the actions conducted pursuant to this CO/AOC; provided, however, that P4 need not disclose such materials if protected from disclosure by a claim of attorney-client privilege or attorney work product, to the extent such protections are not limited under paragraphs 18.3 or 18.4. To the extent P4 contends information disclosed pursuant to this paragraph is subject to a claim of business confidentiality or trade secret, P4 shall make such claim upon the face of the document. Disclosure of such information to IDEQ shall be governed by the provisions of paragraphs 18.3-4 and the Idaho Public Records Act, Idaho Code § 9-342.

17.2 P4 shall use its best efforts to obtain such access as may be needed, if any, to private lands not under its ownership and/or control that are necessary to perform the Work required under this CO/AOC. P4 will use its best efforts to have any access agreement that it obtains include such access by IDEQ as may be necessary for IDEQ and their authorized representatives, and for Support Agency personnel accompanied or authorized by the OSC, to implement the terms of this CO/AOC, and shall specify that P4 is not the representative of IDEQ for purposes of liability associated with Site activities. P4 shall provide IDEQ with copies of all relevant access agreements prior to initiation of field activities on the area covered by the access agreement. To the extent that P4 is unable to obtain consensual access to any private lands, IDEQ may exercise its authorities to obtain access. All persons, including but not limited to IDEQ and the Support Agencies, with access to a Site under this paragraph shall be required to comply with the approved health and safety plans of that Site as well as any other health and safety requirements of the Mine Safety and Health Act, 30 U.S.C.A. Ch. 22, applicable to the Site. For

purposes of this paragraph, "best efforts" includes the payment of reasonable sums of money in consideration of an access agreement, access easement, land/water use restriction, restrictive easement, and/or an agreement to release or subordinate a prior lien or encumbrance, but shall not include the purchase of real property to the extent the reasonable price for such property exceeds the fair market value for such real property as determined by an independent appraisal.

XVIII. SAMPLING AND DATA AVAILABILITY

18.1 P4 shall notify IDEQ at least five (5) working days prior to conducting field events, including construction, excavation, drilling and sampling events. The five-day notice period may be shortened if IDEQ and P4 agree that this notice period would impede or prevent necessary or desirable sampling. Any Party, including its contractors, that is taking samples, will, at the request of another Party, allow split or duplicate samples to be taken by or for the other Party of any samples collected in the course of implementing this CO/AOC.

18.2 Except for objections made in state court based upon Idaho Rules of Evidence 401, 403 and 702 and 703, each Party waives any objection to the validity and admissibility of data generated in the course of performance of Work under this CO/AOC, if such data has been collected or generated in compliance with this CO/AOC, and validated in accordance with the QA/QC procedures set forth in the SAP. The Parties do not waive their rights to object to the relevance or the interpretation of, or the conclusions to be drawn from, such validated data.

18.3 P4 agrees not to assert any business confidentiality claim, or attorney-client or attorney work product privilege, with respect to any analytical data relating to sampling, monitoring, or other activities required to be performed under this CO/AOC, or with respect to observations of conditions at or resulting from releases at the Site made or generated in the course of the performance of the Work pursuant to this CO/AOC. P4 may assert a claim of business confidentiality or other privilege covering any other type of information generated pursuant to the requirements of this CO/AOC, provided, in the case of a business confidentiality claim only, that such claim is consistent with the language of Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7), and is asserted in the manner described in 40 C.F.R. § 2.203. If no claim of confidentiality or other privilege accompanies the information when it is received by IDEQ, it may

be made available to the public without further notice.

18.4 In the event P4 decides to withhold any document or information otherwise required to be disclosed by the provisions of this CO/AOC on the basis of a claim of privilege, it shall inform IDEQ of that decision and provide IDEQ with the date, author, recipient(s), title, and description of the document or information withheld. P4 shall also identify which privilege(s) it asserts applies to the document or information withheld and explain the basis for its assertion. Based on the information supplied by P4, IDEQ shall determine whether to accept P4's claim of privilege. In the event IDEQ disagrees with P4's claim of privilege, P4 shall promptly disclose the document or information previously withheld, unless P4 disputes IDEQ's determination by invoking the Dispute Resolution provisions of Section XXII of this CO/AOC.

18.5 IDEQ and its authorized representatives, and Support Agency personnel accompanied or authorized by the OSC, shall have the authority at all reasonable times to inspect activities at the Sites and conduct such tests on the Sites as deemed necessary and may use cameras, sound recording devices, or any other equipment needed to verify data submitted or monitor activities undertaken by P4. P4 may request split or duplicate samples under paragraph 18.1 of this CO/AOC and, upon request, shall also be entitled to inspect and make copies of any test results, recordings, photographs, or other non-privileged information or materials generated during or as a result of the inspection conducted by IDEQ. Subject to the provisions in paragraph 18.4 of this CO/AOC, IDEQ and its authorized representatives, and the Support Agencies and their authorized representatives accompanied or authorized by the OSC shall be allowed to inspect and make copies of all records, operating logs, contracts, files, photographs, sampling and monitoring data, or any other non-privileged documents related to the Work required under this CO/AOC. Any claim that such materials may be privileged shall be governed by paragraph 18.4 of this CO/AOC. Nothing herein is intended to limit or to expand in any way the right of entry or inspection authority of IDEQ or the Support Agency under CERCLA or any other applicable legal authority.

XIX. WORK STOPPAGE

19.1 IDEQ reserves the right to stop Work from proceeding, either temporarily or

permanently, on any task, activity or Deliverable at any point during performance of the Work required under this CO/AOC if P4 materially fails to comply with the terms of this CO/AOC; provided, however, that IDEQ must provide P4 with written notice to stop Work and its reasons for doing so, unless IDEQ determines that an imminent and substantial endangerment to human health, welfare or the environment exists at the Site, such that written notice is impracticable.

XX. EMERGENCY RESPONSE AND NOTIFICATION

20.1 If any incident or change in Site conditions during the Work conducted by P4 pursuant to this CO/AOC on the Sites, causes or threatens to cause an endangerment to the public health, welfare, or the environment, P4 shall immediately notify the OSC of the incident or Site conditions. If the OSC is unavailable, P4 shall notify the EPA Region 10, Emergency Response and Site Cleanup Unit, 24 Hour Duty Officer, (206) 553-1263. If, in the course of P4's performance of the Work under this CO/AOC on the Site, IDEQ determines there is an imminent and substantial endangerment to human health, welfare or the environment due to unanticipated or changed circumstances at the Site, IDEQ shall notify P4 in writing of modifications to the Work Plan and Specifications, and/or the Deliverables that IDEQ deems necessary to address the immediate threat. Within five (5) working days of the receipt of such notification, P4 shall notify IDEQ in writing whether it agrees to perform the work required under the proposed modifications. If the Parties agree in writing to the proposed modification to the Work Plan and/or the new Deliverables, the modifications to the Work Plan and Specifications and/or the new Deliverables shall become an attachment to this CO/AOC and incorporated herein.

20.2 If P4 does not agree to perform the Work required by the proposed modifications, IDEQ may perform the proposed Work or take any action it deems necessary under section 107(a) of CERCLA, 42 U.S.C. § 9607(a) and applicable state law and may seek recovery of any costs it incurs performing such proposed Work pursuant to applicable law. The Parties agree that any determination by IDEQ that an immediate response at the Sites is required shall not be subject to the dispute resolution provisions in Section XXII of this CO/AOC.

20.3 Nothing in this CO/AOC shall be deemed to grant, limit or affect any authority of any agency of the United States or the State of Idaho, under any statute or agreement other than

this CO/AOC and the MOU, to take, direct, or order any or all appropriate action to protect human health, welfare or the environment.

XXI. ADDITIONAL INVESTIGATION AND ANALYSIS

21.1 If IDEQ determines that additional Work on the Sites is required to meet the objectives of this CO/AOC and that work is not covered by Section XX above, it may notify P4 in writing of its determination and specify any proposed changes to any Deliverable to reflect the additional Work. Within ten (10) working days of receipt of the written determination of IDEQ that additional Work is required, P4 shall provide written notification to IDEQ, stating whether or not it agrees to perform the additional Work. P4 may implement certain additional Work or modifications to the Work based on a verbal agreement between the OSC and the Project Coordinator; however, in such cases, written confirmation of that agreement shall be transmitted between the OSC and Project Coordinator within ten (10) days of such agreement. If P4 agrees to perform the additional Work, within fifteen (15) days of its notice of agreement to IDEQ it shall submit to IDEQ a revised Work Plan or other appropriate Deliverable describing and providing a schedule for performance of the additional Work. If IDEQ and P4 agree in writing to the revisions to the Work Plan and/or the new Deliverable, the revised Work Plan and/or the new Deliverable shall become an attachment to this CO/AOC and incorporated herein. P4 shall perform all agreed upon additional tasks, including providing any additional analytical results and reports as required by the revised Work Plan and/or the new Deliverable. If P4 elects not to perform the additional Work, IDEQ may perform the work or take any action it deems necessary under applicable law, and may seek recovery of any costs it incurs performing such work pursuant to applicable law. Any determination by IDEQ that additional Work is required at the Sites shall be subject to the dispute resolution provisions in Section XXII of this CO/AOC.

21.2 If after collection of the initial data provided in the SI Work Plans, the OSC determines that additional data is needed, consistent with the SOW, the OSC may request that P4 proceed with the draft and final SI Reports, with the condition that P4 will supplement the SI Reports with the additional data collected under a modified SI Work Plan. In addition, if prior to the completion of the SI Work Plans, IDEQ determines that sufficient data has been collected with

respect to a particular position or issue then IDEQ may accelerate the SI report and EE/CA process with respect to that particular portion or issue. The OSC's election to undertake this approach may result in two or more EE/CAs, the combination of which will address all pathways for the release or threatened release of hazardous substances at the Sites. P4 will complete the initial EE/CAs on the schedule provided in the SOW. P4 will complete the subsequent EE/CAs on a schedule provided in a revised EE/CA Work Plan. Any determination by IDEQ that P4 must perform additional Work or other tasks requested by IDEQ under this paragraph, shall be subject to the dispute resolution provisions in Section XXII of this CO/AOC.

XXII. DISPUTE RESOLUTION

22.1 The dispute resolution procedures in this Section are the exclusive mechanism for resolving disputes arising under this CO/AOC. A dispute shall be considered to have arisen when P4 serves IDEQ or Support Agency with a written Notice of Dispute. A Notice of Dispute shall be served by facsimile, overnight mail, or some equivalent service.

22.2 In the first instance, the Parties shall attempt to resolve any dispute arising under this CO/AOC by informal negotiations. The period for informal negotiations shall not exceed thirty (30) days from the date of receipt of the Notice of Dispute, unless IDEQ or the Support Agency and P4 agree in writing to modify the period for informal negotiations. If the Parties fail to resolve the dispute informally, the formal dispute resolution procedure in the following Paragraphs shall apply.

22.3 In the event the Parties cannot resolve the dispute through informal negotiations, then the position of IDEQ or the Support Agency shall be binding unless, within seven (7) days after the conclusion of the informal negotiations period, P4 invokes the formal dispute resolution procedures of this Section by serving on IDEQ or the appropriate Support Agency a written Statement of Position on the matter in dispute. P4's written Statement of Position shall be sent by facsimile, overnight mail, or some equivalent service, and shall define the dispute and state the basis of P4's objections to the position of IDEQ or the Support Agency.

22.4 Following receipt of P4's Statement of Position, IDEQ or the appropriate Support Agency shall promptly provide the appropriate supervisory office with a copy of P4's Statement of

Position and a written response to that Statement. IDEQ or the Support Agency shall simultaneously send its response to P4 by facsimile, overnight mail or some equivalent service. The appropriate supervisory office is the Director of the Department of Environmental Quality for IDEQ. The appropriate supervisory office is the Director of the Environmental Cleanup Office for EPA.

22.5 Following receipt of P4's Statement of Position and IDEQ's or the Support Agency's response, the appropriate supervisory office shall make a final determination resolving the matter in dispute.

22.7 Any decision made by IDEQ or the Support Agency pursuant to this section shall not constitute a final agency action subject to judicial review unless and until IDEQ or the Support Agency commences a judicial action to enforce this CO/AOC, in which case any challenge to the Director's final determination shall be subject to the Idaho Administrative Procedures Act, Idaho Code § 67-5273.

22.8 Nothing in this CO/AOC precludes the Parties from agreeing to use other forms of alternative dispute resolution in lieu of the procedures described in paragraphs 22.3 – 25.5.

22.9 Upon completion of all dispute resolution procedures under this section, P4 shall proceed in accordance with the final determination regarding the matter in dispute. If P4 does not perform any required Work in accordance with the final determination, IDEQ may perform the Work and/or pursue any other appropriate relief, including judicial enforcement of this CO/AOC pursuant to Idaho Code § 39-108, Section 122(d)(3) of CERCLA, 42 U.S.C. § 9622(d)(3), and cost recovery pursuant to Section 107(a) of CERCLA, 42 U.S.C. § 9607(a) or other applicable law.

22.10 The invocation of the dispute resolution provisions of this CO/AOC shall not extend, postpone or affect in any way any unrelated obligation of P4 under this CO/AOC not directly in dispute, unless the Parties agree in writing otherwise. Stipulated penalties shall accrue from the first day of noncompliance with any applicable provision of the CO/AOC; provided, however, that stipulated penalties shall not accrue with respect to a matter subject to Dispute Resolution (Section XXII), during the period, if any, beginning on the day P4 serves IDEQ with a

written Notice of Dispute until the date that IDEQ issues a final decision regarding such dispute. In the event P4 does not prevail on the disputed matter, stipulated penalties shall be assessed and paid as provided in Section XXVI, unless otherwise agreed by the parties in writing.

XXIII. FORCE MAJEURE

23.1 Delays or inability to perform any of the requirements of the CO/AOC within the time limits prescribed shall not be a violation of the CO/AOC where performance is prevented or delayed by a force majeure event. Force majeure is defined as any event arising from causes beyond the control of P4, of any entity controlled by P4, or of P4's contractors, that delays or prevents performance of any obligation under this CO/AOC, despite P4's best efforts to fulfill the obligation. Force majeure does not include the financial inability of P4 to complete performance of the obligation or increased cost of performance. P4 shall have the burden of proving force majeure by a preponderance of the evidence.

23.2 If any event occurs that may materially delay performance of any obligation under this CO/AOC or submittal of any Deliverable past the applicable deadline, P4 shall notify the OSC within twenty-four (24) hours of the time P4 knew that the event would delay such performance or submittal. Within five (5) business days thereafter, P4 shall notify IDEQ in writing of the reasons for the delay, its anticipated length, measures taken or to be taken to minimize the delay, and an estimated timetable for implementation of these measures. Failure to comply with these requirements shall waive any claim of force majeure by P4.

23.3 The OSC shall notify P4 in writing of the determination by IDEQ as to whether force majeure applies to the event or circumstances within seven (7) days after receipt of written notice from P4. If IDEQ determines that the delay has been or will be caused by circumstances constituting a force majeure, the due date for each uncompleted task in this CO/AOC shall be extended for a sufficient period to complete the tasks that were delayed or prevented. Such period shall be at least equal to the delay resulting from the force majeure circumstance. If IDEQ disagrees with P4's force majeure claim, or if there is no agreement on the length of an extension of time, the dispute shall be resolved in accordance with the dispute resolution provisions in Section XXII of this CO/AOC or the stipulated penalties provisions of Section XXVI, as

appropriate.

XXIV. REIMBURSEMENT OF STATE COSTS

24.1 Costs incurred by IDEQ with respect to the Sites under this CO/AOC will be reimbursed in the following manner:

24.1.1 As an initial deposit, P4 will pay the sum of Ten Thousand Dollars to be deposited to an account established for this site

24.1.2 Thereafter, IDEQ shall provide a quarterly accounting and invoice to P4 of Costs incurred by IDEQ in relation to this CO/AOC. "Costs" subject to reimbursement under this paragraph shall mean all direct or indirect costs incurred by IDEQ after January 28, 2002 in connection with IDEQ's support of Work performed by or on behalf of IDEQ under this CO/AOC, as set forth and described in the SOW or for work performed prior to this CO/AOC but used in support thereof, including but not limited to: reasonable time and travel costs associated with oversight of the Work performed under the SOW; IDEQ's contractor costs; compliance monitoring, including the collection and analysis of split samples; Site visits; review and approval or disapproval of reports; reasonable overhead charges and any other costs directly or indirectly incurred in overseeing this CO/AOC.

24.1.3 Within thirty (30) days of P4's receipt of IDEQ's quarterly accounting invoice, P4 shall reimburse the State for all costs reflected in the accounting invoice.

24.1.4 The initial deposit will be returned to P4 within sixty (60) days of the date IDEQ incurs final response costs.

24.2 All payments necessary to IDEQ shall be made to:

Administrative Services-Accounts Receivable
Idaho Department of Environmental Quality
1410 N. Hilton
Boise, ID 83706-1255

24.3 P4 may dispute payment of any portion of IDEQ's submitted costs, but only on the basis of accounting errors, the inclusion of costs outside the scope of this CO/AOC, the inclusion of costs inconsistent with State regulations or the inclusion of costs that have not been paid or approved for payment by IDEQ. Disputes regarding oversight costs will be resolved using

the dispute resolution procedures described in Section XXII. Any objection by P4 shall be made in writing within forty-five (45) days of receipt of the Quarterly Billing and shall specifically identify the disputed costs and the basis of the dispute. All undisputed costs shall be remitted by P4 in accordance with the provisions in the preceding paragraphs of this section. In any Dispute Resolution proceeding, P4 shall bear the burden of establishing its contentions as to inappropriate costs. If IDEQ prevails in the Dispute Resolution proceeding, P4 shall remit the amount(s) in question, including any applicable interest, within thirty (30) days after receipt of the final determination.

XXV. REIMBURSEMENT OF EPA AND FWS COSTS

25.1. P4 shall reimburse EPA for all Future Response Costs associated with the Sites. Future Response Costs for purposes of this Section shall mean all costs, direct and indirect, that EPA incurs after April 30, 2003, in connection with negotiating, overseeing, implementing, or enforcing the terms of this CO/AOC, including but not limited to, payroll costs, contractor costs, travel costs, laboratory costs, the costs incurred pursuant to Section XVII (Access), Section XX (Emergency Response), and Section XXI (Additional Investigation and Analysis).

25.1.1. P4 shall reimburse EPA for all Past Response Costs associated with the Sites. Past Response Costs for purposes of this Section shall mean all costs, direct and indirect, that EPA incurred through April 30, 2003, in connection with the Sites. The parties agree that Past Response Costs incurred by EPA total $7162.09 and are limited to this amount.

25.1.2. For purposes of this Section, Interest shall accrue at the rate established under Section 107(a) of CERCLA, 42 U.S.C. § 9607. The applicable rate of interest shall be the rate in effect at the time the interest accrues. The rate of interest is subject to change on October 1 of each year.

25.1.3. EPA shall submit to P4 after the effective date of this CO/AOC a billing statement for Past Response Costs and subsequently shall submit to P4 on a periodic basis a billing statement for Future Response Costs. All billing statements shall include a SCORPIOs report or other accounting certified by EPA.

25.1.4. Within thirty (30) days of receipt of each billing statement, P4 shall remit

a certified or cashier's check or make payment by wire transfer for the total amount of such costs, except as provided in paragraph 25.3. Checks shall be made payable to the Hazardous Substances Superfund and shall be accompanied by a statement referencing SE Idaho SE/Monsanto Sites, Site ID No. 109Q; EPA Docket No. CERCLA-10-2003-0117, In the Matter of Enoch Valley Mine, Henry Mine, Ballard Mine; P4 Production, LLC, Respondent. Checks shall be sent to :

Mellon Client Service Center
EPA Region 10
500 Ross Street
P.O. Box 360903M
Pittsburgh, Pennsylvania 15251-6903.

25.1.5. At the time of payment, P4 shall send notice that payment has been made to: Financial Management Officer (Mail Code OMP-146), USEPA Region 10, 1200 Sixth Avenue, Seattle, WA 98101.

25.1.6. The total amount to be paid by P4 pursuant to this section shall be deposited in the SE Idaho SE/Monsanto Sites Special Account within the Hazardous Substances Superfund to be retained and used to conduct or finance response actions at or in connection with the Sites.

25.1.7. In the event that payment for either Past Response Costs or Future Response Costs is not made within thirty (30) days of receipt of the billing statement, P4 shall pay Interest on the unpaid balance. Interest shall begin to accrue on the date of receipt of the billing statement, notwithstanding any dispute or objection to any portion of the cost, and shall continue to accrue until the date of payment. Payments of Interest made under this Paragraph shall be in addition to such other remedies or sanctions available to EPA by virtue of P4's failure to make timely payments under this Section, including but not limited to, the payment of stipulated penalties pursuant to Section XXVI.

25.2.1 P4 hereby agrees to commit the sum of up to fifteen thousand dollars ($15,000) per year to pay FWS' reasonable Costs. "Costs," for the purposes of this paragraph, shall mean all direct and indirect costs incurred in connection with FWS' support of Work performed by or on behalf of IDEQ under this CO/AOC, as set forth and described in the SOW,

including, but not limited to, time and travel costs associated with oversight of the work performed under the SOW; contractor costs; compliance monitoring, including the collection and analysis of split samples; site visits; discussions regarding disputes that may arise under this CO/AOC; review and approval or disapproval of reports; and any other costs directly incurred in overseeing this CO/AOC. No later than December 1 of each year, FWS shall submit to P4 an estimated annual Cost budget. Within 30 days of receipt of the estimated annual budget, P4 shall deposit with the FWS an amount equal to the estimated annual budget or $15,000, whichever is less.

25.2.2 The FWS shall use such monies to establish an account fund dedicated solely to its activities associated with this CO/AOC, in accordance with the Appropriations Act for the Department of the Interior and Related Agencies of 2000, Pub. L. 106-113, 113 Stat. 150, and other applicable statutes, regulations and guidance. Within 180 days of the execution of this CO/AOC, and every 180 days thereafter, the FWS shall provide P4 an accounting of its costs, including supporting cost summaries.

25.2.3. Payments to FWS shall be made by certified or cashier's check made payable to the United States Fish and Wildlife Service and mailed to:

U.S. Fish & Wildlife Service
ATTN: Debra Freeman
911 N.E. 11th Avenue
Portland, OR 97232-4181

Each check shall reference:

Site Name: Southeast Idaho Phosphate Mining - Enoch Valley Mine, Henry Mine and Ballard Mine AOC

25.2.4 Within 120 days after completion of FWS support activities under this CO/AOC, FWS shall provide P4 with a final cost accounting. In the event that the monies remain in the Fund, the FWS shall reimburse P4 within 30 days of submission of the final cost accounting.

25.3. P4 may dispute payment of any portion of EPA and/or FWS's response costs, but only on the basis of accounting errors or the inclusion of costs inconsistent with the NCP. Disputes regarding EPA and FWS Response Costs will be resolved using the dispute resolution procedures described in Section XXII. Any objection by P4 shall be made in writing within forty-

five (45) days of receipt of the billing statement and shall specifically identify the disputed costs and the basis of the dispute. Disputed costs shall be paid by P4 into an interest-bearing escrow account while the dispute is pending. All undisputed costs shall be remitted by P4 in accordance with the provisions in the preceding paragraphs of this Section. In any dispute resolution proceeding, P4 shall bear the burden of establishing an accounting error, the inclusion of costs inconsistent with the NCP, the inclusion of costs for work outside the scope of this CO/AOC or the inclusion of costs that have not been paid, or approved for payment by EPA or FWS. If EPA or FWS prevails in the dispute resolution proceeding, P4 shall remit the amount(s) in question, including any applicable interest, within 30 days after receipt of the final determination. If P4 prevails concerning any aspect of the contested costs, P4 shall pay that portion of the costs for which it did not prevail in the manner described in the preceding sentence. P4 shall be disbursed any balance of the escrow account.

XXVI. STIPULATED PENALTIES

26.1 Unless there has been a written modification of a compliance date or other requirement of this CO/AOC by IDEQ, or a force majeure event as defined herein, in the event P4 fails to meet any material requirement of this CO/AOC, P4 shall pay stipulated penalties in the amount of $1,000 per day, per violation for the 1st through 14th days of noncompliance; $3,000 per day, per violation for the 15th through 30th day of noncompliance; and $7,500 per day, per violation for the 31st day of noncompliance and every day thereafter. Compliance by P4 shall include complete and timely performance of each activity required under this CO/AOC including but not limited to reimbursement of response costs pursuant to Section XXIV and XXV, or complete and timely performance of all Work described in any plan, statement or Deliverable approved under this CO/AOC.

26.2 All penalties shall begin to accrue on the day after complete performance is due or the day a violation occurs, and shall continue to accrue through the final day of the correction of the noncompliance or completion of the activity; provided, however, that stipulated penalties shall not accrue: (1) with respect to a deficient submission of a Deliverable under Section IX (Work to be Performed), during the period, if any, beginning on the day of IDEQ's receipt of such

submission until the date that IDEQ notifies P4 of any deficiency and P4 fails to cure the deficiency within seven (7) days of that notice; (2) with respect to a matter subject to Dispute Resolution (Section XXII), during the period, if any, beginning on the day P4 serves IDEQ with a written Notice of Dispute until the date that IDEQ issues a final decision regarding such dispute. Nothing herein shall prevent the simultaneous accrual of separate penalties for separate violations of this CO/AOC.

26.3 IDEQ will advise P4 in writing of any stipulated penalties owed by P4 pursuant to this section. All penalties shall be paid by certified or cashier's check within thirty (30) days of the date of receipt of the demand for payment, unless P4 has properly disputed such demand or related notice of violation. Interest shall begin to accrue on the unpaid balance at the end of the thirty (30) day period. Interest shall accrue at the rate provided in applicable law. Payment shall be made in accordance with instructions provided by IDEQ.

26.4 The stipulated penalties provided for in this section of the CO/AOC shall be the exclusive monetary penalty for violations of this CO/AOC. The provisions in this section, however, do not preclude IDEQ from pursuing any other remedies or sanctions that may be available by reason of P4's failure to comply with any of the requirements of this CO/AOC, nor shall payment of stipulated penalties relieve P4 of the responsibility to comply with any requirement of this CO/AOC. Notwithstanding any other provision of this section, IDEQ may at any time and in its unreviewable discretion, waive any portion of the stipulated penalties that have accrued pursuant to this CO/AOC.

XXVII. OTHER CLAIMS

27.1 By entering into this CO/AOC, the Parties assume no liability for injuries or damages to persons or property resulting from any acts or omissions of any other Party. No Party shall be deemed to be a Party to any contract entered into by any other Party or its contractors, to carry out actions pursuant to this CO/AOC.

XXVIII. ENFORCEMENT

28.1 Except for the provisions of section XXV of this CO/AOC related to EPA cost

recovery and as provided in this paragraph 28.1 below, responsibility for enforcement of the CO/AOC shall be vested in IDEQ as Lead Agency. Determinations regarding compliance with the terms of the CO/AOC and related enforcement actions shall be made by the Lead Agency with the concurrence of Support Agencies and subject to dispute review provisions set forth in the July 17, 2000 MOU. Notwithstanding the foregoing, however, the EPA and Forest Service specifically reserve the right to bring an action to enforce this CO/AOC in circumstances where the Lead Agency has failed to take or is unable to take and/or pursue enforcement action. Furthermore, as provided in Section XXIX of this CO/AOC, the Support Agencies reserve the right to exercise their separate, statutory and regulatory enforcement authorities with respect to the Sites.

XXIX. RESERVATION OF RIGHTS

29.1. Except as expressly provided in this CO/AOC, the State of Idaho and IDEQ and the United States reserve all rights, claims and defenses they may have, including the right to bring an action against P4 under Section 107 and 113 of CERCLA, 42 U.S.C. § 9607 and 9613, or Idaho Code §§39-108(3)(a)(v) and 39-4413(A)(1)(d), for recovery of any unreimbursed response costs incurred in connection with the Site. Nothing in this CO/AOC shall be construed as releasing P4 from liability, if any, for its actions. The State of Idaho, IDEQ and the United States reserve the right to take any enforcement action pursuant to CERCLA or any other legal authority for relief, including, but not limited to, injunctive relief, monetary penalties, and punitive damages for any violation of this CO/AOC, except as provided in Paragraphs 26.4 and 28.1.

29.2 Nothing in this CO/AOC shall be construed as releasing the United States or any of its agencies or departments from any liability for any of its actions. P4 also reserves any defense that may be asserted by law in response to any enforcement action taken by the United States with respect to the Site.

29.3 P4 reserves, and this CO is without prejudice to, claims against the United States, subject to the provisions of Chapter 171 of Title 28 of the United States Code, for money damages for injury or loss of property or personal injury or death caused by the negligent or wrongful act or omission of any employee of the United States while acting within the scope of his

office or employment under circumstances where the United States, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred. However, any such claim shall not include a claim for damages caused, in whole or in part by the act or omission of any person, including any contractor, who is not a federal employee as that term is defined in 28 USC 2671; *nor shall such claim include a claim based on EPA's selection of response actions, or the oversight or approval of P4's plans or activities.* The foregoing applies only to claims which are brought pursuant to statute other than CERCLA and for which the waiver of sovereign immunity is found in a statute other than CERCLA.

29.4 IDEQ expressly reserves the right to seek further relief to address contamination or pollution resulting from the matters addressed herein. Nothing herein shall be deemed to bar such further relief and this agreement shall not operate pursuant to Idaho Code 39-108(3)(a)(v) to preclude the IDEQ from seeking additional relief.

29.5 Nothing in this CO/AOC shall be construed to limit the power and authority of IDEQ or appropriate Support Agencies to take, direct, or order all actions necessary to protect the public health, welfare, or the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances at or from the Sites, as permitted under applicable law.

29.6 Except as expressly provided in this CO/AOC, P4 reserves all rights, claims and defenses it may have, including the right to bring an action against the State of Idaho and/or its agencies and departments under CERCLA for recovery of any response costs incurred in connection with the Site under Sections 113 and 120 of CERCLA. Nothing in this CO/AOC shall be construed as releasing IDEQ from any liability for any of its actions. P4 also reserves any defense that may be asserted by law in response to any enforcement action taken pursuant to IDEQ's reservation of rights in this section.

29.7 P4 reserves, and this CO/AOC is without prejudice to, claims against IDEQ, subject to the provisions of the Idaho Code, respectively, for money damages for injury or loss of property or personal injury or death caused by the negligent or wrongful act or omission of any employee of IDEQ while acting within the scope of his/her office or employment under

circumstances where IDEQ, if a private person, would be liable to the claimant in accordance with the law of the place where the act or omission occurred. However, any such claim shall not include a claim for any damages caused, in whole or in part, by the act or omission of any person, including any contractor, who is not a state employee; nor shall any such claim include a claim based on IDEQ's selection of response actions, or the oversight or approval of P4's plans or activities. The foregoing applies only to claims, which are brought pursuant to a statute other than CERCLA and for which the waiver of sovereign immunity is found in a statute other than CERCLA.

XXX. INDEMNIFICATION

30.1 P4 agrees to indemnify and hold the State of Idaho and the United States and their agencies, departments, agents and employees, harmless from all claims of third parties arising from acts or omissions of P4 or those acting on its behalf, including its officers, employees, agents, contractors, subcontractors, or assigns, in carrying out activities under this CO/AOC.

30.2 Subject to the limitations and procedures of the Idaho Tort Claims Act, Idaho Code § 6-901–29, IDEQ agrees to indemnify P4 and its agents and employees from all claims of third parties arising from acts or omissions of the IDEQ or those acting on its behalf, including its officers, employees, agents, contractors, subcontractors, or assigns, in carrying out activities under this CO/AOC to the extent that such a claim could be made against IDEQ under the Idaho Tort Claims Act, Idaho Code § 6-901-29.

30.3 In performing any of the Work required by this CO/AOC, P4 has an affirmative duty to protect from injury and damage lands of the United States.Damage includes, but is not limited to, fire suppression costs and all costs and damages associated with restoration or rehabilitation of natural resources associated with P4's implementation of this CO/AOC. P4 shall be liable for damage to all roads and trails of the United States caused by the use of P4, or those acting on its behalf, except that damage shall not include reasonable and ordinary wear and tear.

XXXI. NOTICE OF COMPLETION

31.1 Upon completion of all requirements under this CO/AOC, P4 shall certify in writing to IDEQ that all requirements under this CO/AOC, including any additional Work and payment of stipulated penalties, have been completed. The certification shall be signed by a representative of P4 with the requisite knowledge and authority, and shall include the following attestation: "I certify that the information contained in or accompanying this certification is true, accurate and complete." If IDEQ agrees with P4's certification it will so notify P4 in writing and this CO/AOC, with the exception of any continuing obligations, shall be terminated, with respect to the portion of the Sites so certified. For the purposes of this section, continuing obligations shall include, but not be limited to, the following obligations contained in this CO/AOC: Section XII (Record Preservation), Section XXVIII (Reservation of Rights) and Section XXX (Indemnification). If IDEQ determines that any requirements of this CO/AOC have not been completed by P4, they will notify P4 in writing and specify the deficiencies. P4 shall correct such deficiencies in accordance with the notice of IDEQ. Failure by P4 to correct such deficiencies shall be a violation of this CO/AOC.

XXXII. MODIFICATION

32.1 Modification to any plan or schedule may be made, in writing, by the OSC or at the OSC's direction. If the OSC makes an oral modification, it will be memorialized in writing within 10 days; provided, however, that the modification effective date shall be the date of the OSC's oral direction. In the event P4 disagrees with any modification proposed under this paragraph, such disagreement shall be resolved in accordance with the dispute resolution provisions of this CO/AOC.

XXXIII. MISCELLANEOUS

33.1 During the performance of this CO/AOC, P4 agrees that in connection with the performance of Work under this CO/AOC, P4 shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, national origin, age or handicap. P4 shall include and require compliance with the above nondiscrimination provision in any contract or subcontract made with respect to this CO/AOC. IDEQ shall have the right to enforce

the foregoing nondiscrimination provisions by suit for specific performance or any other remedy under the laws of the United States or the state in which the breach or violation occurs.

33.2 If, while implementing the terms of this CO/AOC, P4 discovers any objects of historic or scientific interest, it shall notify the OSC and leave such discoveries intact until and unless otherwise instructed by the OSC. For the purposes of this paragraph, objects of historic or scientific interest include, but are not limited to, historic or prehistoric ruins, fossils, or artifacts. Compliance with any protective and mitigative measures specified by the OSC shall be P4's responsibility.

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

By:_____

Name: C. Stephen Allred
Title: Director, Idaho Department of Environmental Quality

Date:_____

P4 Phosphate Mine Sites
Consent Order/Administrative Order on Consent

P4 Production, L.L.C.

By: Bruce E Pallante

MMS

Name: BRUCE E PALLANTE
Title: V.P. P4 Production, L.L.C.

Date: Sept 2, 2003

P4 Phosphate Mine Sites
Consent Order/Administrative Order on Consent

United States Environmental Protection Agency
Region 10.

By:_____

Name:_____
Title:_____

Date:_____

P4 Phosphate Mine Sites
Consent Order/Administrative Order on Consent

United States Department of Agriculture, Forest Service,
Region 4

By:_____

Name:_____
Title:_____

Date:_____

COPY

MEMORANDUM OF UNDERSTANDING
between
USDA-FOREST SERVICE REGION 4,
ENVIRONMENTAL PROTECTION AGENCY REGION 10,
USDOI (BUREAU OF LAND MANAGEMENT,
BUREAU OF INDIAN AFFAIRS, AND FISH AND WILDLIFE SERVICE),
THE SHOSHONE-BANNOCK TRIBES, and
STATE OF IDAHO DIVISION OF ENVIRONMENTAL QUALITY
concerning
CONTAMINATION FROM PHOSPHATE MINING OPERATIONS
IN SOUTHEASTERN IDAHO

PARTIES:

This Memorandum of Understanding (MOU) is entered into by and between the following governmental entities (Parties):

- The United States Department of Agriculture, Forest Service (Forest Service)
- The United States Environmental Protection Agency (EPA)
- The United States Department of Interior, Bureau of Land Management (BLM)
- The United States Department of Interior, Bureau of Indian Affairs (BIA)
- The United States Department of Interior, Fish and Wildlife Service (USFWS)
- The State of Idaho, Department of Health and Welfare, Division of Environmental Quality (IDEQ)
- The Shoshone-Bannock Tribes (Tribes)

The FS and BLM are hereafter collectively referred to as the "Federal Land Management Agencies." The FS, EPA, BLM, BIA and USFWS are hereafter collectively referred to as the "Federal Agencies."

For purposes of this MOU the Parties designate the individuals identified in Appendix A or their successors as general contacts for issues relating to this MOU

RECITALS

A. Elevated concentrations of selenium and other hazardous substances, pollutants and contaminants have been identified in water, soil, and vegetation associated with current or former phosphate mining operations in southeastern Idaho.

B. The approximate extent of currently known past and present phosphate mining operations is indicated on the map attached hereto as Exhibit 1 (the "Mining Area"), and includes areas located variously on federal land, tribal land, private land, state land, or a mixture of these types of ownership or jurisdictional areas. Individual phosphate mining operations located within the Mining Area are listed in Exhibit 1. The Parties reserve the right to amend Exhibit 1 as necessary upon mutual agreement in light of information received or developed pursuant to this MOU.

C. A number of the Federal Agencies already have incurred and will incur costs in responding to the release and threat of release of hazardous substances in the Mining Area. It is anticipated that all the Parties eventually will incur such costs during the pendency of this MOU.

D. The Federal Agencies have referred matters subject to this MOU to the U.S. Department of Justice ("DOJ") Environmental Enforcement Division for possible litigation and/or concurrences that may be required by Executive Order 12580, as well as for assistance in negotiations.

E. Phosphate Mine Owners and Operators in the Mining Area ("Companies") may be liable for performing response actions and/or for response costs incurred and to be incurred by the "Parties" in responding to releases or threatened releases of hazardous substances within the Mining Area, and/or for natural resource damages.

F. In July 1998, the Forest Service negotiated an Administrative Order on Consent ("AOC") with one of the Companies for completion of a Site Investigation ("SI") and an engineering evaluation/cost analysis (EE/CA) at South Maybe Canyon.

STATEMENT OF PURPOSE:

G. The Parties acknowledge their overlapping authorities and interests in this matter and the complexity of mixed-ownership and jurisdictional issues in the Mining Area. The Parties intend in this MOU to provide a framework for the coordination of their actions and authorities to:

1) Ascertain the overall extent of the contamination present in and around historic and ongoing phosphate mining operations in the Mining Area;

2) Define specific sites for focused investigation and response action;

3) Establish overall priorities for the investigation and response action process in order to protect human health and the environment;

4) Undertake investigations and response actions in a manner that will allow the Parties to recover response costs.

5) Promote future mining operating practices that will safeguard the environment from future contamination; and

6) Negotiate agreements or enter into contracts consistent with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act ("CERCLA"), 42 U.S.C. § 9601 et seq., and the National Oil and Hazardous Substances Pollution Contingency Plan ("NCP"), 40 C.F.R. Part 300, under which the Companies or contractors hired by one of the parties to this MOU will undertake appropriate investigation and response actions in connection with selenium and other contamination within the Mining Area ("Agreements").

H. The Parties agree that they will work together to integrate procedures and substantive requirements for these various tasks under their respective asserted authorities, and to resolve any conflicts among them, in order to minimize duplication of efforts and assure effective and efficient response actions.

I. The Parties also will work together in the exercise of their respective authorities in the Mining Area, to ensure compliance with applicable federal, state, local and tribal laws, including but not limited to the legal authorities listed for each Party in Appendix B hereto.

J. The Parties similarly will work together in the exercise of their respective authorities in the Mining Area, and in accordance with the provisions of CERCLA and the NCP, to preserve their respective rights and interests concerning potential natural resource damage claims arising from injuries to natural resources in the Mining Area.

K. The Parties also agree that it is important to communicate a single set of instructions to the Companies following consultation among themselves, and it

is important to develop and adhere to an agreed-upon communications plan in connection with their efforts under this MOU.

L. This MOU is an agreement between the Federal Agencies, the State and the Tribes, and is not intended to control the relationship among the Federal Agencies.

AUTHORITIES:

M. Each party asserts it has authority to enter into this Agreement and to respond to releases of hazardous substances within the Mining Area, as set forth in the Statement of Legal Authority attached hereto as Appendix B and incorporated as part of this MOU. By entering into this MOU, the Parties do not waive any of their respective authorities or concede authorities or jurisdiction asserted by other Parties. Nothing in this MOU shall be construed to restrict, enlarge, or otherwise determine the rights, interests, and jurisdiction of the United States, the State of Idaho, or the Tribes, or any of their respective departments or agencies.

AGREEMENTS:

A. Task Identification

1. The Parties agree to work together to establish criteria for defining the scope of an area-wide investigation, selecting specific sites for additional investigation or for response actions, and selecting a lead agency to oversee the site-specific response actions under Agreements with the Companies.

2. The Parties agree that an area-wide investigation should be conducted either by IDEQ or under an Agreement with one or more of the Companies. .

3. The Parties agree that decisions concerning the particulars of how they should define the area-wide investigation, identify specific sites for additional investigation or response action, select a site-specific lead agency, identify support agencies, or otherwise implement their commitment to work together under this MOU will be made by a committee consisting of those persons identified in Appendix A, or their designee.

B. Identification of Lead and Support Agencies

4. For the area-wide investigation and for each specific site identified by the Parties for additional investigation or response action ("Site"), the Parties will

cooperatively identify a Lead and any Support Agencies having an interest at the Site. The designation of an agency as Lead Agency shall not exempt that agency from any access or regulatory requirements applicable to land under the jurisdiction, custody, or control of another Party.

5. IDEQ has been designated the Lead Agency with respect to the area-wide investigation.

6. The Parties agree that the existing AOC for South Maybe Canyon is not affected by or subject to this MOU, with the exception of Paragraph 11 hereof.. With respect to any additional Agreements that may be entered into concerning South Maybe Canyon, the Forest Service will remain the Lead Agency. Other Parties may act as Support Agencies pursuant to the terms of this MOU for such subsequent Agreements.

7. The Lead Agency and Support Agencies identified for a Site will negotiate one or more Agreements with the Company or Companies having responsibility for the Site. It is contemplated that Lead and Support Agencies for a Site will mutually determine an approach regarding Agreements appropriate for a particular site. Examples of alternative approaches include:

   a. A single Agreement with a Company, signed by the Lead and Support Agencies;

   b. The Lead Agency and a Support Agency entering into separate Agreements with a Company, with the work undertaken based on a single mutually agreed statement of work (SOW); or

   c. Only the Lead Agency entering into an Agreement with the Company.

In all cases agency coordination would continue, as provided in this MOU.

C. Information Sharing and Coordination

8. The State shall supply an On-Scene Coordinator ("OSC") or Remedial Project Manager ("RPM"), who will have the duties described in the NCP, to oversee the area-wide investigation and the main point of contact for the Federal Agencies and the Companies.

9. The Lead Agency for each Site will supply an OSC/RPM to oversee the implementation of any investigations or response actions undertaken pursuant to

any Agreements between the Lead and Support Agencies and the Companies, and the main contact point for the Support Agencies and the Company or Companies involved.

10. For both the area-wide investigation and for each site-specific investigation and response action, each Support Agency will designate a Project Manager ("Project Manager").

11. The OSC/RPM will share information and coordinate with the Project Manager(s) during both the area-wide investigation and all site-specific investigations and response actions, as follows:

    a. The OSC/RPM will provide the following to the Project Manager(s):

        i. Copies of documents related to the investigation, analysis of alternatives, and response action design and implementation, including drafts of documents identified in Paragraphs 14 and 15 of this MOU.

        ii. Reasonable prior notice of, and an opportunity to participate in, any meetings, conference calls, or other scheduled contacts with the Companies.

        iii. Reasonable prior notice of activities to take place in connection with the area-wide investigation or at a specific Site.

    b. The OSC/RPM and the Project Manager(s) will communicate regularly, by phone, correspondence, and meetings, to review the work status and to address any existing or anticipated technical issues.

    c. The Project Manager(s) will advise the OSC/RPM regarding any issues and concerns of special interest to the Project Manager(s), in addition to those described in this MOU, so that the OSC/RPM can communicate or provide requested information to the Project Manager(s).

12. The Project Manager(s) will use best efforts to provide comments to the OSC/RPM within 21 days of the Project Manager's receipt of a deliverable from the Companies or a request for concurrence pursuant to Paragraphs 14 and 15 of this MOU. If a Project Manager determines that additional time is required to provide comments, the Project Manager will discuss the need for a reasonable amount of additional time (normally 15 days, or less) with the OSC/RPM, as soon as that need is identified.

13. The OSC/RPM will communicate the joint responses of the Parties to the Company(ies).

D. Concurrences

14. With respect to the area-wide investigation, the State, as the Lead Agency, will request concurrence from each Support Agency on a set of decision points to be established by the Signatory Committee or their designees, including but not limited to the following documents or their equivalents:

annual work plans
overall investigation plan
study identification
sampling and analysis plans
study completion reports
changes to statement of work
quality assurance plan
health and safety plan
risk assessment work plan
draft risk assessment
final risk assessment

15. With respect to site-specific work, the Lead Agency will request concurrence from each Support Agency on the following decision points:

a. The Work Plan for the Site investigation and analysis of alternatives. Under CERCLA the analysis of alternatives would be contained within an EE/CA or a Remedial Investigation/Feasibility Study ("RI/FS");

b. The Health and Safety Plan;

c. The Community Relations/Public Involvement Plan;

d. Decisions concerning the need for additional data collection and/or any decision to cease data collection;

e. The final site investigation report;

f. The final human health and/or ecological risk assessments;

g. The final analysis of alternatives;

h. Each proposed or final response action decision, such as a draft or final action memorandum or a Proposed Plan or Record of Decision ("ROD");

i. Deliverables from a Company under an Agreement to implement any response action; and

j. Any decisions pertaining to potential injury to natural resources.

E. Dispute Resolution

16. Resolution of and communication regarding legal issues will be coordinated among appropriate counsel for the Parties and, as appropriate, DOJ attorneys. The legal contacts for the Parties are as follows:

USDA - Attorney, United States Department of Agriculture, Office of General Counsel, James Alexander (or successor or designee)

DOI/BLM/BIA/FWS - Primary Contact: Attorney-Advisor Office of Solicitor, Branch of Federal Facilities Compliance John Seymour; , Supporting Contacts: Attorney-Advisor, Division of Mineral Resources Harvey Blank; Attorney-Advisor, Division of Indian Affairs Jean Rice; Attorney-Advisor, Division of Parks and Wildlife John Carlucci; or Attorney-Advisor from DOI Regional or Field Solicitor's Office (or their respective successors or designees)

EPA - Assistant Regional Counsel, EPA Region 10, Elizabeth McKenna (or successor or designee)

DOJ - Senior Attorney Region 10, Environmental Enforcement Section, Deborah M. Reyher, Ben Franklin Station, P.O. Box 7611, Washington, D.C. 20044, (202) 514-4113 (or successor or designee)

Idaho - Administrator, Waste Management & Remediation Division, Idaho Department of Environmental Quality. (or successor or designee)

Tribes - Special Counsel, Attorney's Office, Shoshone-Bannock Tribes, Jeanette Wolfley (or successor or designee)

17. With respect to both the area-wide investigation and the site-specific investigations and response actions, the Parties will use their best efforts to resolve technical disagreements informally among the OSC/RPM and the Project Manager(s).

18. If the OSC/RPM and the Project Manager(s) do not reach agreement through informal means, the Parties will use the following dispute resolution process:

a. Project Manager(s) and the OSC/RPM for the agencies involved at the site will quickly elevate any unresolved dispute, first to the persons identified in Appendix A, and up through the following management personnel (or their designees):

Forest Service Region 4 Deputy Regional Forester

The BLM Idaho State Office Director

EPA Region 10 Unit Manager of the Office of Environmental Cleanup, Ann Williamson

Program Administrator, Solid Waste Management Program, Idaho Department of Environmental Quality

USFWS - Regional Director

Chairman , Shoshone-Bannock Tribes' Land Use Commission

BIA - Deputy Commissioner

b. If the Parties continue to disagree, the Lead Agency will prepare a proposed written decision which fully evaluates and addresses the expressed concerns of the Support Agencies, and the matter will be elevated to a committee consisting of the signatories to this MOU, or their successors or designees (the "Signatory Committee").

c. If the Signatory Committee cannot reach agreement then the Supporting Agencies may: 1) accept the proposed decision of the Lead Agency; 2) seek mediation or further elevation through a process agreed upon by the disagreeing Agencies; or 3) rely on their respective rights and authorities under Paragraphs 4, 22-27 of this MOU. An unresolved disagreement at one site or on one issue does not require the withdrawal of a Party or termination of the entire MOU. If a disagreement is confined to one site or issue, coordination actions at other sites and on other issues will continue as specified in this MOU. Likewise, disagreement at one site or on one issue will not affect previous agreements reached at other sites or on other issues or prevent the enforcement of agreements at the subject site that became effective before the time of disagreement.

d. To avoid impeding work, the time for resolving disputes among the Parties must be short. When informal dispute resolution between the OSC/RPM and Project Manager(s) does not rapidly resolve a dispute, the OSC/RPM and the Project Manager(s) should elevate the dispute through management within 10 days. The Parties should resolve disputes or issue a decision within 21 days of elevation. In exigent circumstances, any Party may immediately elevate a dispute directly to the Signatory Committee.

19. Work will continue during dispute resolution, except for work that is the subject of or dependent upon the outcome of the pending dispute and that may be delayed without posing an imminent and substantial endangerment to human health, welfare, or the environment.

20. The dispute resolution process described in Section E of this MOU is separate from any dispute resolution process that may be described in an Agreement with a Company or Companies. If applicable, the Parties shall implement the dispute resolution process under such Agreements as follows:

a. The Lead Agency will propose an initial response to disputes raised by the Company, for concurrence by the Support Agencies.

b. If the Lead Agency and one or more of the Support Agencies cannot reach agreement as to how to respond to the dispute raised by the Company, a Support Agency may invoke the dispute resolution process under Section E of this MOU, unless the issue has already been disputed separately under this MOU. If the two dispute resolution processes are proceeding simultaneously, the dispute resolution process with the Company may not reach a final decision in a manner inconsistent with the MOU dispute resolution process.

F. CONFIDENTIALITY

21. The Parties recognize that to effectively and efficiently exercise their authorities concerning the Mining Area, their counsel, employees, and consultants may exchange documents and information subject to attorney-client privilege, attorney work product and other forms of privilege. The Parties, therefore, agree to protect these privileges, to the full extent provided by law. This provision shall remain in effect after this MOU terminates.

G. RESERVATION OF RIGHTS

22. The Federal Agencies reserve the right to exercise their rights and authorities under applicable law, including but not limited to, CERCLA, the NCP, and applicable Executive Orders, including Executive Order 12580, as amended and the Mineral Leasing Act, 30 U.S.C. sec. 181 et seq., including but not limited to, 30 U.S.C. § 211, and the Federal Land Policy and Management Act of 1976, 43 U.S.C. § 1701 et seq.

23. IDEQ reserves the right to exercise its rights and authorities under applicable law, including but not limited to, CERCLA, the NCP, the Idaho Environmental Protection and Health Act ("EPHA"), Idaho Code §§ 39-101 to 39-130, and the Hazardous Waste Management Act of 1983 ("HWMA"), Idaho Code §§ 39-4401 to 39-4432.

24. The Tribes reserve the right to exercise their rights and authorities under applicable law, including but not limited to, CERCLA, their inherent sovereign powers, the Fort Bridger Treaty, the Constitution and Bylaws of 1936, and various provisions of the Land Use Policy Ordinance, the Law and Order Code of 1982, and the 1994 Fort Hall Water Rights Agreement.

25. This MOU is not intended to affect, and the Parties hereby expressly reserve, any and all claims or potential claims each may have arising from injuries to natural resources in the Mining Area.

26. No statements made in the course of negotiations among the Parties or in this MOU may be construed to represent an admission, determination, settlement, or adjudication of any legal or factual dispute relating to any Party's rights, privileges or interests.

27. Each Party expressly reserves the right to assert any and all defenses it may have to any claim that may be asserted by the other Parties or by any other person under federal, state, or tribal law.

28. Nothing in this MOU is intended either to create any rights in or grant any cause of action to any person not a party to this MOU or to release or waive any claim, cause of action, demand, or defense in law or equity that any of the Parties to this MOU may have against any person(s) or entity not a party to this MOU.

29. This MOU is not a fund obligating document. Any reimbursement or contribution of funds between the Federal Agencies that have signed this MOU will be handled in accordance with applicable law and procedures. Such

reimbursement or contribution shall be authorized in separate written agreements signed and approved by the appropriate agency officers or representatives pursuant to appropriate statutory authority. No provision of this MOU shall be interpreted or construed as a commitment or requirement that any of the Federal Agencies obligate or pay funds in contravention of the Anti-Deficiency Act, 31 U.S.C. § 1341, or any other applicable provision of law, in any fiscal year for actions subject to this agreement.

H. GENERAL PROVISIONS

30. This MOU is effective upon the date signed by the last of the Parties.

31. This MOU terminates 10 years after its effective date. Prior to that, this MOU may be terminated, modified, or extended upon the written agreement of the Signatory Committee. A Party may terminate its participation in this MOU upon 14 days written notice to all Parties.

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

By: _____
for Jack A. Blackwell
Regional Forester
U.S.D.A. Forest Service, Region 4

June 15, 2000
DATE

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

ENVIRONMENTAL PROTECTION AGENCY

By: _____
Mike Gearhard
Hazardous Waste Division Director
EPA Region 10

5 July 2000
DATE

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

IDAHO DIVISION OF ENVIRONMENTAL QUALITY

By: _____
C. Stephen Allred
Director
Idaho Department of Environmental Quality

June 30, 2000
DATE

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

UNITED STATES DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT

By: _____
for Martha Hahn
Idaho State Director
Bureau of Land Management

June 11, 2002
DATE

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

UNITED STATES DEPARTMENT OF INTERIOR
FISH AND WILDLIFE SERVICE

Acting
By: _____
Anne Badgley
Regional Director
USFWS Region 1

JUL 14 2000
_____
DATE

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

UNITED STATES DEPARTMENT OF INTERIOR
BUREAU OF INDIAN AFFAIRS

By: _____
(need title)
Bureau of Indian Affairs

_____
DATE

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

UNITED STATES DEPARTMENT OF INTERIOR
BUREAU OF INDIAN AFFAIRS

By: M Sharon Blackwell
Deputy Commissioner of Indian Affairs
Bureau of Indian Affairs

July 17, 2000
DATE

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

SHOSHONE-BANNOCK TRIBES

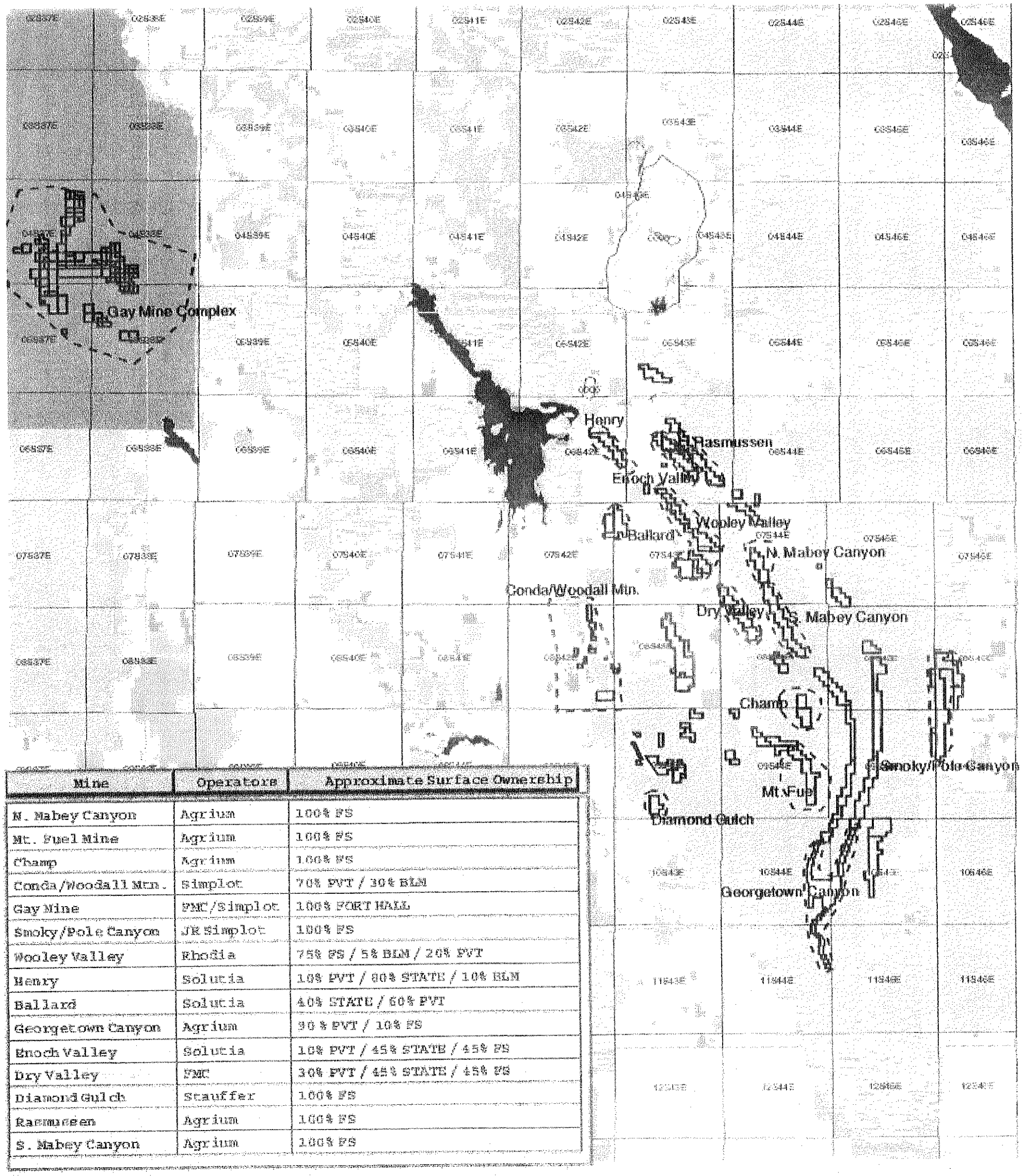
By: Claudeo M. Broncho
Claudeo Broncho
Vice Chairman, Fort Hall Business Council

6-14-00
DATE

EXHIBIT 1

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

Southeast Idaho Phosphate Mine Sites for Selenium Investigations



Mine	Operators	Approximate Surface Ownership
N. Mabey Canyon	Agrium	100% FS
Mt. Fuel Mine	Agrium	100% FS
Champ	Agrium	100% FS
Conda/Woodall Mtn.	Simplot	70% PVT / 30% BLM
Gay Mine	FMC/Simplot	100% FORT HALL
Smoky/Pole Canyon	JR Simplot	100% FS
Wooley Valley	Rhodia	75% FS / 5% BLM / 20% PVT
Henry	Solutia	10% PVT / 80% STATE / 10% BLM
Ballard	Solutia	40% STATE / 60% PVT
Georgetown Canyon	Agrium	90 % PVT / 10% FS
Enoch Valley	Solutia	10% PVT / 45% STATE / 45% FS
Dry Valley	FMC	30% PVT / 45% STATE / 45% FS
Diamond Gulch	Stauffer	100% FS
Rasmussen	Agrium	100% FS
S. Mabey Canyon	Agrium	100% FS

MOU Concerning Selenium Contamination in Southeast Idaho
Exhibit 1

Mine Leases
Township Range Boundaries
Land Ownership
B.L.M.
Fort Hall Reservation
Caribou National Forest
Private
State
Open Water

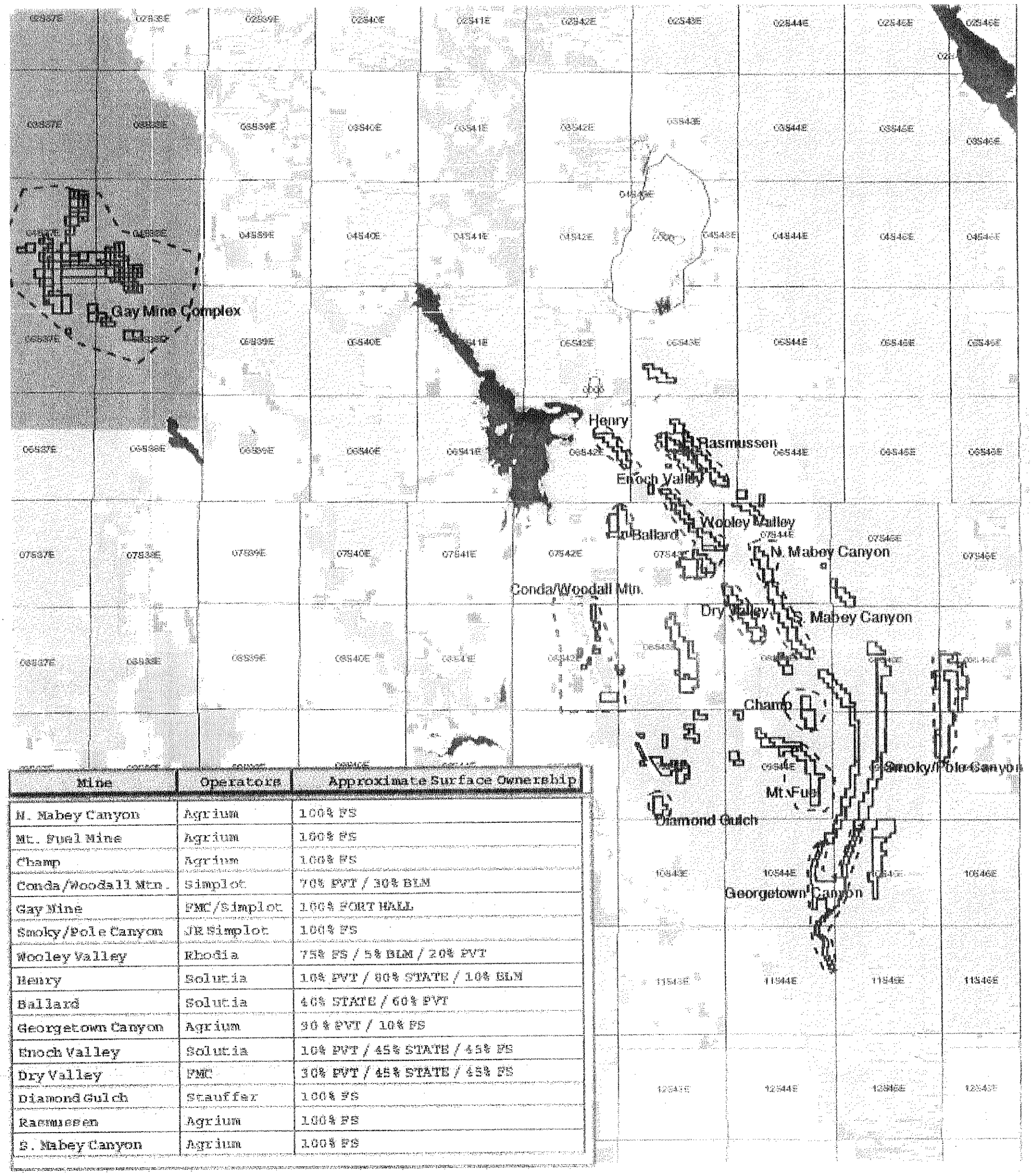
N

5 0 5 10 15 Miles

1:350000

mz/jj 8/07/00
cwork/temp/matt/state leases.apr
Size: 11X17

Southeast Idaho Phosphate Mine Sites for Selenium Investigations



Mine	Operators	Approximate Surface Ownership
N. Mabey Canyon	Agrium	100% FS
Mt. Fuel Mine	Agrium	100% FS
Champ	Agrium	100% FS
Conda/Woodall Mtn.	Simplot	70% PVT / 30% BLM
Gay Mine	FMC/Simplot	100% FORT HALL
Smoky/Pole Canyon	JR Simplot	100% FS
Wooley Valley	Rhodia	75% FS / 5% BLM / 20% PVT
Henry	Solutia	10% PVT / 80% STATE / 10% BLM
Ballard	Solutia	40% STATE / 60% PVT
Georgetown Canyon	Agrium	90 % PVT / 10% FS
Enoch Valley	Solutia	10% PVT / 45% STATE / 45% FS
Dry Valley	FMC	30% PVT / 45% STATE / 45% FS
Diamond Gulch	Stauffer	100% FS
Rasmussen	Agrium	100% FS
S. Mabey Canyon	Agrium	100% FS

MOU Concerning Selenium Contamination in Southeast Idaho
Exhibit 1

- Mine Leases
- Township Range Boundaries

Land Ownership

- B.L.M.
- Fort Hall Reservation
- Caribou National Forest
- Private
- State
- Open Water

N

5 0 5 10 15 Miles

1:350000

mc/jj 6/07/00
cwork/temp/mat/state_lease.apr
Size: 11X17

APPENDIX A

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

For the purpose of this MOU The Parties designate the following persons, or their successors or designees, as general contacts for issues relating to this MOU:

USDA/Forest Service - Forest Supervisor of the Caribou-Targhee National Forest (currently Jerry Reese , 420 North Bridge Street, St. Anthony, ID 83445, (208) 624-3151)

DOI/BLM - District Manager, Upper Snake River District (currently Jim May1405 Hollipark Driver, Idaho Falls, ID 83401, (208)524-7500.

BIA - Land Manager (currently Jeffery Loman [add address and phone])

USFWS - Supervisor, Eastern Idaho Field Office (currently Michael J. Donahoo, 4425 Burley Dr., Suite A. Chubbuck, ID 83202)

EPA - Nick Ceto, 1200 Sixth Avenue, ECL 116, Seattle, WA 98101, (206) 553-1816

DOJ - Senior Attorney, Region X, Environmental Enforcement Section (currently Deborah Reyher), Ben Franklin Station, P.O. Box 7611, Washington, D.C. 20044, (202) 514-4113)

IDEQ - Katherine Kelly, Administrator, Waste Management & Remediation Division, 1410 N. Hilton, Boise, ID 83706, 208-373-0445

TRIBES - Jeanette Wolfley, Tribal Attorney, Shoshone-Bannock Tribes, P.O. Box 306, Fort Hall, ID 83203, (208) 232-1922

APPENDIX B

MEMORANDUM OF UNDERSTANDING
concerning
SELENIUM CONTAMINATION IN SOUTHEASTERN IDAHO

STATEMENT OF AUTHORITY[1]

1. Pursuant to CERCLA, the President is responsible for responding to releases of hazardous substances, or pollutants and contaminants, to protect the public health or welfare or the environment. The President's CERCLA response authority is generally delegated to EPA. 42 U.S.C. 9601 et seq.; Executive Order 12580, §§ (2)(g) & 4(d)(1)&(2).

2. Pursuant to Executive Order 12580, as amended by Executive Order 13016, the President delegated the authority to conduct various activities under CERCLA, including investigations and response activities (42 U.S.C. § 9604), cost recovery (42 U.S.C. § 9607), issuing such orders as may be necessary to protect public health or welfare or the environment (42 U.S.C. § 9606(a)), and entering agreements with a potentially responsible party ("PRP") for the PRP to perform investigations (42 U.S.C. § 9622(d)(3)) to several executive departments and agencies, including the Environmental Protection Agency ("EPA"), the United States Department of Agriculture ("USDA"), and the United States Department of the Interior ("DOI").

3. USDA is generally delegated the President's CERCLA authority where a release of a hazardous substance is on, or the sole source of the release is from, a facility under the jurisdiction, custody or control of an agency within the USDA.

---

[1] Each of the Parties to the Memorandum of Understanding Concerning Selenium Contamination in Southeastern Idaho executed in June 2000 (MOU) has submitted a Statement of Authority as set forth herein pursuant to Paragraph M of the MOU. This Appendix to the MOU does not constitute an agreement among the parties nor have any legal significance separate and apart from its incorporation by reference in the MOU. No statements or assertions contained herein shall be construed to restrict, enlarge, or otherwise determine the rights, interests and jurisdiction of the United Sates, the State of Idaho, or the Shoshone-Bannock Tribes, or any of their respective departments, agencies or members. Nor shall any statements made herein be construed to represent an admission, determination, settlement or adjudication of any legal or factual dispute relating to any Party's rights, privileges, interests, authority or jurisdiction.

Executive Order 12580, §§ 2(e)(1) and 4(b)(1). The Forest Service administers National Forest System land on behalf of the public. With certain limitations, USDA delegated its CERCLA authority to the Forest Service where a release of a hazardous substance is on, or the sole source of the release is from, a facility under the jurisdiction, custody or control of the Forest Service. Executive Order 12580, §§ 2(e)(1) and 4(b)(1); 7 C.F.R. § 2.60(a)(39). Executive Order 13016 amends EO 12580 to authorize USDA's use of CERCLA Section 106 authority to address releases or threats of releases of hazardous substances affecting lands and natural resources under the Forest Service's trusteeship, jurisdiction, custody or control, subject to the concurrence of the Administrator of EPA. The CERCLA roles of USDA and the Forest Service are also recognized in various provisions of the NCP. 40 C.F.R. Part 300.

4. DOI is generally delegated the President's CERCLA authority where a release of a hazardous substance is on, or the sole source of the release is from, a facility under the jurisdiction, custody or control of an agency within DOI. Executive Order 12580, §§ 2(e)(1) and 4(b)(1). The CERCLA roles of DOI are also recognized in various provisions of the NCP. 40 C.F.R. Part 300. DOI has re-delegated its authorities under Executive Order 12580 to the Bureau Directors with respect to land, resources, and facilities within the jurisdiction, custody, or control of the Bureaus including BLM and BIA. Executive Order 13016 amends EO 12580 to authorize DOI's use of CERCLA Section 106 authority to address releases or threats of releases of hazardous substances affecting lands and natural resources under DOI's trusteeship, jurisdiction, custody or control, subject to the concurrence of the Administrator of EPA. The Secretary of the Interior also has authority to lease phosphate deposits of the United States and lands containing such deposits pursuant to the Mineral Leasing Act, 30 U.S.C. sec. 181 et seq. and to manage public lands pursuant to the Federal land Policy and management Act of 1976, 43 U.S.C. § 1701 et seq. These authorities have been implemented by BLM, on behalf of the Secretary, through regulations contained in 43 C.F.R. Parts 3500 and 3590. DOI is also a trustee for natural resources, and USFWS is responsible for the protection and restoration of trust resources injured by uncontrolled releases of hazardous materials. USFWS also is responsible for conducting assessments to establish injury and the dollar equivalent of that injury for collection of damages from parties responsible for releasing hazardous materials. In addition to the authorities stated in Paragraphs 1 and 2, supra, USFWS participates in this MOU based on the following authorities: CERCLA Section 122(j), 42 U.S.C. § 9622(j); the Endangered S pecies Act of 1973, 16 U.S.C. §§1531-1544; the Migratory Bird Treaty Act of 1918, 16 U.S.C. §§ 703-712; the Bald Eagle Protection Act of 1940, 16 U.S.C. §§ 668-668d; the Fish and Wildlife Coordination Act, 16 U.S.C.

§§ 661-667e; and the National Wildlife Refuge System Administration Act of 1966, 16 U.S.C. §§ 668dd-668ee.

5. IDEQ is the Idaho State agency that generally has authority over the identification, investigation and clean-up of facilities where hazardous substances have come to be located in the State of Idaho. IDEQ exercises this authority pursuant to the Idaho Environmental Protection and Health Act ("EPHA"), Idaho Code §§ 39-101 to 39-130, and the Hazardous Waste Management Act of 1983 ("HWMA"), Idaho Code §§ 39-4401 to 39-4432. IDEQ is also the Idaho State agency with the authority to participate in the initiation and development of CERCLA response actions to be undertaken in the State of Idaho.

6. The Shoshone-Bannock Tribes ("Tribes") are federally recognized Indian tribes with a governing body known as the Fort Hall Business Council, which has authority to enter into this MOU on behalf of the Tribes. The Tribes, on July 3, 1868, concluded the Second Treaty of Fort Bridger with the United States, which was ratified by the United States Senate on February 24, 1869. 15 Stat. 673. Article 4 of the Fort Bridger Treaty reserved the Fort Hall Indian Reservation ("Reservation") as a "permanent home" for the signatory Tribes. Article 4 reserved off-Reservation hunting, fishing and gathering rights to the Tribes; these Treaty-guaranteed rights are exercised on public lands throughout the State of Idaho. The Tribes are obligated to protect both the individual and communal interests of the successors-in-interest of Indian signatories to the Treaty, and are responsible to protect the health, welfare and safety of Tribal members, and the environment of the Tribes. The Tribes have authority over the identification, investigation, and cleanup of hazardous substances found within Indian Country, including on the Reservation, and retain protectable Treaty interests in public lands and water located off-Reservation that may be affected by hazardous substances or pollutant and contaminants. The Tribes exercise their authority pursuant to, among other authorities, CERCLA, their inherent sovereign powers, the Fort Bridger Treaty, the Constitution and Bylaws of 1936, and various provisions of the Land Use Policy Ordinance, the Law and Order Code of 1982, and the 1994 Fort Hall Water Rights Agreement. The Tribes anticipate finalizing a Hazardous Waste Management Act in 2000.

COPY

APPENDIX 2: STATEMENT OF WORK FOR SITE INVESTIGATIONS (SIs) AND ENGINEERING EVALUATIONS/COST ANALYSES (EE/CAs) AT P4 PRODUCTION'S ENOCH VALLEY, BALLARD, AND HENRY MINES

TASK 1: SCOPING (Work Plans delivered within 60 days of Order execution)

A. P4 Production will prepare and submit separate work plans for performing Site Investigations (SIs) and Engineering Evaluations/Cost Analyses (EE/CAs) at each separate mine.

B. The SI Work Plans will provide a comprehensive mine description, including, but not limited to:
   - Mine history and description.
   - Historical operations/ownership (adjacent/surrounding owners, potential receptors, etc.).
   - Existing topographic features/modifications (pre- and post-land surfaces, area of features, elevations, etc.).
   - Associated ancillary mine activities (maintenance facilities, industrial operations, transportation corridors, etc.) and any known or recorded releases of any hazardous substances.
   - Existing relevant mine-specific information/data (i.e., hydrology, climatology, geology, hydrogeology, ecology, design, and available as-built construction details for all dumps/fills, etc.).
   - Additional data (estimated waste quantities, locations, design, volume, holding/catchment ponds, production/processing facilities, monitoring data, background sampling data, etc.).

C. The SI Work Plans shall propose the work to be performed, and specify the approach, schedule, and rationale for performing each activity. Conceptual Site Models will be included for each subject mine. Each such model will address contaminants, exposure pathways, and receptors of potential concern. Each such plan will specify sampling strategies and methodologies, environmental target media, analytes, and data quality objectives. A project management plan will also be included specifying points of contact, responsibilities, data handling, reporting, pre-scheduled meetings, etc. A suggested format for the SI Work Plans is provided in Attachment A.

D. The EE/CA Work Plans will describe the evaluation process to be implemented upon completion of the SIs. The plans shall describe the data evaluation process, risk assessment protocols for any human health and ecological assessments, required bench- or pilot-scale treatability investigation processes, procedures for identification and comparative analysis of removal alternatives, and proposed schedule of the EE/CA process. A suggested format for the EE/CA Work Plans is provided in Attachment A.

E. Separate SI and EE/CA Reports will be required for each mine to allow for maintenance of site-specific administrative records, and management of future site actions and regulatory decision-making. Combined documents may be used for certain Sampling and Analysis Plan components (e.g., QAP, HSP) having similar procedures, but the Field Sampling Plans and SI reports will be submitted under separate cover for each mine.

TASK 2: PLANNING (SAPs delivered within 20 days of work plan approvals)

A. P4 Production will prepare and submit a Sampling and Analysis Plan (SAP), including Field Sampling Plan (FSP), Health and Safety Plan (HSP), and Quality Assurance Plan (QAP) for implementation of the SI at each subject mine. P4 Production shall provide a separate FSP for each mine, but may chose to develop a multi-mine programmatic plan for HSPs and QAPs covering similar analytical and field sampling activities. Suggested formats for the SAP are provided in Attachment A.

B. P4 Production has planned many investigational and engineering activities and studies at each of its mines. Some of these activities have been conducted pursuant to mine permits, some pursuant to agreed order with IDEQ in conjunction with other members of the Idaho Mining Association's Selenium Committee (IMA), and some done voluntarily, including mine-specific surface water and sediment investigation work initiated in 2002 at the request of IDEQ and with the agency's explicit assurance that said work would be credited toward the mine-specific CO to which this SOW is attached. In addition to work of this nature done by P4 Production, much work that could be relevant has been and is being done by or for many entities, including but not limited to:

- IMA and each of its other four member companies--Agrium, Astaris (including FMC), Rhodia, and Simplot;
- IDEQ;
- IDH;
- IDL;
- USFS;
- USDA;
- USBLM;
- USFWS;
- USGS;
- USDOE;
- USBIA;
- Shoshone-Bannock Tribes;
- Idaho State University; and,
- University of Idaho.

All work done by these or any other entity, that is, in IDEQ's sole discretion, of sufficient relevance and quality, may be used by P4 Production in fulfilling some of the planning requirements of Task 2.

C. The SAP will specify the methodologies, protocols, and locations for sample collection and other data-gathering activities. It will summarize sampling objectives, frequencies, equipment, sample designations, and handling and analysis methods that will meet the data quality objectives.

D. The HSP will be prepared in conformance with P4 Production's health and safety program, and in compliance with applicable OSHA and MSHA regulations and protocols. The IDEQ will review this document to ensure the necessary elements are included to provide for the protection of human health and safety, however, the Agency will not "approve" P4 Production's plan.

E. The QAP will describe objectives and organization, functional activities, and quality assurance and quality control (QA/QC) procedures to be used to achieve the data quality objectives in accordance with CO requirements. It shall address sampling procedures, custody, analytical procedures, data reduction, validation, reporting, and personnel qualifications. Each laboratory to be used will submit their QA program and methods, consistent with USEPA data validation protocols, for approval. All P4 Production-generated data reporting documents will append raw lab-reported data.

F. The Community Relations Plan (CRP) and public involvement activities for the SI and EE/CA process will be developed and managed by the IDEQ in accordance with the NCP, and may consist of a multi-mine programmatic document. P4 Production will be consulted or informed in advance of each scheduled activity undertaken pursuant to this CRP.

TASK 3: SITE INVESTIGATION (SI) (SI Reports delivered within 90 calendar days of completing fieldwork, laboratory work, and data validation)

A. The SIs will collect the data necessary to physically characterize each site, define the sources of contamination, describe the nature and extent of on-site and off-site impacts, and support future mine evaluation, bench-/pilot-scale studies, risk assessment, and all other subsequent activities. A suggested format for the SI Reports is provided in Appendix A.

B. P4 Production has executed many investigational activities at each of its mines. Some of these activities have been conducted pursuant to mine permits, some pursuant to agreed order with IDEQ in conjunction with other members of the Idaho Mining Association's Selenium Committee (IMA), and some done voluntarily, including mine-specific surface water and sediment investigation work initiated in 2002 at the request of IDEQ and with the agency's explicit assurance that said work would be credited toward the mine-specific CO to which this SOW is attached. In addition to work of this nature done by P4 Production, much work that could be relevant has been and is being done by or for many entities, including but not limited to:

- IMA and each of its other four member companies--Agrium, Astaris (including FMC), Rhodia, and Simplot;
- IDEQ;
- IDH;
- IDL;
- USFS;
- USDA;
- USBLM;
- USFWS;
- USGS;
- USDOE;
- USBIA;
- Shoshone-Bannock Tribes;
- Idaho State University; and,
- University of Idaho.

All work done by these or any other entity, that is, in IDEQ's sole discretion, of sufficient relevance and quality, may be used by P4 Production in fulfilling some of the site characterization requirements of Task 3.

C. P4 Production will characterize geology, hydrology, and hydrogeology to include seasonal flow rates, concentrations, hydraulic gradients, , aquifers, aquicludes, receiving streams, loading calculations, seeps, springs, drains, pits, ponds, and potential receptors for the mine and relevant surrounding area. All existing wells on and near the mine will be sampled, and new wells will be installed in sufficient quantity to characterize up- and down-gradient conditions in the vicinity of individual mine waste units. Water balances will be generated to represent the mine under local climatic conditions and, where

possible, correlated to a regional hydrograph. Any on-site or impacted off-site wetlands will be formally delineated by a soil scientist and described in terms of functional analysis, dominant wildlife and vegetation species, soil units, hydrology, wildlife use, etc. Analysis of off-site impacts will include transport and fate analyses, calculation of loading estimates of contaminants of potential concern (COPCs) from the mine, and assessment of adjacent watershed sub-basin impacts.

D. P4 Production will determine the nature and extent of all surface and ground water impacts for the following chemical parameters: selenium, cadmium, chromium, copper, nickel, vanadium, and zinc. Metals will be analyzed as dissolved fractions, except for potential drinking water sources and selenium, which require total recoverable fractions. Non-chemical-specific water parameters will include pH, temperature, specific conductivity, and hardness as indicated in the attached *Summary of Project Analytical Methods*. P4 Production will complete an ion balance on sampling results.

E. P4 Production will determine the nature and extent of on-site and off-site impacts in soils, sediments, vegetation, and other applicable media to include, but not be limited to: the locations of mine waste dumps and fills, constructed roads, reclaimed areas, seep and drain outfall areas, etc., in a manner that identifies areal trends, sub-unit values, and potential hot spots. Target parameters as specified above for surface and ground water.

F. P4 Production shall perform any subsequent flora or fauna surveys, ecological studies, or biological sampling, including temporal data collection, required for baseline risk assessment protocols and other mine-specific needs.

G. P4 Production shall collect data required for any proposed treatability studies or testing requirements needed to evaluate potential removal alternatives or innovative technologies. Preliminary designs for bench- or pilot-scale studies must be reviewed and approved by the IDEQ prior to initiation of such studies.

H. P4 Production will identify and establish background levels for each sampling medium by selecting local, unimpacted reference control areas or approved historic data.

TASK 4: ENGINEERING EVALUATION/COST ANALYSES (EE/CAS) (EE/CAs delivered within 120 days of SI completion and approval and after completion of Task 3, the risk management phase of the Area-Wide Investigation)

A. P4 Production will develop an EE/CA for each mine that includes baseline human health (as required) and ecological risk assessment summaries identifying areas exceeding action levels for site-specific conditions, identification and screening of removal alternatives, comparative analysis of applicable site alternatives, and schedule of implementation. A suggested format for the EE/CA reports is provided in Attachment A.

B. P4 Production has executed many engineering activities and studies at each of its mines. Some of these activities have been conducted pursuant to mine permits, some pursuant to agreed order with IDEQ in conjunction with other members of the Idaho Mining Association's Selenium Committee (IMA), and some done voluntarily. In addition to work of this nature done by P4 Production, much work that could be relevant has been and is being done by or for many entities, including but not limited to:

- IMA and each of its other four member companies--Agrium, Astaris (including FMC), Rhodia, and Simplot;
- IDEQ;

- IDH;
- IDL;
- USFS;
- USDA;
- USBLM;
- USFWS;
- USGS;
- USDOE;
- USBIA;
- Shoshone-Bannock Tribes;
- Idaho State University; and,
- University of Idaho.

All work done by these or any other entity, that is, in IDEQ's sole discretion, of sufficient relevance and quality, may be used by P4 Production in fulfilling some of the EE/CA requirements of Task 4.

C. P4 Production will submit work plans for any proposed treatability studies.

D. P4 Production will identify and propose plans for interim removal action activities in areas requiring immediate measures to protect human health or the environment, or to mitigate on-going releases.

E. P4 Production will propose mine-specific monitoring programs to assess the effectiveness of proposed removal activities.

F. P4 Production will support selected alternatives with appropriate studies and modeling.

G. If probabilistic risk assessment procedures are used, P4 will conform with USEPA's protocols and guiding principles on the use of these methods.

SOUTHEAST IDAHO PHOSPHATE MINING RESOURCE AREA
SUMMARY OF PROJECT ANALYTICAL METHODS

(METHOD DETECTION LIMITS TO BE APPROVED BY LEAD AGENCY PRIOR TO SAMPLING)

Analyte	Water		Soil/Sed/Veg	Comments/Sample Preparation Methods
cadmium	200.8		M6020 ICP-MS	3005/3010
chromium (total)	200.7		M6010 ICP	
copper	200.8		M6020 ICP-MS	3005/3010
nickel	200.8)		M6020 ICP-MS	3005/3010
Selenium (total)	SM 3500-Se C		M7742 modified	AA-hydride generation
vanadium	200.7		M6010 ICP	NAR
zinc	200.8		M6020 ICP-MS	3005, 3010
hardness	130.2		NA	
dissolved oxygen/ pH/ temp/specific conductivity	field measurements		NA	

ANALYTICAL METHODS REFERENCES:

1. USEPA; *Methods for Determination of Metals in Environmental Samples, Jun 1991*, EPA-600/4-91-010
2. USEPA; SW-846 *Test Methods for Evaluating Solid Waste, Nov 1986*
3. APHA, AWWA, WEF; *Standard Methods for the Examination of Water and Wastewater, 18th Ed, 1992*
4. USEPA; *Methods for Chemical Analysis of Water and Wastes, Mar 1983,* EPA-600/4-79-020
5. USGS; *Methods for Determination of Inorganic Substances in Water and Fluvial Sediments, 1979*
6. USEPA; *Methods for the Determination of Inorganic Substances in Environmental Samples, Jun 1991*, EPA/600/R-93-100
7. Black, CiA; *Methods of Soil Analysis, Part 2*
8. USEPA Radiological Approved Methods

ATTACHMENT A

SUGGESTED REPORT FORMATS

(Distribution of documents should include one electronic copy and 3 hard copies for IDEQ and 1 hard copy for each person designated in Section 8.3 of the Consent Order)

SUGGESTED FORMAT FOR SI WORK PLAN

EXECUTIVE SUMMARY

1.0 INTRODUCTION

2.0 SITE BACKGROUND
- 2.1 DESCRIPTION AND SETTING
- 2.2 PAST OPERATIONS/OWNERSHIP/TYPES AND VOLUMES OF MINE-RELATED WASTE PRESENT
- 2.3 TOPOGRAPHIC FEATURES/PAST MODIFICATIONS
- 2.4 EXISTING RELEVANT SITE-SPECIFIC INFORMATION/DATA
- 2.5 PRODUCTION INFORMATION

3.0 DATA QUALITY OBJECTIVES/WORK PLAN RATIONALE

4.0 SITE INVESTIGATION TASKS
- 4.1 SURFACE WATER
- 4.2 SEDIMENT
- 4.3 GROUNDWATER
- 4.4 SOIL
- 4.5 VEGETATION
- 4.6 ECOLOGICAL/BIOLOGICAL STUDIES
- 4.7 WATER BALANCE/LOADING CALCULATIONS

5.0 PROJECT MANAGEMENT PLAN
- 5.1 PROJECT APPROACH
- 5.2 REPORTING PROCEDURES/COORDINATION
- 5.3 PROJECT ORGANIZATION/SUBCONTRACTORS
- 5.4 PROJECTED SCHEDULE

FIGURES, TABLES, APPENDICES AS REQUIRED

SUGGESTED FORMAT FOR EE/CA WORK PLAN

1.0 INTRODUCTION

2.0 SITE CHARACTERIZATION/FIELD STUDIES

3.0 DEVELOPMENT OF REMOVAL ACTION OBJECTIVES

4.0 RISK ASSESSMENT PROCESS DESCRIPTION

5.0 ANALYSIS OF REMOVAL ACTION ALTERNATIVES

6.0 SCHEDULE

FIGURES, TABLES, AND ATTACHMENTS AS REQUIRED

SUGGESTED FORMAT FOR SAMPLING AND ANALYSIS PLAN (SAP)

1.0 INTRODUCTION

2.0 SITE BACKGROUND

3.0 SAMPLING OBJECTIVES

4.0 SAMPLE LOCATIONS AND FREQUENCY

5.0 SAMPLE DESIGNATION

6.0 SAMPLING EQUIPMENT AND PROCEDURES

7.0 SAMPLE HANDLING AND ANALYSIS

FIGURES, TABLES, AND ATTACHMENTS AS REQUIRED

SUGGESTED FORMAT FOR QUALITY ASSURANCE PLAN (QAP)

TITLE PAGE

TABLE OF CONTENTS

1.0 PROGRAM DESCRIPTION

2.0 PROGRAM ORGANIZATION AND RESPONSIBILITIES

3.0 QA OBJECTIVES FOR MEASUREMENT

4.0 SAMPLING PROCEDURES

5.0 SAMPLE CUSTODY

6.0 CALIBRATION PROCEDURES

7.0 ANALYTICAL PROCEDURES

8.0 DATA REDUCTION, VALIDATION AND REPORTING

9.0 INTERNAL QUALITY CONTROL

10.0 PERFORMANCE AND SYSTEMS AUDITS

11.0 PREVENTATIVE MAINTENANCE

12.0 DATA ASSESSMENT PROCEDURES

13.0 CORRECTIVE ACTIONS

14.0 QUALITY ASSURANCE REPORTS

FIGURES, TABLES, AND ATTACHMENTS AS REQUIRED

SUGGESTED FORMAT FOR SITE INVESTIGATION (SI) REPORT

EXECUTIVE SUMMARY

1.0 INTRODUCTION
- 1.1 PURPOSE OF REPORT
- 1.2 SITE BACKGROUND
  - 1.2.1 SITE DESCRIPTION
  - 1.2.2 SITE HISTORY
  - 1.2.3 PREVIOUS INVESTIGATIONS
- 1.3 REPORT ORGANIZATION

2.0 STUDY AREA INVESTIGATIONS/FIELD STUDIES
- 2.1 SURFACE FEATURES/TOPOGRAPHY
- 2.2 CONTAMINANT SOURCE INVESTIGATIONS
- 2.3 METEOROLOGICAL INVESTIGATIONS
- 2.4 SURFACE WATER/SEDIMENT INVESTIGATIONS
- 2.5 GEOLOGICAL INVESTIGATIONS
- 2.6 SOIL AND VADOSE ZONE INVESTIGATIONS
- 2.7 GROUNDWATER INVESTIGATIONS
- 2.8 ECOLOGICAL INVESTIGATIONS

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA
- 3.1 SURFACE FEATURES
- 3.2 METEOROLOGY
- 3.3 SURFACE WATER HYDROLOGY
- 3.4 GEOLOGY
- 3.5 SOILS
- 3.6 HYDROGEOLOGY
- 3.7 DEMOGRAPHY AND LAND USE
- 3.8 ECOLOGY

4.0 NATURE AND EXTENT OF CONTAMINATION/IMPACTS
- 4.1 CONTAMINANTS OF POTENTIAL CONCERN
- 4.2 SOURCES
- 4.3 SOILS AND VADOSE ZONE
- 4.4 GROUNDWATER
- 4.5 SURFACE WATER AND SEDIMENTS
- 4.6 AIR

5.0 CONTAMINANT FATE AND TRANSPORT
- 5.1 POTENTIAL ROUTES OF MIGRATION/EXPOSURE PATHWAYS
- 5.2 CONTAMINANT PERSISTENCE/ACCUMULATION
- 5.3 CONTAMINANT MIGRATION/MODELING

SUGGESTED FORMAT FOR SITE INVESTIGATION (SI) REPORT (CONTINUED)

6.0 BASELINE RISK ASSESSMENT
- 6.1 HUMAN HEALTH EVALUATION
  - 6.1.1 EXPOSURE ASSESSMENT
  - 6.1.2 TOXICITY ASSESSMENT
  - 6.1.3 RISK CHARACTERIZATION
- 6.2 ECOLOGICAL/ENVIRONMENTAL EVALUATION
  - 6.2.1 SPECIES/COMMUNITY/HABITAT CONSIDERATIONS
  - 6.2.2 PROBLEM FORMULATION
  - 6.2.3 EXPOSURE PATHWAYS/TARGET SPECIES
  - 6.2.4 ECOTOXICITY/STRESSOR RESPONSE ASSESSMENT
  - 6.2.5 RISK CHARACTERIZATION

7.0 SUMMARY AND CONCLUSIONS
- 7.1 SUMMARY
  - 7.1.1 NATURE AND EXTENT OF CONTAMINATION/IMPACTS
  - 7.1.2 FATE AND TRANSPORT
  - 7.1.3 RISK ASSESSMENT/ACTION LEVEL EXCEEDANCES
- 7.2 CONCLUSIONS
  - 7.2.1 DATA LIMITATIONS AND RECOMMENDATIONS FOR FUTURE WORK
  - 7.2.2 RECOMMENDED REMEDIAL ACTION OBJECTIVES

APPENDICES: ANALYTICAL DATA AND QA/QC RESULTS, RISK ASSESSMENT METHODS

FIGURES, TABLES, AND ATTACHMENTS AS REQUIRED

SUGGESTED FORMAT FOR EE/CA REPORT

EXECUTIVE SUMMARY

1.0 INTRODUCTION

2.0 SITE CHARACTERIZATION
- 2.1 SITE DESCRIPTION AND BACKGROUND
- 2.2 PREVIOUS REMOVAL ACTIONS
- 2.3 SOURCE, NATURE AND EXTENT OF CONTAMINATION
- 2.4 ANALYTICAL DATA
- 2.5 RISK EVALUATION

3.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES
- 3.1 DETERMINATION OF REMOVAL SCOPE
- 3.2 DETERMINATION OF REMOVAL SCHEDULE
- 3.3 PLANNED REMEDIAL ACTIVITIES

4.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES
- 4.1 EFFECTIVENESS
- 4.2 IMPLEMENTABILITY
- 4.3 COSTS

5.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

RECOMMENDED REMOVAL ACTION ALTERNATIVE (TO BE DEVELOPED BY THE AGENCIES TO ACCOMPANY EE/CA DOCUMENT DURING PUBLIC COMMENT PERIOD)

FIGURES, TABLES, AND ATTACHMENTS AS REQUIRED

COPY

IN THE MATTER OF: Area-Wide Investigation of Contamination from Phosphate Mining in Southeastern Idaho	))))))))))))	ADMINISTRATIVE CONSENT ORDER FOR WORK RELATED TO AREA-WIDE INVESTIGATION

I. PARTIES

1. The parties to this Administrative Consent Order ("Order") are as follows:

-Idaho Department of Environmental Quality ("IDEQ")

-United States Environmental Protection Agency ("EPA")

-United States Department of Agriculture, Forest Service ("USFS")

-Bureau of Land Management, United States Department of the Interior ("BLM")

-Fish and Wildlife Service, United States Department of the Interior ("USFWS")

-Bureau of Indian Affairs, United States Department of the Interior ("BIA")

-Shoshone-Bannock Indian Tribes

(The above 7 parties are collectively referred to as the "Agencies")

-J.R. Simplot Company

-Nu-West Industries, Inc.

-Rhodia, Inc.

-FMC Corporation

-P4 Production, L.L.C.

(The above 5 parties are collectively referred to as the "Companies")

II. BACKGROUND

2. Effective June 20, 2001, the parties entered into a Consent Order/Administrative Order on Consent ("CO/AOC") in which the Companies agreed to pay certain costs of the Agencies to conduct an area-wide investigation of contamination from phosphate mining in southeastern Idaho. The CO/AOC allows the assignment of tasks associated with the area-wide investigation to the Companies and provides that the work associated with those tasks "will be performed pursuant to

enforceable agreements that will be separately executed and made subject to [the] CO/AOC". CO/AOC, Section VII.

III. JURISDICTION AND GENERAL PROVISIONS

3. This Order is entered into voluntarily by the Agencies and the Companies. This Order governs the authorization and performance of work by the Companies that may be assigned to the Companies by the Agencies, and which the Companies accept, during IDEQ's Area-Wide Investigation into contamination from phosphate mining operations in Southeast Idaho, under the separate agreements contemplated by Section VII of the CO/AOC, if and when such agreements are executed (the Work Agreements"), and incorporates by reference the provisions of the CO/AOC, where appropriate. The Agencies retain complete discretion as to what specific tasks under the CO/AOC may be assigned to the Companies, and any decision to decline to allow the Companies to conduct specific tasks under the CO/AOC, or to disapprove a Notice of Commitment from the Companies is not reviewable under the Dispute Resolution provisions of this Order or of the CO/AOC, and is not subject to judicial review. Any Work Agreements entered into shall be deemed executed and become effective when a Notice of Commitment to Undertake Work (the "Notice of Commitment"), substantially in the form set forth in Exhibit 1, is executed by the Companies' Project Coordinator and approved in writing by IDEQ. Upon execution by the Companies' Project Coordinator and acceptance by IDEQ, such Work Agreements become an enforceable part of this Order and the CO/AOC. This Order shall have no force and effect except as it applies to the authorization and performance of specific Work Agreements. By signing this Order, the undersigned representatives of the Companies certify that they

are fully authorized to enter into the terms and conditions of this Order and to bind the parties they represent to this document, and further authorize the Companies' Project Coordinator to bind them to a Notice of Commitment.

4. This Order is issued pursuant to the authorities described in Section IV of the CO/AOC.

5. The Companies agree to comply with and be bound by the terms of this Order. The Companies will not contest the basis or validity of this Order or its terms.

IV. PARTIES BOUND

6. This Order applies to and is binding upon the Agencies and the Companies. Any change in ownership or corporate status of Companies including, but not limited to, any transfer of assets or real or personal property shall not alter the Companies' responsibilities under this Order. The Companies are jointly and severally liable for carrying out all activities required by any Work Agreement executed pursuant to this Order. Compliance or noncompliance by one or more Companies with any provision of this Order or any Work Agreement shall not excuse compliance by any of the other Companies.

7. The Companies shall provide their contractors, subcontractors, and representatives with a copy of this Order and any Work Agreements executed pursuant to this Order, and shall assure compliance with this Order and any such Work Agreements. The Companies shall be responsible for any noncompliance with this Order or any Work Agreements by such persons.

V. DEFINITIONS

8. Terms used in this Order that are defined in the Comprehensive Environmental Response, Compensation and Liability Act, as amended, 42 U.S.C. 9601 et seq. and the National Oil and Hazardous Substances Pollution Contingency Plan, as amended, 40 C.F.R. Part 300, shall have the definitions contained therein. The term "days" refers to calendar days unless business days are specifically noted.

VI. FACTUAL BACKGROUND, CONCLUSIONS OF LAW AND DETERMINATIONS

9. The relevant factual background is set forth in Section V of the CO/AOC.

VII. DESIGNATION OF CONTRACTOR, PROJECT COORDINATOR, AND ON-SCENE COORDINATOR

10. The Companies shall perform the tasks required by any Work Agreement entered into pursuant to this Order or retain contractors to do so. The Companies shall notify the IDEQ of the names and qualifications of any contractors or subcontractors retained to perform the tasks under a Work Agreement within 15 days of IDEQ's approval of a Notice of Commitment to perform such tasks. The Agencies retain the right to disapprove of the contractors and/or subcontractors retained by the Companies, or of the Companies' choice of themselves to undertake the tasks. In the event the Agencies disapprove of the contractors and/or subcontractors retained by the Companies, or of the Companies' choice of themselves to undertake the designated tasks, then the Companies, in their discretion, may either identify an alternative contractor or, within 5 business days of receipt of such disapproval, elect not to perform such tasks and, in that case, may terminate the Work Agreement without penalty.

11. The Companies' Project Coordinator shall be responsible for administration of all the Companies' actions required by the Order. The Companies' Project Coordinator is:

Scott Sprague
Agrium Conda Phosphate Operations
3010 Conda Road
Soda Springs, ID 83276
Telephone: (208)-574-2420, Ext. 30
E-Mail: ssprague@agrium.com

The Project Coordinator shall be readily available at all reasonable times while work is being performed under a Work Agreement. The Agencies retain the right to disapprove of any Project Coordinator named by the Companies. Receipt by the Companies' Project Coordinator of any notice or communication from the on-scene coordinator ("OSC") relating to this Order or any Work Agreement shall constitute receipt by all Companies. The Companies' Project Coordinator is authorized to sign a Notice of Commitment on behalf of the Companies in the form provided in Exhibit 1.

12. The following shall be the OSC for the Agencies:

Richard Clegg
State of Idaho
Department of Environmental Quality
15 West Center
Soda Springs, Idaho 83278
(208) 547-1940
(208) 547-3989 (fax)

13. The Companies shall direct all submissions required by this Order or any Work Agreement to the OSC, with a copy to the following Agency personnel:

Jeffrey L. Jones
USDA Forest Service
Soda Springs, Idaho 83276
(208) 547-4356
fax: (208) 239-7624
jjones13@fs.fed.us

R. Matthew Wilkening
EPA - Region 10
Idaho Operations Office
1435 N Orchard St.
Boise, ID 83706

Peter Oberlindacher
Geologist
BLM Idaho State Office
1387 South Vinnell Way
Boise, Idaho 83709-1657
Tel: 208-373-3884

Daniel Noble
Environmental Scientist
Bureau of Indian Affairs
1849 C Street, NW
MS 4513 MIB
Washington, DC 20240
Tel (202) 208-3607
Fax (202) 208-1605
danielnoble@bia.gov

Susan Burch
Contaminants Specialist
USFWS - Idaho Snake River Basin Office
1387 S. Vinell Way, Room 368
Boise, Idaho 83709

Selenium Project Manager
Shoshone-Bannock Tribes
P.O. Box 306
Fort Hall, Idaho 83203

The Agencies and Companies shall have the right, subject to paragraph 11of this

Order, to change their designated OSC or Project Coordinator. The Companies shall

notify the Agencies 15 days before such a change is made. This initial notification may be orally made but it shall be promptly followed by a written notice.

14. The OSC will coordinate and transmit all Agency comments on all deliverables, reports, or other communications, to the Companies. The OSC will also serve as point of contact for the Companies' Project Coordinator, as work proceeds under any Work Agreement executed pursuant to this Order. Approvals required under this Order or any Work Agreement shall be communicated to the Companies in writing by the OSC. The OSC's coordination with the Agencies regarding communications with the Companies is governed by the Agencies' July 15, 2000 Memorandum of Understanding.

15. The OSC shall have the authority vested by the NCP and as set forth in Section IV of the CO/AOC. The OSC shall also have the authority to sign the Notice of Commitment on behalf of the Agencies following coordination with the Agencies pursuant to the Agencies' July 15, 2000 Memorandum of Understanding.

VII. WORK TO BE PERFORMED

16. WORK PLAN AND IMPLEMENTATION

16.1 The OSC or the Mining Companies at any time may initiate informal discussions as to specific tasks contemplated by the CO/AOC that may be appropriate for the Companies to undertake. The OSC shall establish a schedule and the technical requirements for such discussions, including the submission of appropriate work plans. The requirements set by the OSC for such discussions are not subject to dispute resolution or judicial review. If these informal discussions result in agreement, then the OSC shall issue a formal Request for Commitment from the Mining

Companies to perform the specific tasks. Within five (5) business days of the date of that Request the Companies will either decline to undertake the tasks or submit an executed Notice of Commitment in the form provided in Exhibit 1. All necessary work plans must be attached to the Notice of Commitment.

16.2 The OSC may approve, disapprove or require revisions to any Notice of Commitment, including attached materials, submitted pursuant to paragraph 16.1 of this Order. If the OSC requires revisions, the Companies shall either submit a revised Notice of Commitment within 14 days of receipt of the OSC's notification of the required revisions or, in the Companies' sole discretion, decline to perform the subject tasks and withdraw the Notice of Commitment without penalty.

16.3 Once a Notice of Commitment is approved, constituting an effective Work Agreement, the Companies shall complete the tasks authorized by the approved Work Agreement in accordance with the schedule contained in the approved Work Agreement.

16.4 The OSC may approve, disapprove, require revisions to, or modify any document submitted in connection with the implementation of the approved Work Agreement pursuant to Paragraph 16.3 of this Order. If the OSC requires revisions, the Companies shall submit a revised document within 21 days of receipt of the OSC's notification of the required revisions. Once approved, or approved with modifications, any tasks, the schedule, and any subsequent modifications shall be fully enforceable under this Order. The Companies shall notify the OSC at least forty-eight (48) hours prior to performing any field work pursuant to an approved Notice of Commitment and shall keep the OSC fully informed regarding the implementation of the work.

17. HEALTH AND SAFETY PLAN

17.1 On a schedule established in the Work Agreement, the Companies shall submit to the OSC for review and comment a plan that ensures the protection of the public health and safety during performance of work under the Work Agreement. This plan shall be prepared in accordance with EPA's current Standard Operating Safety Guide. In addition, the plan shall comply with all current applicable Occupational Safety and Health Administration (OSHA) regulations found at 29 C.F.R. Part 1910.

18. QUALITY ASSURANCE AND SAMPLING

18.1 All sampling and analyses performed pursuant to any Work Agreement shall be subject to the OSC's direction and approval, and conform to EPA guidance regarding sampling, quality assurance/quality control (QA/QC), data validation, and chain-of-custody procedures. The Companies shall ensure that the laboratory used to perform the analyses participates in a QA/QC program that complies with the appropriate EPA guidance. The Companies shall follow all relevant EPA guidance documents as guidance for QA/QC and sampling including: "Quality Assurance/Quality Control Guidance for Removal Activities: Sampling QA/QC Plan and Data Validation Procedures", OSWER Directive Number 9360.4-01; "Environmental Response Team Standard Operating Procedures", OSWER Directive Numbers 9360.4-02 through 9360.4-08;

18.2 Upon request by the OSC, the Companies shall have such a laboratory analyze samples submitted by the OSC for quality-assurance monitoring. The Companies shall provide to the OSC the quality assurance/quality control

procedures followed by all sampling teams and laboratories performing data collection and/or analysis.

19. REPORTING

19.1 The Companies shall submit a written progress report to the OSC concerning actions undertaken pursuant to any Work Agreement every 30 days after the date the OSC signs the Notice of Commitment, until receipt of the Notice of Completion for that work as provided for in Paragraph 48, unless otherwise directed by the OSC, in writing. These reports shall describe all significant developments during the preceding period, including the actions performed and any problems encountered, analytical data received during the reporting period, and the developments anticipated during the next reporting period, including a schedule of actions to be performed, anticipated problems, and planned resolutions of past or anticipated problems.

20. ACCESS TO PROPERTY AND INFORMATION

20.1 The Companies shall provide and/or obtain the access necessary to implement any Work Agreement executed pursuant to this Order, and provide access to all records and documentation related to the actions conducted pursuant to any Work Agreement. Such access shall be provided to the Agencies' employees, contractors, and representatives. These individuals may move freely in any area where work is to be performed pursuant to any Work Agreement.

20.2 Where tasks under a Work Agreement are to be performed in areas not owned by, or in possession of, the Companies, the Companies shall use their best efforts to obtain all necessary access agreements within a time specified, in writing, by the OSC. If unable to obtain such agreements, Companies shall immediately

notify the OSC in writing of their efforts to obtain access. The Agencies may exercise their respective authorities to obtain the access necessary to effectuate this Order or any Work Agreement.

20.3 The Companies shall submit to the OSC, upon receipt, the results of all data related to any Work Agreement executed pursuant to this Order, and, upon request, any raw data upon which such results are based.

21. RECORD RETENTION, DOCUMENTATION, AVAILABILITY OF INFORMATION

21.1 The Companies shall preserve all documents and information relating to work performed under any Work Agreement executed pursuant to this Order by or for the Companies pursuant to a Work Agreement for ten (10) years following termination of this Order. After the end of this ten (10) year period and thirty (30) days before any document or information is destroyed, the Companies shall notify the OSC that such documents and information are available for inspection, and, upon request, shall provide the originals or copies of such documents and information to the OSC. In addition, the Companies shall provide documents and information retained under this Section at any time before expiration of the ten (10) year period at the written request of the OSC. At any time after the completion of the tasks required pursuant to a Work Agreement and before the expiration of the ten (10) year period, the Companies may tender or forward documents or information retained under this Paragraph to the OSC, together with a certification attesting that all documents and information relating to the work are being surrendered, which shall satisfy the Companies' obligations under this Paragraph.

21.2 The Companies may assert a business confidentiality claim pursuant to 40 C.F.R. § 2.203(b), or, with respect to state law claims, Idaho Code Section 9-342A and IDAPA 58, Title 01, Chapter 21, with respect to part or all of any information submitted to the OSC pursuant to this Order, provided such claim is allowed by Section 104(e)(7) of CERCLA, 42 U.S.C. § 9604(e)(7) or applicable state law. Analytical and other data specified in Section 104(e)(7)(F) of CERCLA shall not be claimed as confidential by the Companies. The Agencies shall disclose information covered by a business confidentiality claim only to the extent permitted by, and by means of, the procedures set forth at 40 C.F.R. Part 2, Subpart B or, with respect to state law claims, Idaho Code Section 9-342A and IDAPA 58, Title 01, Chapter 21. If no such claim accompanies the information when it is received by the OSC the Agencies may make it available to the public without further notice to Companies.

22. COMPLIANCE WITH OTHER LAWS

22.1 The Companies shall perform all actions required pursuant to any Work Agreement executed pursuant to this Order in accordance with all applicable local, state, and federal laws and regulations except as provided in Section 121(e) of CERCLA, 42 U.S.C. § 9621(e), and 40 C.F.R. § 300.415(i).

23. EMERGENCY RESPONSE AND NOTIFICATION OF RELEASES

23.1 If any incident, or change in conditions, caused by or resulting from, in whole or in part, the actions conducted by or for the Companies pursuant to any Work Agreement executed pursuant to this Order, causes or threatens to cause an additional release of hazardous substances from the Site or an endangerment to the public health, welfare, or the environment, the Companies shall immediately take all

appropriate action. The Companies shall take these actions in accordance with all applicable provisions of this Order and any Work Agreement, including, but not limited to, the Health and Safety Plan, in order to prevent, abate, or minimize such release or endangerment caused or threatened by the release. The Companies shall also immediately notify the OSC. If the OSC is not available, the Companies shall notify the EPA Regional Duty Officer, Emergency Planning and Response Branch, EPA Region 10, (206) 553-1263, of the incident or conditions. If the Companies fail to respond, the Agencies may respond to the release or endangerment and reserve the right to pursue cost recovery.

23.2 In addition, in the event of any additional release of a hazardous substance under the preceding Paragraph, the Project Coordinator shall immediately notify the OSC and the National Response Center at telephone number (800) 424-8802. The Companies shall submit a written report to the OSC within seven (7) days after each release, setting forth the events that occurred and the measures taken or to be taken to mitigate any release or endangerment caused or threatened by the release and to prevent the reoccurrence of such a release. This reporting requirement is in addition to, not in lieu of, any other reporting obligations under federal, state, or local law or regulations, including but not limited to Section 103(c) of CERCLA, 42 U.S.C. § 9603(c), and Section 304 of the Emergency Planning and Community Right-To-Know Act of 1986, 42 U.S.C. § 11001, et. seq.

VIII. AUTHORITY OF THE ON-SCENE COORDINATOR

24. The OSC shall be responsible for overseeing the Companies' implementation of any Work Agreement executed pursuant to this Order. The OSC shall have the authority vested in an OSC by the NCP, including the authority to halt, conduct, or direct any work required by any Work Agreement executed pursuant to this Order. Environmental Protection and Health Act, Idaho Code 39-101-130; Idaho Hazardous Waste Management Act of 1983, Idaho Code 39-4401-4432. Unavailability of the OSC shall not be cause for stoppage of work unless specifically directed by the OSC.

IX. REIMBURSEMENT OF COSTS

25. Costs incurred by the Agencies in connection with work performed under any Work Agreement executed pursuant to this Order, including costs to enforce this Order or any Work Agreement, shall be reimbursed as provided in Section VI of the CO/AOC.

X. DISPUTE RESOLUTION

26. The Parties to this Order shall attempt to resolve expeditiously and informally any disagreements concerning implementation of this Order and any Work Agreement. If the Parties fail to resolve a dispute informally, the Dispute Resolution procedure in the following Paragraph shall apply, except with respect to disputes about penalties to be assessed or a demand for indemnity under this Order, which shall be governed by the dispute resolution provisions of the CO/AOC.

27. If a dispute is not resolved informally, and if the Companies intend to invoke the Dispute Resolution provisions of this Order, the Companies' Project Coordinator shall notify the OSC in writing of their objections. The Companies' written objections shall define the dispute, state the basis of objections, and be sent by facsimile, overnight mail or some equivalent service. IDEQ and the Companies then have an additional fourteen (14) days to reach agreement. If an agreement is not reached within this time period, the Companies may, within seven (7) days, request a final determination by IDEQ, and within the same period may submit additional documentation to IDEQ for review prior to the final resolution of the dispute. IDEQ's final determination shall be communicated to the Companies by IDEQ's Program Administrator, Solid Waste Management Program, and IDEQ shall provide a written explanation to the Companies of IDEQ's decision. All material submitted or exchanged during the Dispute Resolution process shall become part of the administrative record. IDEQ's coordination with the other Agencies regarding disputes with the Companies is governed by the Agencies' July 15, 2000 Memorandum of Understanding.

28. The Companies shall proceed in accordance with the final decision regarding the matter in dispute. If the Companies do not perform work in accordance with IDEQ's final decision, the Agencies may perform the work and/or seek any other appropriate relief.

29. While a matter is pending in Dispute Resolution, the Companies are not relieved of the obligations to perform activities not related to the dispute.

30. The Agencies may withdraw prior approval of tasks authorized to be conducted by the Companies under a Work Agreement. In that event, the Work

Agreement governing those tasks shall be deemed terminated, in whole or in part, as applicable. Such a decision by the Agencies is not subject to dispute resolution or judicial review. However, any disputes about penalties to be assessed or a demand for indemnity as a result of the Agencies' decision to withdraw approval of such tasks shall be governed by the dispute resolution provisions of the CO/AOC.

XI. FORCE MAJEURE

31. The Companies agree to perform all requirements under any Work Agreement executed pursuant to this Order within the time limits established in the Work Agreement, unless the performance is delayed by a Force Majeure. For purposes of this Order and any Work Agreement executed hereunder, a Force Majeure is defined as any event arising from causes beyond the control of the Companies, including, but not limited to, their contractors and subcontractors, that delays or prevents performance of any obligation under any Work Agreement executed pursuant to this Order, despite the Companies' best efforts to fulfill the obligation. Force Majeure does not include financial inability to complete the work or increased cost of performance.

32. The Companies shall notify the OSC orally within 24 hours after the event, and in writing within 7 days after the Companies become or should have become aware of events which constitute a Force Majeure. Such notice shall: identify the event causing the delay and anticipated length of delay, including necessary demobilization and re-mobilization; state the measures taken or to be taken to minimize the delay; and estimate the timetable for implementation of the measures. The Companies shall take all reasonable measures to avoid and minimize the delay. Failure to comply with the

notice provision of this action shall waive any claim of Force Majeure by the Companies.

33. If the OSC determines a delay in performance of a requirement under any Work Agreement executed pursuant to this Order is or was attributable to a Force Majeure, the time period for performance of that requirement shall be extended as deemed necessary by the OSC. Such an extension shall not alter the Companies' obligation to perform or complete other tasks required by the Order which are not directly affected by the Force Majeure.

XII. STIPULATED PENALTIES

34. For each day, or portion thereof, that the Companies fail to fully perform any requirement of any Work Agreement executed pursuant to this Order, in accordance with the schedule established pursuant to the Work Agreement, the Companies shall be liable for stipulated penalties in the amount of $1,000 for each day of non-compliance.

35. Upon receipt of written demand for payment of stipulated penalties by the OSC, the Companies shall make payment to IDEQ within 30 days. Interest at the Idaho statutory rate for interest on judgments, pursuant to Idaho Code Section 28-22-104, shall accrue on late payments from the date of the violation or act of non-compliance triggering the stipulated penalties.

36. Even if violations are simultaneous, separate penalties shall accrue for separate violations of this Order or any Work Agreement. Penalties accrue regardless of whether the OSC has notified the Companies of a violation or act of noncompliance. The payment of penalties shall not alter in any way the Companies' obligations to

complete the performance of the work required under any Work Agreement executed pursuant to this Order.

37. Nothing in this Order shall be construed as prohibiting, altering or limiting the ability of the Agencies to seek other remedies or sanctions. Should the Companies violate any portion of this Order or any Work Agreement, the Agencies may carry out the required actions unilaterally, pursuant to Section 104 of CERCLA, 42 U.S.C. § 9604, and/or may seek judicial enforcement of this Order or any Work Agreement executed pursuant to this Order.

XIII. RESERVATION OF RIGHTS

39. Except as specifically provided in this Order, nothing herein shall limit the power and authority of the Agencies to take, direct, or order all actions necessary to protect public health, welfare, or the environment or to prevent, abate, or minimize an actual or threatened release of hazardous substances, pollutants, or contaminants, or hazardous or solid waste. Further, nothing herein shall prevent the Agencies from seeking legal or equitable relief to enforce the terms of this Order or any Work Agreement, from taking other legal or equitable action as deemed appropriate and necessary, or from requiring the Companies in the future to perform additional activities pursuant to CERCLA or any other applicable law.

XIV. OTHER CLAIMS

40. By issuance of this Order, the Agencies assume no liability for injuries or damages to persons or property resulting from any acts or omissions of Companies. The Agencies shall not be deemed a party to any contract entered into by the Companies in carrying out actions pursuant to any Work Agreement executed pursuant to this Order.

41. This Order does not constitute a preauthorization of funds under Section 111(a)(2) of CERCLA, 42 U.S.C. § 9611(a)(2). The Companies waive any claim to payment under Sections 106(b), 107, 111, and 112 of CERCLA, 42 U.S.C. §§ 9606(b), 9607, 9611, and 9612, against the Hazardous Substance Superfund (Superfund), other than claims expressly reserved in the CO/AOC.

42. Nothing in this Order precludes the Agencies or the Companies from asserting any claims, causes of action or demands against any persons not parties to this Order for indemnification, contribution, or cost recovery.

XV. INDEMNIFICATION

43. The Companies agree to indemnify, save and hold harmless the Agencies, their officials, agents, contractors, subcontractors, employees, and representatives from any and all claims or causes of action: (A) arising from, or on account of, acts or omissions of Companies, the Companies' officers, heirs, directors, employees, agents, contractors, subcontractors, receivers, trustees, successors or assigns, in carrying out actions pursuant to any Work Agreement executed pursuant to this Order; and (B) for damages or reimbursement arising from or on account of any contract, agreement, or arrangement between (any one or more of) the Companies, and any persons for

performance of work on or relating to any Work Agreement executed pursuant to this Order, including claims on account of delays. In addition, the Companies agree to pay the Agencies all costs incurred by the them, including litigation costs arising from or on account of claims made against them based on any of the acts or omissions referred to in the preceding paragraph.

XVI. INSURANCE

44. At least seven (7) days prior to commencing any work under any Work Agreement executed pursuant to this Order, the Companies shall secure, and shall maintain for the duration of the Work Agreement, comprehensive general liability insurance and automobile insurance with limits of at least $5,000,000.00, combined single limit. Within the same time period, the Companies shall provide the OSC with certificates of such insurance. If the Companies demonstrate by evidence satisfactory to the OSC that any contractor or subcontractor maintains insurance equivalent to that described above, or insurance covering some or all of the same risks but in an equal or lesser amount, then the Companies need provide only that portion of the insurance described above that is not maintained by such contractor or subcontractor.

XVII. MODIFICATION

45. Modifications to any report or analysis submitted pursuant to a Work Agreement, or extensions to any schedule established under a Work Agreement, may be made in writing by the OSC, or at the OSC's oral direction. If the OSC makes an oral modification, it will be memorialized in writing within 7 days; provided, however, that the effective date of the modification shall be the date of the OSC's oral direction.

Any modifications of the work to be performed by the Companies under a Work Agreement, to shorten the schedule for the work, or to other requirements of this Order or the Work Agreement may be made, in writing, by mutual agreement of the OSC and the Project Coordinator.

46. If the Companies seek permission to deviate from any approved Work Plan, schedule, Statement of Work or other task, the Companies' Project Coordinator shall submit a written request to the OSC for approval outlining the proposed modification and its basis.

47. No informal advice, guidance, suggestion, or comment regarding reports, plans, specifications, schedules, or any other writing submitted by the Companies shall relieve the Companies of their obligations to obtain such formal approval as may be required by this Order, and to comply with all requirements of this Order.

XVIII. NOTICE OF COMPLETION

48. When the Agencies determine, after review of the final document required under a Work Agreement, that all work required under that Work Agreement has been fully performed in accordance with the Work Agreement and this Order, the OSC will provide a notice of completion of that Commitment to the Companies' Project Coordinator. If the Agencies determine that any work has not been completed in accordance with the Work Agreement or this Order, the OSC will notify the Companies' Project Coordinator, provide a list of the deficiencies, and require that the Companies correct such deficiencies. The Companies shall correct the deficiencies and submit a modified final document in accordance with the OSC's notice. Failure by the Companies to correct the deficiencies identified shall be a violation of this Order. The

OSC's coordination with the Agencies regarding the issuance of a Notice of Completion to the Companies is governed by the Agencies' July 15, 2000 Memorandum of Understanding.

XIX. SEVERABILITY

49. If a court issues an order that invalidates any provision of this Order or any Work Agreement, or finds that the Companies have sufficient cause not to comply with one or more provisions of this Order or any Work Agreement, the Companies shall remain bound to comply with all provisions of this Order or any Work Agreement not invalidated or determined to be subject to a sufficient cause defense by the court's order.

XX. TERMINATION

50. This Order terminates upon termination of the CO/AOC.

XXI. EFFECTIVE DATE

51. This Order may be executed in any number of counterparts, each of which when executed and delivered to IDEQ shall be deemed to be an original, but such counterparts shall together constitute one and the same document. This Order shall be effective on the date it has been signed by all the parties and approved by the Attorney General of the United States or her/his designee.

IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

By: _____
C. Stephen Allred, Director

9/30/02
Date

ENVIRONMENTAL PROTECTION AGENCY

By: _____

Michael F. Gearheard
Director, Office of Environmental Cleanup
EPA Region 10

30 August 2002
Date

UNITED STATES DEPARTMENT OF INTERIOR
BUREAU OF LAND MANAGEMENT

By: Michael A. Ferguson

Acting Idaho State Director
Bureau of Land Management

7/15/02
Date

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

By: _____
Jack G. Troyer
Regional Forester
U.S.D.A. Forest Service, Region 4

Date: 8/7/02

UNITED STATES DEPARTMENT OF INTERIOR
BUREAU OF INDIAN AFFAIRS

By: _____
for Terry Virden
Director, Office of Trust Responsibilities
Bureau of Indian Affairs

8/5/02
Date

UNITED STATES DEPARTMENT OF INTERIOR
FISH AND WILDLIFE SERVICE

By: Rowan W. Gould

Anne Badgley
Regional Director, Western Region
Fish and Wildlife Service

8/5/02
Date

I hereby concur with the exercise by the United States Department of Agriculture Forest Service, the Department of the Interior, Bureau of Land Management, Bureau of Indian Affairs, and Fish and Wildlife Service, and the United States Environmental Protection Agency of their authority to enter into the foregoing Administrative Consent Order.

U.S. Department of Justice
Environment and Natural Resources Division

By: Catherine R. McCabe

Name: Catherine R. McCabe

Title Deputy Section Chief, EES

Date: 3/5/03

SHOSHONE-BANNOCK TRIBES

By: _____

Blaine J. Edmo
Chairman
Fort Hall Business Council

July 31, 2002
Date

J. R. SIMPLOT COMPANY

By: _____

Name: RONALD N. GRAVES

Title: SENIOR VICE-PRESIDENT, SECRETARY AND CHIEF LEGAL OFFICER

2/6/02

Date

NU-WEST INDUSTRIES, INC.

By: Charles H Ross

Name: Charles H Ross

Title: Vice President

Feb 27, 2002

Date

RHODIA, INC.

By: R. Robert Briggs

Name: R. Robert Briggs

Title: Director of Manufacturing Services

February 19, 2002

Date

FMC CORPORATION

By: _____

Name: John T. Bartholomew

Title: Director, Phosphorus Equity Division

6/18/02

Date

P4 PRODUCTION, L.L.C.

By: Bruce E Pallante

Name: BRUCE E PALLANTE

Title: ASSISTANT SECRETARY P4 LLC

mMS

Feb 22, 2002

Date

Exhibit 1

Notice of Commitment to Undertake Work

Pursuant to the _____, 2001, Administrative Consent Order ("Order") between

-Idaho Department of Environmental Quality ("IDEQ")
-United States Environmental Protection Agency ("EPA")
-United States Department of Agriculture, Forest Service ("USFS")
-Bureau of Land Management, United States Department of Interior ("BLM")
-Fish and Wildlife Service, United States Department of Interior ("USFWS")
-Bureau of Indian Affairs, United States Department of Interior ("BIA")
-Shoshone-Bannock Indian Tribes
(The above 7 parties are collectively referred to as the "Agencies")

and

-J.R. Simplot Company
-Nu-West Industries, Inc.
-Rhodia, Inc.
-FMC Corporation
-P4 Production, L.L.C.
(The above 5 parties are collectively referred to as the "Companies")

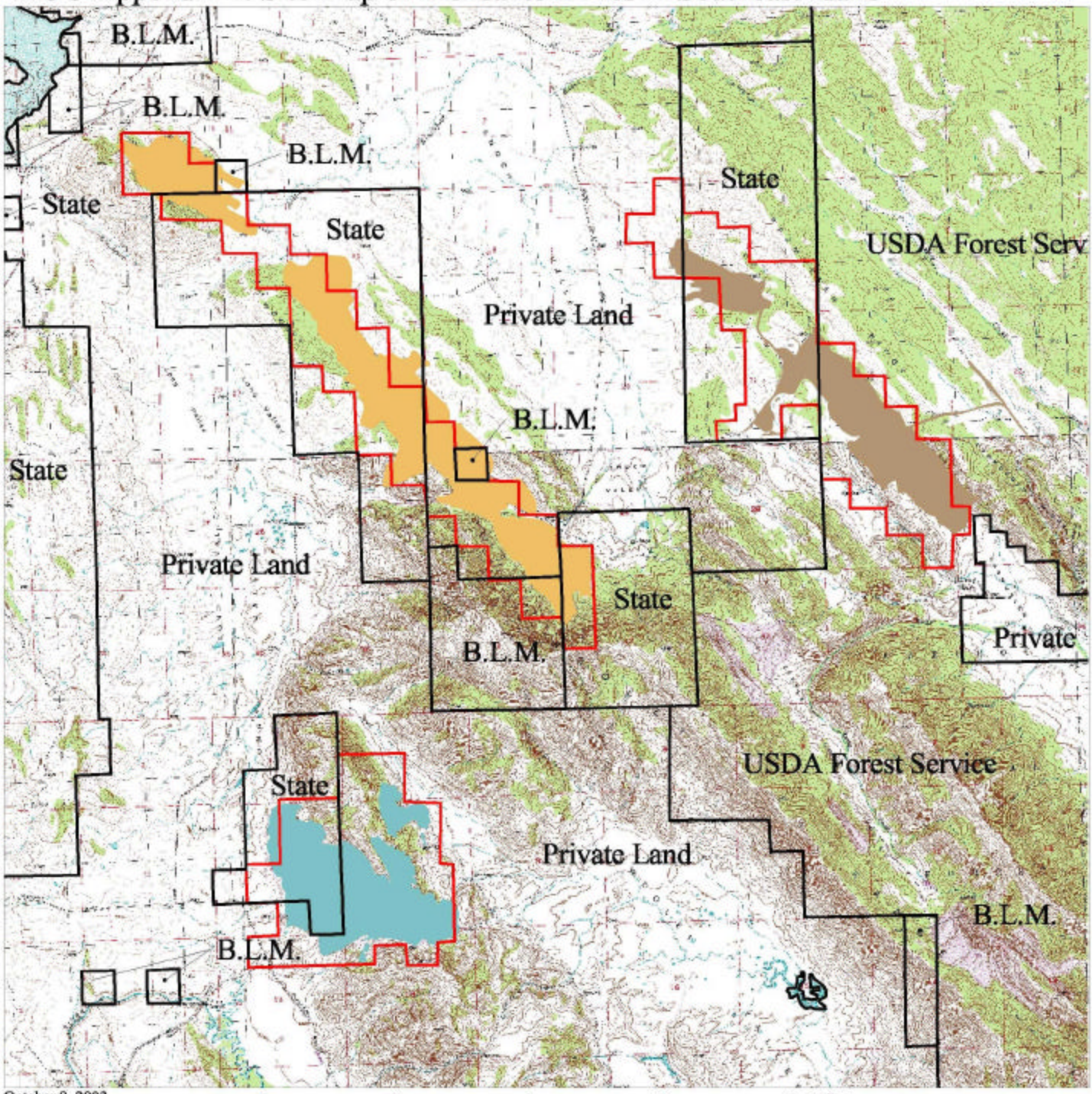
The Companies agree to conduct the tasks described in the attached [Insert name of document specifying the work to be performed.] on the schedule provided therein [this schedule must address all aspects of the work, including the submission of a sampling and analysis plan and quality assurance plan], and that the Companies' performance of such work shall be governed by the terms and conditions of the Order.

_____ By_____
Date Project Coordinator for the Companies

On behalf of the Agencies, IDEQ hereby accepts the Companies commitment to conduct the tasks described in the [insert name of document specifying work to be performed].

_____ By_____
Date Rick Ciegg
Area-Wide On-Scene Coordinator

AOC Appendix 4: Site Map of Monsanto Mines in Southeast Idaho



October 8, 2003

1 0 1 2 3 Miles

2 0 2 4 Kilometers

N

Restriction of Liability: Neither the State of Idaho nor the Idaho Department of Environmental Quality, nor any of their employees make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness or usefulness of any information or data provided. Metadata is provided for all data sets, and no data should be used without first reading and understanding its limitations. The data could include technical inaccuracies or typographical errors. The Department of Environmental Quality may update, modify, or revise the data used at any time, without notice.

Legend

- Ownership Boundaries
- Monsanto Mine Boundaries
- Ballard Mine Area of Operations
- Enoch Valley Mine Area of Operations
- Henry Mine Area of Operations

Appendix B
Standard Operating Procedures

SOP-5, "Groundwater Level Data Collection
SOP-NW-5.3, "Collection of Groundwater Quality Samples"
SOP-NW-7.2, "Collection of Soil Samples"
SOP-NW-9.1, "Collection of Surface Water Samples"
SOP-NW-9.2a, "Surface Water Flow Measurements Using Man-Portable Devices or Estimation Techniques"
SOP-NW-9.3, "Collection of Sediment Samples"
SOP-NW-18.1, "Data Validation"
SOP-NW-19.0, "Collection of Vegetation Samples"
SOP-45, "Collection of Fish Samples: Electrofishing and Netting"

SOP-5

Groundwater Level Data Collection

MWH
MONTGOMERY WATSON HARZA

SOP-5

GROUNDWATER LEVEL DATA COLLECTION

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 PURPOSE

The purpose of this technical procedure is to establish a uniform and consistent procedure for measuring water levels in wells, piezometers and boreholes.

The groundwater level measurement procedures presented in the following sections were developed using standard industry-accepted practices, as well as international organization and agency guidelines and standard practices. The same care must be exercised in implementing field investigations and sampling events that are exercised in planning the program design and analyzing samples in the laboratory. No analytical result is better than the sample from which it was obtained.

Specific organizations and agencies with guidelines and standard procedures that were used include:

- U.S. Environmental Protection Agency (EPA)
- State of Nevada (U.S.) Division of Environmental Protection (NDEP)
- American Society of Testing and Materials (ASTM)

2.0 DEFINITIONS

2.1 Electric Water Level Sounder (EWS)

An electronic water-level sounder (EWS) is an instrument for measuring water levels in wells, piezometers and boreholes. An EWS is essentially an open circuit involving an ammeter and battery mounted on a reel to which an insulated two-wire electric cord (calibrated by length) is wound. The circuit is closed, and a buzzer sounds when the electrodes on the probe are immersed in water. Depth to water is recorded at the depth where the buzzer sounds.

3.0 DISCUSSION

Measurement of static water levels may constitute a separate task or be performed in conjunction with groundwater sampling. Prior to any purge sampling activity at each monitor well, a water level measurement is required to be taken. Measurement of the static water level is important in determining the hydrogeologic characteristics of the groundwater system.

Prior to taking the EWS to the field, check that the EWS is functioning properly and that the batteries are in working order by turning instrument on and pushing the test button located on the side of the instrument. Also verify that the probe is functioning properly by submerging it in tap water. Both the audio and visual signals should function.

Decontaminate the probe and cord of the EWS using Alconox or equivalent non-phosphate detergent and distilled water. Rinse a minimum of three (3) times with distilled water. At a minimum decontaminate the probe and the length of reel you believe will be in the well plus an additional 3 meters.

The measurement will be referenced from the reference point marked on the top of the well casing; this is typically located on the north side of the casing. The measurement to the static water level in the well

will be to the nearest 0.01-foot interval. The measurement will be immediately repeated to verify the accuracy of the initial reading. The depth to water measurement will be compared in the field to previous measurements to verify that the measurement is reasonable. Record the depth to water level on the field logbook and Record of Water Level Readings form (see Appendix A). Other items to record include well identification number, casing diameter, vertical height of measuring point above ground surface, and time and date of measurement.

If depth to water is measured in an open borehole, note that the reference level is ground surface. Also note, especially if the ground is uneven, from which side of the borehole (i.e. north, etc.) the measurement was referenced.

In addition, it is good practice to periodically measure total well depth, since silt can build up and decrease the total depth of the well. Measure the total depth of the well following determination of static water level. If using the EWS to determine the depth of the well, make sure that the additional cable that will be submerged has been decontaminated and that the probe tip length is added to the total depth measured. Total well depth measurement also ensures that the well is in good condition to total depth.

4.0 EQUIPMENT AND MATERIAL

The following is a list of equipment that should be available in the field to perform water level measurements.

- Electric Water-level Sounder or Measuring Tape with a Wetable Surface
- Folding Rule
- Field logbook or field data sheet (see Record of Water Level Readings form, found in Appendix A)
- Data on Well Identification Number and Locations
- Spare Battery for Electric Water-level Meter
- Permanent, waterproof pens

5.0 PROCEDURES

- Record well identification number and measuring device type and serial number.
- Each water level sounder or measuring tape used for recording water levels should have the depth graduations checked with an independent folding rule or measuring tape for calibration prior to field use.
- Clean all downhole instruments and equipment before and after measurements between wells. Cleaning should be with a non-phosphate detergent rinse followed by a rinse with approved tap water, then rinse with organic free distilled or deionized water.

- Measure and record distance from ground level to top of casing or standpipe. Measure the vertical distance from the top of casing or standpipe to the point of the elevation survey mark (if different from top of casing or standpipe).

- If an EWS is used, turn on the EWS, check the battery, lower the wire into the borehole or standpipe and stop at the depth where the EWS meter indicates a repeatable, completed circuit. Record the length of the wire below the casing collar or top of the standpipe to the nearest 0.01-foot.

- If a measuring tape is used, lower the tape (with a weight attached) into the borehole. The tape must be lowered a sufficient depth into the well to ensure the wetable surface section of the tape is partially submerged. The total length of the tape within the well (from the top of casing or standpipe) and the length of the wetted surface to the submerged end of the tape will be recorded.

- Record date, time, well designation, measuring device and all measurements on a Record of Water Level Readings form (Appendix A), and bound logbook. The personnel making the measurement will initial or sign each measurement recorded. All water level measurement records will be maintained in the project records files.

6.0 REFERENCES

American Society of Testing and Materials (ASTM). 1994. *Standards on Ground Water and Vadose Zone Investigations*. Second Edition. ASTM Committee D-18 on Soil and Rock. Philadelphia, Pa.

American Society of Testing and Materials (ASTM), 1995. *ASTM Standards on Environmental Sampling*. PCN-03-418095-38, Philadelphia, Pa.

U.S. Environmental Protection Agency (EPA), 1994. *Standard Operating Procedures for Field Sampling Activities, Version 2*. EPA Region VIII, Denver, Colorado.

U.S. Environmental Protection Agency (EPA), 1995. *Standard Operating Procedures for Water Level and Non-Aqueous Phase Liquid (NAPL) Measurements in Boreholes and Monitoring Wells, Version 1*. EPA Region VIII, Denver, Colorado.

APPENDIX A

RECORD OF WATER LEVEL READINGS

RECORD OF WATER LEVEL READINGS

Job No. _____ **Project No.** _____ **Location** _____

Borehole No.	Date	Time	Measuring Device	Reading	Corrections Or Conversions	Water Level	Surf. Elev.	Water Level Elev.	By	Comments

SOP-NW-5.3

Collection of Groundwater Quality Samples

MWH
MONTGOMERY WATSON HARZA

SOP-NW-5.3

Collection of Groundwater Quality Samples

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

This technical procedure establishes methods for collecting groundwater samples for chemical analysis representative of aquifer water quality.

This technical procedure is designed to cover general techniques for obtaining valid, representative samples from groundwater monitoring wells. The scope is intended to provide guidance while preparing for and during actual field sampling activities. The specific methods to be used at each monitoring well are described in the applicable workplan or sampling analysis plan (SAP).

This technical procedure is applicable to all MWH personnel engaged in the collection of groundwater samples from wells for purposes of chemical analysis and are intended to be used in conjunction with a project-specific workplan or SAP.

2.0 DEFINITIONS

2.1 Dedicated Pump System

A dedicated pump system is a permanently installed device for removing water from a well. The system is not removed from the well and does not have the potential to become contaminated between uses.

2.2 Well Storage Volume

Well storage volume is defined as the volume of water enclosed by the well casing and screen gravel/sand pack under equilibrium conditions.

2.3 Bailer

A bailer is a tubular device, with a check-valve at the top and/or bottom, used for collecting and removing groundwater from wells. The three most common types of bailers are: Single check valve; double check valve; and “thief” or “messenger” samplers.

- A single check valve bailer will expose part of the sample to the atmosphere. The typical sample transfer occurs by inserting a tube into the bottom of the bailer, pushing up the check valve, which allows the water to be released into the sample container. If used for VOC sampling the bailer should have a sample cock or draft valve at or near the bottom of the sampler allowing withdrawal of the sample from the well below the exposed surface water. Otherwise, discard the first few inches of sample at the bottom of the bailer.

- The double check valve sampler allows for point source sampling at a specific depth. The liquid will pass through the sampler while it is descending until the desired depth is reached. Once retrieval of the sample commences, both check valves close simultaneously, thereby allowing the

specific depth to be sampled.

- The thief or messenger sampler also allows for point source sampling at a specific depth. A weighted messenger is dropped down the suspension line and closes the sampling vessel thus obtaining a sample at the desired depth.

To avoid potential sources of contamination, keep the bailer suspension lines off the ground and away from any other potentially contaminating sources to minimize the possibility of contaminants being carried down into the well. If needed, a decontaminated tarp or plastic bag is recommended for storage of the bailer suspension line.

2.4 Non-Dedicated Sampling Apparatus

A non-dedicated sampling apparatus is sampling equipment that is not used solely for collection of groundwater samples from a single well. This term is also used to describe equipment that is only used for sampling a single well, but is removed from the well and could potentially become contaminated.

2.5 Groundwater Sample

A groundwater sample is defined as water acquired from a well for chemical analyses that is representative of groundwater within the aquifer or the portion of the aquifer being sampled.

2.6 Positive Pressure Pump

A positive pressure pump is a device for removing water from a well by forcing water to the surface through positive pressure when operated below the water level in a well. A positive pressure pump may be operated electrically, mechanically, or by air/nitrogen pressure. Submersible impeller, bladder, and check valve pumps are common types of positive pressure pumps.

2.7 Suction Lift Pump

A suction lift pump is a device for removing water from well by negative pressure (suction). Direct line, peristaltic and centrifugal pumps are the three types of suction lift pumps. The limitation for lifting water by suction is usually 20 to 25 feet. These pumps are only acceptable for non-volatile analytes and analytes that are not affected by aeration or changes in pH. They are useful as purging devices for shallow groundwater wells.

Peristaltic pumps are preferred when a suction lift pump is required. This is the only suction lift pump, of the three mentioned above, in which the liquid being sampled moves entirely within the sample tubing. The groundwater sample never contacts the actual pump apparatus during sampling thus eliminating a possible source of sample contamination from the actual pump, lubricants, or parts.

Standard silicon tubing is the most commonly used sample tubing. Most pump manufacturers and rental companies offer acceptable tubing lined with TFE-fluorocarbons or Viton. The National Council of the Paper Industry for Air and Stream Improvement recommends medical grade silicon tubing for organic sampling;

however, it is limited to use over a restricted range of ambient temperatures. Standard silicon tubing uses an organic vulcanizing agent, which has been shown to leach into samples.

2.8 Sample Bottles

Sample bottles are containers specifically designed and prepared for storing liquid samples. Sample bottle type, material, size, and type of lid shall be as specified in the governing workplan or SAP. Sample bottles must be properly cleaned and prepared by a laboratory or the manufacturer in accordance with standard laboratory methods and procedures. Coordinate with selected analytical laboratory for bottle type and preparation requirements.

2.9 Acceptable Material

Acceptable materials are defined as pump systems that have minimal effect on water quality when used to obtain groundwater samples from wells. The use of pumps is dependent on the analyses being conducted on the acquired samples. The parts of pumps that will contact the groundwater sample contain only acceptable materials.

3.0 RESPONSIBILITIES

3.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the Project Manager and designated project secretary, all as described in this technical procedure.

3.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled and shipped to the appropriate laboratory as specified in project work documents and this technical procedure.

3.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Task Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, groundwater purging and sampling forms, generated data, and other associated and pertinent project information.

4.0 DISCUSSION

The following is a listing of general procedures that should be followed during every sampling event.

- Groundwater samples shall be collected in quantities and types as described in the governing workplan or SAP.
- Water level data collection (see MWH SOP-5 for appropriate procedure).
- Determination of well storage volume (see Section 5.2.1, below).
- All instruments used for field analyses should be calibrated in accordance with the manufacturer's instructions.
- All non-dedicated sampling equipment shall be decontaminated before and after each use.
- If so directed by the governing workplan or SAP, purge water and decontamination fluids shall be captured and contained for disposal.
- Samples shall be collected in properly prepared containers of the appropriate size and type, and all samples shall be appropriately labeled and sealed, as required by the governing workplan or SAP.
- Samples shall be stored and transported in coolers chilled to 4º Celsius or less. Sample handling and chain of custody shall be as specified in the governing workplan or SAP.
- The Groundwater Purging and Sampling Form (see Appendix A) and the field log book shall be used to document daily site activities and sample collection.
- All variations from established procedure shall be documented on the Groundwater Purging and Sampling Form (see Appendix A) and shall be approved by the Project Manager prior to proceeding with the work variation.

PROCEDURE

5.1 General Considerations

5.1.1 Decontamination

All non-dedicated sampling equipment that may contact the sample must be decontaminated before and after

each use unless it is disposable and being used for only a single well. Non-dedicated pumps or bailers require decontamination of internal and external parts prior to being lowered into the well. Non-dedicated equipment shall first be washed with clean tap water (whose chemistry is known and acceptable), non-phosphate detergent, and rinsed with clean tap water. For inorganic analytes a weak hydrochloric acid (HCl) or nitric acid (HNO_3) solution shall be used for the second wash. For organic analytes, reagent-grade methanol shall be used for the second wash. A final rinse with organic-free distilled/deionized water shall complete the decontamination. At a minimum, all acid and methanol wash solutions must be captured (see Section 5.5.1, below).

5.1.2 Sample Quantities, Types, and Documentation

Samples shall be collected in quantities and types as specified in the governing workplan or SAP.

The Groundwater Purging and Sampling Form (Appendix A) and the field logbook shall be used to document daily site activities and sample collection (see Section 5.6, below). Samples shall be transferred to the analytical laboratory under formal chain of custody, which shall be documented and maintained in accordance with procedure.

5.1.3 Sample Containers

All sample bottles must be properly cleaned and prepared. Coordinate with selected analytical laboratory for appropriate sample bottle types and preparation requirements. All groundwater samples shall be labeled and sealed and immediately placed in coolers chilled to 4º Celsius or less with securely closed lids and custody seals on the outside of the cooler for storage and transport. Samples must be received by the analytical laboratory in sufficient time to conduct the requested analyses within the specified holding time.

5.1.4 Acceptable Materials

Stainless steel and fluorocarbon resin (Teflon, PTFE, FEP, or PFA) are acceptable materials that may contact groundwater samples. Glass is an acceptable material for contacting samples except when silica or fluoride analyses are to be performed. Plastics (PVC, polyethylene**,** polypropylene, tygon) are an acceptable material for contacting samples when the analyses are for inorganic analytes (metals, radionuclides, anions, cations).

5.1.5 Sample Acquisition

Groundwater samples shall be removed from the well with the use of a permissible pump or bailer. Electric positive-pressure pumps, as defined in Section 3.6, made of acceptable materials are permissible to use for acquiring any groundwater sample. Air/nitrogen pressure activated positive-pressure pumps made of acceptable materials are permissible to use for acquiring any groundwater sample if the air/nitrogen does not contact the sample. Positive-pressure pumps operated by mechanically forcing water through check valves are permissible for acquiring groundwater samples. Bailers made of acceptable materials are permissible for acquiring groundwater samples.

Peristaltic pumps and airlift pumps are not preferred for acquiring groundwater samples but are permissible when samples are to be analyzed for analytes that are not volatile, are not affected by aeration, and are not affected by changes in pH.

Other types of pumps (peristaltic, centrifugal, air lift, recirculation, etc.) may be used for purging groundwater from wells prior to sample acquisition, if: (1) pump materials contacting well water are acceptable; (2) pumping does not aerate or change the pH of the remaining well water; and (3) pumped water does not mix with remaining well water during pumping or after the pumping is stopped.

5.2 Equipment And Materials

If wells are equipped with dedicated pump systems, equipment to operate the dedicated pump systems (i.e., air compressor, compressed air or nitrogen cylinders, electric generator, etc.) as well as non-dedicated sampling apparatus, such as surface discharge tubing and valves, may be necessary.

If wells do not have permissible and dedicated pump systems, permissible pump systems or bailers and accessories of small enough diameter to enter the wells will be necessary. All equipment that could contact the sample shall be made of acceptable materials.

Sample bottles and preservatives appropriate for the parameters to be samples will be necessary. Coordinate with selected analytical laboratory for bottle type and preparation requirements.

Field test equipment necessary for groundwater sampling:

- Thermometer
- pH meter and standards
- Conductivity meter and standards
- dissolved oxygen meter (optional)
- turbidity meter and standards
- Filtration apparatus (0.45 micron), if necessary
- Depth to water measuring device
- Coolers and ice packs
- Organic-Free Distilled or deionized water
- Cleaning equipment (scrub brushes) and solutions (non-phosphate detergent)
- Indelible ink pens and felt-tip markers
- Sample labels and seals
- Container(s) for capturing, containing, treating and measuring waste decontamination solutions, if necessary.
- Well specifications
- Groundwater Purging and Sampling Forms (Appendix A)
- Field logbook
- Chain of Custody Forms (provided by selected laboratory)
- As required, 55 gallon steel drums fitted with bung holes, or suitable tank(s) for containing purged

groundwater.

- Additional preservatives (i.e., HNO_3)
- Copy of this SOP, SOP-5 and the governing workplan or SAP.

5.3 Groundwater Sample Acquisition

5.3.1 Purging the Well

The pump or bailer shall be used and operated in accordance with the manufacturer's operational manual. Before collecting the actual groundwater sample, a minimum of three (3) well bore storage volumes of water shall be purged from the well by pumping unless low-flow sampling techniques are being employed. Calculate this volume by measuring the depth to water and subtracting this depth from the total depth of the well. If a gravel/sand pack surrounds the screen, the pore volume of the gravel/sand pack (assume a porosity of 25 percent if unknown) shall be added to the total well volume. While purging water from the well, the conductivity, pH, temperature, dissolved oxygen (optional) and turbidity of the water shall be periodically measured. If the conductivity (within 10%), pH (within 0.1 pH units), temperature (within 0.5 degrees Celsius), dissolved oxygen (within 10%) or turbidity (within 10% and less than 5 NTU) of the water has not stabilized when a minimum of three (3) well volumes have been purged, then continue to purge water until these parameters stabilize as specified above. If the parameters of interest in the investigation include VOCs, care must be taken to ensure that purging does not induce degassing within the well. Where the well screen and sand pack are completely below the water table, the rate of purging should be controlled such that it does not draw the water level in the well below the top of the well screen. Where the well screen and sand pack are intersected by the groundwater level, the rate of purging should correspond with the rate of sampling, if continuous sampling methods are used. Large drawdowns in water table wells should be avoided. Purged groundwater that has a reasonable potential of containing hazardous substances shall be captured and characterized prior to discharge or disposal (see Section 5.5.1, below). Record the time after each well volume has been purged in order to keep track of actual pumping rate.

5.3.2 Samples for Major Cation, Metal, and Metallic Radionuclide Analyses

Samples for major cation, metal, and metallic radionuclide analyses (including Se) shall be immediately filtered after acquisition. Filtration is best accomplished with the use of an in-line filter system in which the sample is directly fed from the discharge port of a positive-pressure pump through the filter and into the appropriate sample bottle. A less preferred but acceptable method is the collection of an adequate amount of sample from a permissible positive-pressure pump or bailer into a properly cleaned and prepared high-density linear polyethylene or glass bottle. Samples shall be immediately fed through the filter and collected directly into the appropriate sample bottle. The final filter pore size should be 0.45 micron. (Note: New filters shall be used for each sample, and the filter system must be decontaminated before and after each sample.) These groundwater samples shall be preserved after filtration with nitric acid ($HN0_3$) to a pH less than 2.

In addition, if toxic metal or priority pollutant metal analyses are to be performed, an unfiltered sample will also be obtained (in addition to the filtered sample) directly from a permissible positive-pressure pump discharge

port or from the bailer into appropriate sample bottles and preserved with nitric acid ($HN0_3$) to a pH less than 2. The only exception is analysis of chromium VI, in which case preservatives shall not be added to the sample.

5.3.3 Samples for Cyanide Analyses

Samples for cyanide analyses shall be collected directly into appropriate sample bottles from the bailer or the port of a positive-pressure pump. Samples shall not be filtered nor shall they be allowed to overflow the sample bottle. Samples shall be immediately preserved with sodium hydroxide (NaOH) to a pH greater than 12.

5.3.4 Samples for Major Anion and Biological Oxygen Demand (BOD) Analyses

Samples for major anions (chloride, fluoride, sulfate, alkalinity, acidity, total silica, bromfide) and for biological oxygen demand shall be collected directly into appropriate sample bottles from the port of the pump or from the bailer. These samples do not require filtration, but may be filtered, if desired. Preservatives shall not be added.

5.3.5 Samples for Total Phosphate and Orthophosphate Analyses

Groundwater samples for total phosphate and orthophosphate analyses shall be immediately filtered after initial sample acquisition. Filtration is best accomplished with an in-line system in which a positive-pressure pump discharge port feeds groundwater directly through the filter system into an appropriate sample bottle. A less preferred but acceptable method is to collect a liter of sample from a positive-pressure pump or bailer in a properly cleaned and prepared high-density polyethylene or glass bottle, and than immediately feed the sample through a filter system which discharges into the appropriate sample bottle. The final filter pore size shall be 0.45 micron. (Note: New filters must be used for each sample and the filter system must be decontaminated before and after each use.) Samples shall be immediately preserved with sulfuric acid (H_2SO_4) to pH less than 2.

5.3.6 Samples for Nitrogen Compound, Chemical Oxygen Demand, Oil and Grease, and Total Organic Carbon Analyses

Groundwater samples for nitrogen compound, chemical oxygen demand, oil and grease, and total organic carbon analyses shall be collected directly into appropriate sample bottles from a permissible positive pressure pump discharge port or from the bailer. These samples shall not be filtered and shall be preserved with sulfuric acid (H_2SO_4) to a pH less than 2.

5.3.7 Samples for Analysis of Total Dissolved Solids

Groundwater samples for analyses of total dissolved solids shall be immediately filtered in the field by methods discussed in Section 5.3.3 above, and collected directly into an appropriate sample bottle. Samples shall not be preserved with additives.

5.4 Field Analyses

5.4.1 Calibration of Instruments

All instruments used for field analyses shall be calibrated prior to use and daily during use. Only equipment with a calibration tag showing a recall date later than the anticipated date of use shall be taken to the field. Each instrument should be accompanied by a copy of the manufacturer's operation manual.

5.4.2 Water Temperature

A pocket thermometer or other measuring device shall be used to measure the temperature of the water on an aliquot of purged water obtained just before or after sampling. The thermometer reading shall be allowed to stabilize and shall be recorded to the nearest 0.5 degree centigrade. The instrument shall be rinsed with distilled or deionized water before and after each use.

5.4.3 pH Measurement

A pH meter shall be used to measure the pH of the sample on sample of purged water that was obtained just before or after sampling. Measurements shall be made immediately on the obtained sample (note: if possible, measure pH continuously on the purged water in a closed flow-through system). Calibration shall be in accordance with the manufacturer's procedures (provided with the instrument). Calibration shall be performed with standardized buffered pH solutions bracketing the range of expected pH and conducted at the beginning and end of each day. Before and after each reading, the probe shall be thoroughly rinsed with distilled or deionized water. The pH shall be recorded to one-tenth (or one-hundredth if the meter is stable enough) of a pH unit.

5.4.4 Conductivity Measurement

A conductivity probe shall be used for conductivity measurement on an aliquot of purged water obtained just before or after sampling. Measurements shall be made as soon as possible on the obtained aliquot. The meter shall be calibrated in accordance with manufacturer's procedures (provided with the instrument) with standardized KCl solutions. At a minimum calibration shall be performed at the beginning and ending of each days use. The conductivity shall be recorded to two significant figures. The temperature of the sample at the time of conductivity measurement shall also be recorded. The probe must be thoroughly rinsed with distilled/deionized water before and after each use.

5.4.5 Dissolved Oxygen Measurement

A dissolved oxygen meter is used to measure dissolved oxygen (DO) in water samples. Measurements shall be made immediately on aliquots obtained just before or after sample acquisition. (Note: If possible, measure DO continuously on the purge water in a closed flow-through system). The meter shall be calibrated in accordance with the manufacturer's procedures (provided with the instrument) using distilled/deionized water that has been allowed to equilibrate with the atmosphere at a given elevation. The salinity adjust shall be adjusted to the

appropriate salinity of the water. Measure the temperature and concentration of dissolved oxygen in the sample while the salinity is on the fresh setting. The probe must be thoroughly rinsed with distilled or deionized water before and after each use. Measurements shall be recorded to the nearest 0.1 ppm concentration.

5.4.6 Turbidity Measurements

A turbidity meter shall be used to make turbidity measurements on aliquots of water samples obtained just before or after sample acquisition. Measurements shall be made as soon as possible on the obtained aliquot. Operation and calibration shall be in accordance with the manufacturer's procedures (provided with the instrument). Standardized solutions shall be used for calibration. The instrument shall be calibrated at least once during the purging and sampling of each well. The outside of the glass vials used for containing the aliquot for measurement must be wiped thoroughly dry before and after each use. Measurements shall be recorded to the nearest 0.1 NTU when less than 1 NTU; the nearest 1 NTU when between 1 and 10 NTU; and the nearest 10 NTU when between 10 and 100 NTU.

5.5 Capture And Disposal Of Purge Water And Decontamination Solutions

5.5.1 Purge Water

If specified in the applicable workplan or SAP, purged groundwater shall be captured and contained in 55 gallon steel drums or suitable tank(s). If so required, each drum or tank containing captured purge water shall be properly labeled with a weatherproof label as to the contents, the well(s) from which the contained purge water originated and the date in which the contents were generated. Storage of the drums or tanks shall be as specified in the project work documents or as directed by the Project Manager.

Captured and contained purge water shall be characterized for discharge, treatment and/or disposal. Characterization of the captured and contained purge water should be specified in the project work documents or by the Project Manager, but could rely on the analytical results of groundwater samples associated with each drum or tank, or could involve direct sampling and analyses of the contained water.

The requirements and options available for discharge, treatment and/or disposal are dependent upon many variables such as chemical consistency, local and state regulations, and location of site. Discharge, treatment, and/or disposal of captured and contained purge water must be in accordance with local, state and Federal regulations and shall be specified in the project work documents.

5.5.2 Decontamination Waste Solutions

Decontamination waste solutions that are generated during groundwater sampling include: spent detergent wash solutions; spent tap water rinses; any spent weak acid rinses, any spent methanol rinses; and spent final distilled/deionized water rinses. All spent acid and methanol rinses shall be captured and contained in plastic buckets or drums. Other spent decontamination waste solutions shall be captured and contained in appropriately sized buckets or drums if a reasonable potential exists for the spent solutions to contain hazardous

substances. Project work documents shall address, or the Project Manager shall determine, whether spent decontamination solution requires capture and containment.

Captured and contained decontamination waste solutions shall be subject to the same procedures as described for purge water. Some noteworthy differences are as follows: (1) all acid solutions shall be neutralized with lime prior to discharge or disposal; (2) methanol solutions may be able to be evaporated if segregated from other waste solutions, if generated in small enough quantities, and if conditions are favorable; and (3) if quantities are sufficiently small, decontamination waste solutions (detergent washes, rinse waters, neutralized acid solutions) may be added to the captured and contained purge water that corresponds to the same well sampling effort.

5.6 Documentation

Documentation for sampling groundwater includes labeling sample bottles, and completing Groundwater Purging and Sampling Forms, and Chain of Custody Records, and securing individual samples or sample coolers with chain of custody seals.

5.6.1 Sample Labels

Samples shall be immediately labeled. Labels shall be waterproof. Information shall be recorded on each label with indelible ink. All blanks shall be filled in (N/A if not applicable). Groundwater sample designations shall be as specified in the governing workplan or SAP.

5.6.2 Groundwater Purging and Sampling Forms

Groundwater Purging and Sampling Forms (Appendix A) shall be used by the Field Sampling Engineer to record daily activities. Data shall be recorded on the Groundwater Purging and Sampling Form in chronological format. The time of each recorded event shall be included. The original Groundwater Purging and Sampling Form shall be submitted as soon as possible to the Project Manager or Task Leader.

5.6.4 Field Log Book

The field logbook is used by the Field Sampling Engineer to document the official raw field information for each sample that will be chemically analyzed. The original must be submitted as soon as possible to the Project Manager or Task Leader.

5.6.5 Chain of Custody Records

Sampling handling and chain of custody protocols shall be as specified in the governing workplan or SAP. Chain of custody records will normally be used to record the custody and transfer of samples. Chain of custody forms are normally provided by the selected analytical laboratory. These forms shall be filled in completely (use N/A if not applicable). Tamper-proof seals shall be placed on either sample bottles or shipping coolers. The seal number shall be recorded on the Chain of Custody Form. The original form must accompany the samples to the analytical laboratory to be completed and returned to MWH for filing. A copy of the Chain of Custody

Record documenting the transfer of samples from the field shall be submitted to the Project Manager or Task Leader.

6.0 REFERENCES

ASTM, 1995, ASTM Standards On Environmental Sampling - (PCN - 03-418095-38). ASTM, Philadelphia, PA.

U.S. EPA, 1986, RCRA Ground-Water Monitoring Technical Enforcement Guidance Document, U.S. EPA/ Office of Solid Waste, Washington D.C.

U.S. EPA, 1986, Test Methods for Evaluating Solid Waste - (SW-846). U.S. EPA/Office of Solid Waste, Washington, D.C.

Wood, W.W. (1976), Guidelines for Collection and Field Analysis of Ground-Water Samples for Selected Unstable Constituents, Techniques of Water-Resources Investigations of the United states Geological Survey, Book 1, Collection of Water Data by Direct Measurement, Chapter D2.

APPENDIX A

GROUNDWATER PURGING AND SAMPLING FORM

GROUNDWATER PURGING AND SAMPLING FORM

Project No.:_____ Project Name:_____ Client:_____

Location:_____ Well No:_____

Date_____ Start Time_____ Weather_____

Depth to Water _____ Measuring Point _____

Water Column Height _____ Well Dia. _____

Sampling Method: Submersible Pump ☐ Centrifugal Pump ☐ Peristaltic Pump ☐ Other ☐ ☐

Bottom Valve Bailer ☐ Double Check Valve Bailer ☐ Stainless-Steel Kemmerer ☐

Criteria: 3 to 5 Casing Volumes of Water Removal ☐ Stabilization of Indicator Parameters ☐ Other_____

Gal/ft x ft of water	Water Volume in Well		Gal/oz to be removed
	Gallons	Ounces	

Time (military)	pH (su)	SC (umhos/cm)	Temp (°C)	ORP (millivolts)	D.O. (mg/L)	Turbidity (NTU)	Vol Evac. (gal.)	Comments/ Flow rate

Final: Time	pH	SC	Temp	Eh-ORP	D.O.	Turbidity	Ferrous Iron	Vol Evac.	Comments/Flow Rate

COMMENTS:

INSTRUMENTATION: pH Meter ☐ _____ Temperature Meter ☐ _____

DO Monitor ☐ _____ Other ☐ _____

Conductivity Meter _____

Water Disposal_____

*Sample ID*_____

Sample Date _____ *Sample Time*_____

SOP-NW-7.2

Collection of Soil Samples

MWH
MONTGOMERY WATSON HARZA

SOP-NW-7.2

Collection of Soil Samples

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

The purpose of this document is to define the standard operating procedures (SOP) for the collection and handling of soil samples using hand-operated devices. This SOP does not describe sampling procedures for lithified deposits or rocks or sampling procedures using drill rigs. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of soil sampling and is intended to be used in conjunction with site-specific workplans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with the approved by the Project Manager or Task Leader and the Quality Assurance (QA) Manager.

2.0 DEFINITIONS

None.

3.0 RESPONSIBILITIES

3.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the Project Manager and designated project secretary, all as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements

3.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled and shipped to the appropriate laboratory as specified in project work documents and this technical procedure.

3.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, soil sampling forms, generated data, and other associated and pertinent project information.

3.4 QA Manager

The QA Manger is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or workplans.

4.0 DISCUSSION

The methods described by this procedure may be used to acquire soil samples for chemical or radiological analysis. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or workplans.

5.0 PROCEDURE

The sampling methods described in this SOP are suitable for collecting soil samples. Because of the potentially high degree of heterogeneity found in soils, the collection of representative samples requires careful planning and considerable technical judgment. Sampling locations shall be as specified in the governing workplan or SAP. However, in general, the preferred sampling strategy requires collection of subsamples from a specified sample location and compositing of those subsamples in the field to form a single sample before shipment. At a minimum, three such subsamples should be collected.

5.1 Equipment List

The following is a list of required equipment for performing soil sampling:

- Balance with a 250-gram capacity calibrated to ± 0.1 grams (optional)
- Bound field notebook
- Copy of this SOP and applicable workplan or SAP
- Decontamination equipment and waste containers
- Detergent solution (0.1 to 0.3 percent Alconox or equivalent detergent)
- Distilled water
- Hand-operated soil collection device or devices as specified in the workplan or SAP
- 100-ft measuring tape
- 10-ft steel measuring tape (optional)
- Sample bags
- Sample containers
- Sample labels and seals
- U.S. Standard Sieve No. 10 with collection pan and cover (optional)
- Site map of sampling area
- Soil sample collection form (see attachment)
- Stainless steel mixing bowl
- Stainless steel spoon

Criteria for selecting appropriate soil samplers will follow ASTM Standard D 4700-91, Standard Guide for Soil Sampling from the Vadose Zone (ASTM, 1998).

5.2 General Considerations

The selection of sampling locations shall be as specified in the applicable workplan or SAP. The sampling site shall be photographed if so specified in the governing workplan or SAP. Samples will be composited in a manner specific to each sample location; compositing is described in Section 5.2.1. In addition, to remove residual organic matter and large soil particles, each soil sample designated for trace metals analysis may be sieved prior to shipment, if required by the governing workplan or SAP. The sieve procedure is described in Section 5.2.2. During soil sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan.

The procedures for collecting one soil sample at a given location is as follows:

- Using a decontaminated stainless steel tile spade, remove soil to the top of the desired sample interval from an area having a minimum diameter of eight inches to avoid cross-contaminating soil layers.
- Using decontaminated sampling equipment under the protocols described in Section 5.3, collect soil from the interval of concern or to refusal of the equipment.
- If the equipment is refused, record the depth of refusal.
- Retain the soil in a clean stainless steel mixing bowl.

If two or more samples are to be collected from differing depths at a single sample location, the procedure for collecting soil is as follows:

- If the upper layer of topsoil is to be collected, begin by driving a clean stainless steel sample coring device two inches into the ground with a hammer until the top of the box is flush with the ground.
- Remove the material within the coring bit to the required depth with a decontaminated stainless steel scoop or spade.
- Retain the sample in a clean, stainless steel mixing bowl.
- If an additional sample is required at a depth below the topsoil sample, remove at least one-inch of soil and discard.

- If no topsoil sample is collected, remove soil to the top of the desired sample interval from an area having a minimum diameter of eight inches to avoid cross-contaminating soil layers using a decontaminated stainless steel tile spade.

- Using decontaminated sampling equipment under the protocols described in Section 5.3, collect soil from the interval of concern or to refusal of the equipment.

- Retain the soil in a clean stainless steel mixing bowl.

- If additional samples are required at deeper intervals, repeat procedure until refusal.

5.2.1 Compositing

If soil samples are collected at a particular location, the following procedure will be used for compositing:

- Combine each sample in a decontaminated stainless steel mixing bowl.

- Mix the contents of the mixing bowl for several minutes.

- Remove material other than soil, such as litter, root matter, and rocks. Shake soil material from roots and sod.

- Mix again for several minutes to obtain a homogeneous mixture.

Homogenization of samples may also occur at the analytical laboratory, per the governing workplan or SAP. Thus, field homogenization would not be necessary.

5.2.2 Sieving

Soil collected for the analysis of trace metals shall be sieved to remove residual organic detrius and larger soil particles if required by the governing SAP or workplan. Sieving will follow the following procedure:

- Place soil in top of a sieve having a maximum opening size of 2.0 mm and equipped with a collection pan, cover and manually agitate.

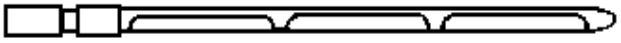
- At the end of sieve procedure, weigh soil particles that are retained on the sieve and the collection pan.

- Discard soil particles retained on the sieve.

5.3 Sample Acquisition Methods

5.3.1 Thief Sampler

The "thief" sampler consists of two slotted concentric stainless steel tubes with a pointed tip. The inner tube may be rotated to isolate the sampler interior. It is recommended for use in the sampling of dry granular or powdery soils with a particle diameter less than one third the width of its slots. To take a sample, close the sampler and insert it into the soil to the desired sampling interval. Rotate the inner tube to open the sampler, and tap gently to induce a flow of soil into the interior. Close the sampler, withdraw it from the soil, and lay it horizontally, with the slots facing up. Remove the inner tube and transfer the sample to an appropriate sample container or decontaminated compositing bowl.



Theif Sampler

5.2.2 Sampling Trier

The sampling trier is recommended for use in cohesive soils with a particle size less that half the trier diameter. To acquire a sample, insert the trier into the sampling interval at a 45 degree angle, and rotate the handle 360 degrees to cut soil core. Withdraw the trier with the concave side up, and transfer the sample material to an appropriate sample container or decontaminated compositing bowl.

Sampling Trier

5.2.3 Portable Auger

Hand- or electric motor-operated portable augers should generally be used in hard-packed soils or sediments. Because of the potential for site contamination, gasoline-powered augers are not permitted unless specifically authorized by approved project-specific plans. To acquire a sample, insert the auger through the catchpan at the desired sampling location and rotate the auger to the required sampling interval. Withdraw the auger and transfer the sample material in the catchpan (or that may have adhered to the auger surface) to an appropriate sample container or decontaminated compositing bowl using a decontaminated stainless steel spoon, trowel, or spatula.

5.2.4 Grab Samples

When permitted by site-specific project plans, grab samples may be taken with a decontaminated shovel or trowel and directly transferred to an appropriate sample container or decontaminated compositing bowl.

5.4 Sample Handling

Sample handling procedures and chain of custody requirements shall be as specified in the governing workplan or SAP. Typical handling procedures for soil samples are as follows:

- If specified in the site workplan or SAP, a photograph should be taken of the soil sample.
- Using a decontaminated stainless steel scoop, divide the soil sample in the mixing bowl or sieve pan into two clean wide-mouth, 16-ounce sampling jars; one shall be labeled for analysis, and one for archive purposes.
- As each container is filled, carefully wipe the upper edges of the container with a paper towel so that excess soil is removed from the threads and mouth of the jar. This is done to ensure that a tight seal exists after the container is closed. Attempt to maintain the proportion of water solids that exists in the mixing bowl or sieve pan while filling containers.
- Store sample containers in coolers for transportation in compliance with the sample handling and chain of custody requirements specified in the workplan or SAP.
- Sample documentation and labeling requirements shall be as specified in the governing workplan or SAP.

During soil sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan to minimize cross-contamination.

5.4 Decontamination

Sample acquisition and compositing tools shall be decontaminated as follows:

1. Ensure that the cleaning solutions and rinseate containers required by governing sampling plans are available
2. Scrub the sample acquisition or compositing tool with a brush and rinse with deionized or distilled water.
3. Dispose of the rinseate and wiping rags in the manner specified in governing sampling plans.
4. Wrap the decontaminated device in clean plastic sheeting or bags and tape securely pending next

use.

6.0 REFERENCES

ASTM D4700-91 (1998)e1. "Standard Guide for Soil Sampling from the Vadose Zone". ASTM International. Available: www.astm.org

SOIL SAMPLE COLLECTION FORM

Project:_____ **Project Number:** _____

Date: ____/_____/_____ **Time:** _____

Field Personnel: _____ **Signatures**: _____

_____ _____

_____ _____

SITE DESCRIPTION

Site Location: _____

Station Number: _____ **Photo. No.:** _____ **Roll No.:** _____

GPS Coordinates: **Latitude** _____°_____´_____´´ **Longitude** _____°_____´_____´´

Elevation_____

Comments/Descriptions:_____

_____

_____

_____

FIELD DESCRIPTION

Sample Identification Number: _____

Soil Characteristics (color, appearance, structure): _____

_____

_____

_____

Collection Method: _____

Sieve Analysis: Size _____ **Weight Retained** _____

Comments/Descriptions: _____

_____

_____

_____

Soil Collection for Agronomic Testing at Ballard Mine

Date_____ **Project Number** _____

Sample Location _____ **Sample ID**_____

Sampler Names _____ **Sampler Signatures** _____

_____ _____

Reclamation type: unreclaimed poorly-reclaimed well reclaimed well

GPS Location (NW corner) NAD27

LAT ° ' " LONG ° ' "

Area Description: _____

_____

_____

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Average
Sub-composite location						NA
%cover (basal area)						
%canopy						
%slope						
Aspect						NA
Type of waste rock						NA
Photo taken						
Soil Characteristics (moist or dry, color, amount shales, etc.)						NA

SOP-NW-9.1

Collection of Surface Water Samples

MWH
MONTGOMERY WATSON HARZA

SOP-NW-9.1

Collection of Surface Water Samples

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

The purpose of this document is to define the standard operating procedures (SOP) for the collection and handling of surface water samples. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of surface water sampling and is intended for use in conjunction with site-specific workplans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with approval of the Project Manager or Task Leader and the Quality Assurance (QA) Manager. Sampling locations shall be as specified in the governing workplan or SAP.

2.0 RESPONSIBILITIES

2.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the Project Manager, as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements.

2.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled and shipped to the appropriate laboratory as specified in project work documents and this technical procedure.

2.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, sediment sampling forms, generated data, and other associated and pertinent project information.

2.4 QA Manager

The QA Manager is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or workplans.

3.0 DISCUSSION

The methods described by this procedure may be used to acquire water samples for chemical or radiological analysis. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or workplans.

4.0 PROCEDURES

The sampling methods described in this SOP are suitable for collecting water samples that are located at or near active and historic phosphate mines in the southeast Idaho project area. This SOP describes collecting surface water samples at four different types of water bodies, streams, seeps, reservoir or lakes, and standing water locations (ponds). Sample documentation and labeling, as well as, sampling frequency, locations, volumes and analyses shall be as specified in the governing workplan or SAP.

4.1 Decontamination

Before sampling at a new location, all water sample collection equipment will be decontaminated by rinsing the water collection equipment three times with source water, or as specified in the governing workplan or SAP.

4.2 Instrument Calibration

Electronic equipment used during sampling to obtain field parameters will include, but is not limited to, a pH meter with automatic temperature compensation, a specific conductivity meter, a dissolved oxygen meter, a turbidity meter, and an oxidation-reduction potential meter (ORP or eH). Before going into the field, the field team leader will verify that all equipment is operating properly. Calibration, times and appropriate readings will be recorded in the field notebook and as specified in the governing workplan or SAP. Meters will be calibrated according to manufacturer's instructions.

4.3 Filtering

Samples to be analyzed for dissolved state will be filtered during the field sampling event by using a disposable 0.45 micron filter apparatus and peristaltic pump, vacuum pump, syringe, or equivalent equipment. Other samples for a particular analysis may require filtering as specified in the governing workplan or SAP. Filtered samples will be collected according to the following procedure:

- Assemble filter device according to manufacturer's instructions.

- Filter sample either by pouring sample in the top portion of filter unit or pumping it through an in-line filter using the pump or syringe.

- Transfer filtered sample to appropriate sample bottle with required preservative.

- Dispose of the used filter and tubing.

- Decontaminate any reusable filtering equipment. Place decontaminated equipment in a clean plastic bag or container for transportation between sampling locations.

4.4 Obtaining Water Samples

The following general procedures will be used before collecting surface water samples:

- Describe physical characteristics of the water source to be sampled, including type (seep, pond, stream, reservoir, lake, etc.), any visual discoloration of water, odor, clarity, or any other notable characteristic of the water source.

- Collect field measurements of water quality parameters.

- Assemble all necessary sample collection and filtering equipment.

- Make sure that the sample labels have been correctly filled out for the sampling location. Assemble bottles for filling.

- Decontaminate sample collection equipment by rinsing the equipment three times with source water.

- Collect water sample. Ideally, the sample will be taken from a point away from where the rinsing of collection equipment occurred when sampling standing water or upstream of the rinsing point when collecting flowing water. The water collection container will be lowered into the water, taking care to avoid collecting items floating in the water and disturbing any sediment during sample collection. After the container is filled, carefully lift it out of the water and empty it into a clean sample composite container. Repeat the process at the sampling location until a sufficient amount of sample has been placed into the composite container as described below. The amount of sample to be composited shall be as specified in the governing workplan or SAP.

- Transfer to appropriately labeled containers

4.4.1 Seeps

Water samples will be collected by immersing the sample transfer container as described above, or for a raw sample, the sample container in the water source. This collection method results in a grab sample that characterizes the medium at a point in space and time, and assumes that the water body sampled (seep) is

homogeneously mixed and has no stratification. Water sample collection from seeps will be done closest to the point of discharge as possible, to minimize contamination from surficial contact.

4.4.2 Ponds

Water samples will be collected by immersing the sample transfer container as described above, or for a raw sample, the sample container in the water source. This collection method results in a grab sample that characterizes the medium at a point in space and time, and assumes that the water body sampled (pond) is homogeneously mixed and has no stratification due to it's small size. Collecting water samples from standing water will have the emphasis placed upon the sampler not to disturb the water to be sampled, and the use of a swing sampler to collect as far from the shoreline as possible. This method will be especially important when collecting samples from ponds that have loose material and high gradient slopes that define the pond shoreline, which is typical of mine pit ponds. This will also be important to minimize the immersion risk of sampling personnel. Water samples for ponds may be collected from any point along the shoreline.

4.4.3 Streams and Rivers

Samples will be collected from the same cross section of the stream as that which is used for the discharge (flow) measurement, if discharge is measured. Samples will always be collected prior to making discharge measurements. The sampler will stand downstream of the water to be sampled if safe to do so. If sampling multiple stations on the same stream, downstream samples will always be collected first. Prior to sampling, the stream will be observed for any upstream activities or events that may affect the sample quality. If such events are occurring, the sample will not be collected until the stream clears and the occurrence will be recorded in the field notes.

Selection of sampling methods and equipment based on flow conditions is as follows:

- If the stream is less than 10 ft wide, the sample will be collected from the center of the flow at mid-depth.

- If the stream is greater than 10 ft wide, one composite, consisting of three samples will be collected. The water samples will be taken at ¼, ½, and ¾ of the distance across the river or stream cross-section. These samples should be taken at mid-depth in the water column at each location across the stream channel. All three samples will be composited into one larger container, and apportioned as necessary, into the appropriate sample containers.

Water will be collected from smaller streams and rivers using a standard Kemmerer or Van Dorn horizontal water bottle sampler with the field technician standing downstream and to the side of the bottle. The sampler is a plastic cylinder with rubber stoppers that leave the ends open while being lowered to allow free passage of water through the cylinder. The Kemmerer horizontal water bottle sampler may need to be lowered on a line to reach the desired depth. Once the sampler reaches the desired depth, a 'messenger' is sent down the line, causing the stoppers to close the cylinder, which is then raised. In shallow and faster moving streams and rivers,

operation of the Kemmerer horizontal water bottle sampler will be done by hand, and not with a 'messenger'. The water inside the sampler will then be transferred to a clean composite container. The process will be repeated at the sampling location until a sufficient amount of sample has been placed into the composite container. When a sufficient amount has been collected, transfer the water from the composite container into the appropriate sample containers. If unsafe wadding conditions exist (i.e., deep water, fast flowing water, slippery surfaces, etc.) a swing sampler will be utilized instead of the horizontal water bottle sampler to collect sample water for compositing. The method of sample collection shall be recorded in the field notebook.

4.4.4 Reservoirs and Lakes

Each lake and/or reservoir sample consists of collecting and compositing samples at several depths along a vertical profile using a standard Kemmerer or Van Dorn horizontal water bottle sampler. This collection method results in a vertically composited sample that characterizes the medium at a point in space and time, and takes into account the possibility of the water body sampled (i.e., reservoir or lake) is not homogeneously mixed and may be stratified. The sampler is a plastic cylinder with rubber stoppers that leave the ends open while being lowered to allow free passage of water through the cylinder. Once the sampler reaches the desired depth, a 'messenger' is sent down the line to cause the stoppers to close the cylinder, which is then raised. The water inside the sampler will then be transferred to a clean composite container. Repeat the process at the sampling location until a sufficient amount of sample has been placed into the composite container. When a sufficient amount has been collected, transfer the water from the composite container into the appropriate sample containers. A boat shall be utilized to collect samples from reservoirs and lakes.

4.5 Sampling Documentation

A field sampling data sheet will be completed at each sample location. Items not applicable to the sampling will be labeled as not applicable (NA). Sampling information will also be recorded in a bound field notebook. The information recorded on the data sheet and in the field notebook will include the following:

- Sampling location
- Date and time of sampling
- Persons performing the sampling
- Field water quality parameter measurements (specific conductivity, temperature, dissolved oxygen, pH, oxidation-reduction potential, etc.)
- Physical description of the water body to be sampled (color, odor, etc.)
- Sample identification numbers
- Number of samples taken- note containers, analytes, filtering and preservation methods
- Identification numbers of any QC samples from the site
- Any irregularities or problems which may have a bearing on sample quality

4.6 Equipment List

Sample bottles and preservatives (ultra-pure or metal grade nitric acid) will be obtained from the laboratory selected to perform the chemical analyses of the samples. Extra sample bottles with appropriate preservatives will be obtained in case of breakage or other problems.

Equipment used during surface water sample collection includes:

- Camera
- Chain of custody
- Coolers with ice/blue ice
- Copy of this SOP, SOP-NW-9.2 and -9.2a (if applicable) and the governing workplan or SAP
- Dissolved oxygen meter
- Filtering apparatus with disposable 0.45 micron filters
- GPS unit
- Hand pump, peristaltic pump, vacuum pump, or equivalent equipment
- Oxidation-reduction potential meter
- Plastic HDPE sample pitcher
- Plastic squeeze bottle filled with distilled water
- Plastic trash bags
- pH/eH meter (with automatic temperature compensation)
- Rope if obtaining deep samples
- Rite-in-the-Rain™ field notebook
- Sample containers that are certified clean
- Sample labels
- Specific conductivity meter
- Strapping and clear tape
- Swing sampler
- Kemmerer or Van Dorn horizontal water bottle sampler
- Suitable HDPE 5 L container
- Turbidity meter
- Silicon tubing
- Wooden stakes
- Writing instruments
- Measuring tape

The governing workplan or SAP may require the use of other equipment based on the scope and objective of an individual project. Project personnel will review the workplan or SAP for any equipment not listed in this SOP.

4.7 Field Quality Assurance/Quality Control Samples

Field QA/QC sample requirements shall be as specified in the governing workplan or SAP.

4.8 Sample Containers

All sample bottles must be properly cleaned and prepared. Coordinate with selected analytical laboratory for appropriate sample bottle types and preparation requirements. Plastic, such as PVC, polyethylene, polypropylene, and Tygon, is an acceptable material for contacting samples when the analyses are for inorganic analytes (metals, radionuclides, anions, and cations). Stainless steel and fluorocarbon resin (Teflon, PTFE, FEP, HDPE, or PFA) are acceptable materials that may contact surface water samples. Glass is an acceptable material for contacting samples except when silica or fluoride analyses are to be performed.

4.9 Sample Handling

Sample handling procedures and chain of custody requirements shall be as specified in the governing workplan or SAP. Typical handling procedures for surface water samples are as follows:

- Store sample containers in coolers for transportation in compliance with the sample handling and chain of custody requirements specified in the workplan or SAP.

- Sample documentation and labeling requirements shall be as specified in the governing workplan or SAP.

All surface water samples shall be labeled and sealed and immediately placed in ice-filled coolers with securely closed lids for storage and transport. The analytical laboratory must receive samples in sufficient time to conduct the requested analyses within the specified holding time.

During surface water sampling operations, the proper personal protective equipment will be worn, as described in the applicable workplan or site safety and health plan, to minimize cross-contamination and to ensure the safety of the field sampling personnel.

SURFACE WATER SAMPLE COLLECTION FORM

Project:_____ **Project Number:** _____

Date: _____/____/_____ **Time:** _____

Field Personnel: _____ **Signatures:** _____

_____ _____

SITE DESCRIPTION

Site Location: _____ **Elevation**_____

Station Number: _____ **Photo No.:** _____ **Roll No.:** _____

GPS Coordinates: **Latitude**_____°_____´_____´´ **Longitude**_____°_____´_____´´

Comments/Descriptions:_____

FIELD DESCRIPTION

Sample Identification Number: _____

Surface Water Characteristics (color, odor, appearance): _____

_____

Collection Method: **Grab, Kemmerer**_____

Field Measurements

Parameter	Reading/Measurement Sample 1	Sample 2	Sample 3	Initials	Remarks
Air Temperature (°C or F)					
Specific Conductivity (mhos) @ 25° C					
Conductivity					
Dissolved Oxygen (mg/L)					
pH					
Oxidation-Reduction Potential (ORP)					
Turbidity (FTU)					
Water Temperature (°C)					

SOP-NW-9.2a

Surface Water Flow Measurements Using Man-Portable Devices or Estimation Techniques

MWH
MONTGOMERY WATSON HARZA

SOP-NW-9.2a

Surface Water Flow Measurements Using Man-Portable Devices or Estimation Techniques

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

This Standard Operating Procedure (SOP) provides general techniques for obtaining valid, representative flow measurements from natural open-channels using estimation techniques or man-portable devices. Direct methods for flow measurements in open channels using weirs, flumes, or other devices and direct and indirect flow measurements in pipes are provided in SOP-NW-9.2, *Surface Water Flow Measurements.* This SOP applies to any work performed by MWH or subcontractor personnel for any portion of stream flow measurements and is intended to be used in conjunction with governing work plans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with the approved by the Project Manager or Task Leader and the Quality Assurance (QA) Manager.

Stream flow measurement methods in this SOP assume the following conditions:

- No control structures will be used for flow measurements at surface water stations;
- A current meter will be the preferred method for discharge measurements; and
- A few locations may be appropriate for engineering estimates or volumetric measurement.

2.0 DEFINITIONS

Discharge is defined as the volume rate of flow of water, expressed in cubic feet per second (cfs), including any substances suspended or dissolved in the water. Methods for measuring discharge are based on a variety of flow conditions. Many discharge measurement methods are required because flow conditions differ from site to site.

3.0 RESPONSIBILITIES

3.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for field testing, total and accurate completion of data sheets, and delivery of data to the Project Manager and designated project secretary, all as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements.

3.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision

includes ensuring that stream flows are measured as specified in project work documents and this technical procedure.

3.3 Project Manager

The Project Manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, surface water flow measurement forms, generated data, and other associated and pertinent project information.

3.4 QA Manager

The QA Manager is responsible for developing and managing procedures outlined in the SOPs and in site specific SAPs, QA plans, and/or work plans.

4.0 DISCUSSION

The methods described by this procedure may be used to measure flow in open channels. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or work plans.

Because of the dynamic nature of surface water behavior, flow measurement by the methods described in this document may, on occasion, be impossible at some sites. It is understood that if unmeasurable flow conditions are encountered at any of the surface water data collection sites which are to be measured in this program, the field team will attempt to measure flow at a point upstream or downstream of the site and will note this point relative to the marked data collection point in the field logbook. Whether or not a measurement is made, the team will note the conditions that inhibited accurate flow measurement. This situation will be brought to the attention of the MWH Project Manager and QA Manager using the field change protocol established in the governing workplan or SAP.

5.0 PROCEDURES

5.1 Velocity-Area Method

Surface flow in stream channels that are greater than one foot wide, or where flow is estimated to exceed 2.0 cfs, will be measured by using the traditional stream gaging technique, the velocity-area method.

When using the velocity-area method to perform discharge measurements of flowing surface water streams, a current meter will be used. The most common current meters are vertical axis meters, such as the Price meter Type AA, and horizontal axis or propeller-type meters. The standard Price meter has a rotor 5 inches in diameter and 2 inches high with six cone-shaped cups mounted on a stainless steel shaft. A pivot bearing supports the rotor shaft. In addition to the type AA meters, a Price pygmy meter is used in shallow depths. The pygmy meter is scaled two-fifths as large as the standard meter and has no tailpiece. Propeller-type current meters employ a propeller turning about a horizontal axis. Variable flow conditions may require the use of the pygmy meter, the Price AA meter, or a propeller-type meter, depending on the amount of runoff contributing to streamflow.

5.1.1 Theoretical Considerations

The volume rate of flow of water, which is commonly called discharge (Q), is the product of multiplying the average velocity (V) times the total cross-sectional area (A):

$$Q = V * A$$

The current meter measures velocity at a point. The velocity-area method of making discharge measurements at a cross-section requires measurement of the mean velocity in multiple portions of the cross-section at each of the selected verticals. These are taken at subsections of the cross-section. A complete discussion of area-velocity methods is found in *Measurement and Computation of Streamflow: Volume 1 - Measurement of Stage and Discharge* (Rantz, 1982)

By dividing the stream width into subsections, total discharge becomes the total of discharges measured in each subsection. Velocity (v) is estimated using the two-point method, or for shallow streams, the six-tenths-depth method, measured at each subsection. The two-point method consists of measuring the velocity at 0.2 and then at 0.8 of the depth from the water surface, and using the average of the two measurements. For streams shallower than 2 feet, the six-tenths-depth method will be used. The six-tenths-method consists of measuring the velocity at 0.6 of the depth from the water surface.

Discharge becomes the sum of the products of each point velocity and cross-sectional area of each subsection:

$$Q = \Sigma (v * a)$$

where:

Q = total discharge (in cubic feet per second),
v = point velocity (feet per second), and,
a = area of the subsection (square feet).

In measuring discharges for developing stream ratings for litigation and flood-plain insurance purposes, federal agencies typically base the number of subsections on the criterion that each subsection contain no more than 5 percent of the total discharge. While this method has reportedly resulted in measurement accuracy as high as 98 percent, factors such as the characteristics of the measurement section reduce this accuracy. Furthermore, measurements limiting flow to 5 percent of the total discharge are time-consuming. Therefore, in the interests of conserving time while maximizing measurement accuracy, current-meter measurements performed in channelized streams will be based on selecting subsections to contain approximately 10 percent or slightly more of the total discharge. However, the stream should not be partitioned into sections that are significantly greater than 10 percent of the total stream flow because individual measurements that may be in error will then have a significant impact on the overall average velocity determination.

In general, depending on average depth and velocity distribution, a stream less than 2 feet wide will require no more than 8 to 10 subsections. A stream up to 4 feet wide will require about 10 to 12 subsections. Streams wider than 4 feet will require more subsections. Further, subsections need not be of identical width. For example, because velocities near banks are generally lower than velocities near the center of streams, these subsections may be wider than subsections near the center. Subsections will also be more closely spaced if a stream has an unusually deep portion in the cross-section, or if velocities are higher than usual for the cross-section.

Velocity will be observed by current meter at each point for a period that ranges from 40 to 70 seconds.
The stage of a stream is the height of the water surface above an established datum plane. The water-surface elevation referred to is an arbitrary gage datum called the "gage height." Stage or gage height is to be measured and recorded in feet and tenths of a foot.

5.1.2 Required Measurement Conditions

In order to make a velocity-area discharge measurement using a flowmeter, the following conditions are required:

- The stream must be channelized: that is, observable banks must channel the stream flow;
- Depth must be greater than 0.2 foot across most of the cross-section being measured; and
- The stream must have measurable velocity of at least 0.2 feet per second in most of the

cross-section, although the pygmy meter is capable of measuring velocity as low as 0.070 feet per second.

The first two conditions can often be met in streams of very low discharge by conservatively modifying the stream channel to produce a narrower and slightly deeper cross-section in order to meet measurement requirements. These modifications will include removal of aquatic growth or ice, moving large stones which impact velocity upstream or downstream of the cross-section, and narrowing or deepening of the cross-section. By rearranging small amounts of native rock or sand, the technician will produce a measurable cross-section. When such modifications are made, great care will be exercised to avoid unnecessary movement of sediments or the splashing of sediments or water onto field team members. After clearing the cross-section, flow will be allowed to stabilize before the current-meter measurement of velocities begins.

If depths of 0.2 feet or greater cannot be found or made, the velocity will be estimated by recording the time required for a floating object to cover a known length of the stream. The object velocity will be calculated by multiplying the fixed distance with the average stream area and a correction factor of .9 and dividing by the recorded time. At a minimum, three separate trials will be completed and a mean object velocity calculated.

Current meter measurements are best made by wading, if conditions permit. The Price AA, Pygmy, or propeller-type meters are used for wading measurements. Vertical axis current meters do not register velocities accurately when placed close to a vertical wall. A Price meter held close to a right-bank vertical wall will under-register because the slower water velocity near the wall strikes the effective (concave) face of the cups. The converse is true at a left-bank vertical wall. (The terms "left-bank" and "right-bank" designate direction from the center of a stream for an observer facing downstream). The Price meter also tends to under-register when positioned close to the water surface or close to the streambed.

5.1.3 Equipment

Current meters, timers, depth and width measuring devices, and a means of counting meter revolutions are needed for measurement of discharge. The equipment includes:

- Depth-measuring device
- Current meter
- Width-measuring devices, either engineer's tape or tagline
- Stopwatch
- Marker

<u>Depth-Measuring Device.</u> The depth-measuring device may consist of a graduated rod or staff in feet

and tenths. If a Price-type meter is used, the depth-measuring device will be the topsetting 2-inch diameter hexagonal wading rod.

Current Meter. A current meter is an instrument used to measure the velocity of flowing water. The principle of operation is based on the proportionality between the velocity of the water and the resulting angular velocity of the meter's rotor. By placing the current meter at a point in a stream and counting the number of revolutions of the rotor during a measured interval of time, the velocity of water at that point is determined.

Engineer's Tape or Tagline. Steel tapes, metallic tapes, or premarked taglines are used for width determinations during discharge measurements made by wading. Direct measurement of width using tapes or taglines can be accurate with proper precautions. Orientation normal to the flow pattern of the river and elimination of most of the sag, through support or tension, are recommended for improved accuracy.

Stopwatch. A stopwatch is used to measure time during which velocity is measured at each point in the cross-section. Velocity at each point is measured for a period greater than or equal to 40 seconds and less than or equal to 70 seconds.

Marker. Each location where the velocity-area method will be consistently applied will be marked with a field stake.

If a Price meter is used, additional equipment includes a headset. A headset attaches to an electronic connection at the upper end of the wading rod.

5.1.4 Maintenance and Calibration Procedures

Prior to use of the current meter and following use of the meter, tests will be conducted to ensure that the unit performs acceptably. For Price-type and propeller-type meters, calibration tests will be conducted prior to and after fieldwork. Calibration tests will be conducted in streams fitted with Parshall flume or equivalent measurement device. Stream velocities derived from flume readings will be compared to the meter readings.

In addition, for Price-type meters, spin tests will be conducted. The spin test will be performed in an enclosed area, such as in the cab of a truck or in the enclosed rear of a truck, to prevent wind interference. The test is to be performed prior to attaching the current meter to the wading rod. While holding the meter steady in an area sheltered from breezes, the technician will spin the rotor and then press the start button on the stopwatch. The technician will observe the meter until the rotor ceases to spin. The duration of the spin for the pygmy meter should be more than 40 seconds and for the Price AA meter should be more than 90 seconds. If the meter fails to meet the time-of-spin criteria, the meter

will be cleaned and oiled before use. If the meter continues to spin well beyond these time limits, the record will indicate that the meter spun for 40+ seconds, in the case of the pygmy meter, or for 90+ seconds, in the case of the Price AA meter.

To ensure reliable observations of velocity, it is necessary that the selected current meter be kept in good condition. Before and after each discharge measurement, meter cups, vanes, or propellers, pivot and bearing, and shaft should be examined for damage, wear, or faulty alignment. During measurements, the meter will be observed periodically when it is out of the water to be sure that the rotor or propeller spins freely.

Meters will be cleaned and, if applicable, oiled daily when in use. If measurements are made in sediment-laden water, the meter will be cleaned immediately after each measurement. After cleaning and lubrication, the rotor or propeller will be spun to make sure that it operates freely. If the rotor or propeller stops abruptly, the cause of the trouble will be sought and corrected before using the meter.

In addition to meter maintenance, the entire meter unit will be checked before departure to the field each day as follows:

- For Price-type meters, attach the current meter and digital counter/headset to the wading rod. Test the headset by:

    1. Spinning the current meter to ensure that audible clicks occur.
    2. If audible clicks do not occur, the following steps should correct the problem:

        - Check that electronic connections are tight;
        - Check that the cat's whisker lightly contacts the upper part of the shaft;
        - Spin again and if audible clicks still do not occur, check that the battery in the headset is properly aligned. Replace the battery, if necessary.

- For propeller-type meters, activate the sensor and test by:

    1. Moving the propeller through the air to ensure that electronic readings are displayed.
    2. If no display is visible, the following steps should be completed:

        - Check that the batteries have power. Replace if necessary;
        - Check that sensor and display are connected to the shaft wire.

5.1.5 General Considerations

Based on approximate depths, either the Price-type or propeller-type meter will be used to perform a velocity-area measurement. If depths or velocities under natural conditions are too low for a dependable current meter measurement, the cross-section will be modified, if practical, to provide acceptable conditions. A shovel will be used to remove aquatic vegetation, ice, or rocks that may interfere with meter operation or discharge measurement.

At each measurement point (or station) across the stream cross-section, depth is measured prior to measurement of velocity. Therefore, it is recommended that the measuring rod be set with the current meter suspended out of the water and above the tagline, which is used to measure width and to identify stations across the cross-section. Placement of the rod about 0.5 feet downstream from the tagline prevents contact between the tagline and the current meter when the meter is lowered into measuring position. The measuring rod will be placed in the stream so the base rests on the streambed, and the depth of water will then be read from the graduated main rod. The main rod is graduated into 0.l-foot increments.

The meter operator reads water depth directly from the depth-measuring rod. In high velocity areas, it is recommended that depth be read as the value between the depth on the upstream side of the rod and the depth on the downstream side of the rod. Depth is measured to the nearest 0.02 foot. This depth is used to set the vertical location on the current meter.

The meter operator will stand in a position that least affects the velocity of the water passing the current meter. The meter operator will face upstream while holding the depth-measuring rod vertically and close to the tagline or measuring tape. The meter operator stands at about a 45-degree angle downstream from the measuring rod and at least 1.5 feet from the depth-measuring rod. This angle is an imaginary angle between the extended arm holding the depth-measuring rod and the tagline or measuring tape. The meter operator should avoid standing in the water if his or her feet and legs occupy a significantly large percentage of a narrow cross-section. For narrow streams, it is often possible to stand astride the stream.

The depth-measuring rod should be held in a vertical position with the meter parallel to the direction of flow while the velocity is being observed. When measuring streams that have shifting beds, the soundings or velocities can be affected by the scoured depressions left by the hydrographer's feet. For such streams, the meter should be placed ahead of and upstream from the operator’s feet.

5.1.6 Discharge Calculations

A stream discharge is the summation of the products of the subsection areas of the stream cross-section and their respective average velocities. The formula $Q = \Sigma (v * a)$ represents the computation, where Q is the total discharge, a is an individual subsection's area, and v is the corresponding mean velocity of

flow normal to the subsection. The summation of the discharges for all the subsections is the total discharge of the stream. The order for calculating discharge is:

- Use the distances from initial point to compute width for each section. The first width is computed by subtracting the first distance from the second distance, and dividing this quantity by two. The second width will be the quantity of difference between the third distance and the first distance, divided by two. For each subsequent width, subtract the distance on the line above the line you are calculating from the distance on the line below the line you are calculating, and divide this quantity by two. This procedure is carried out for each line until you reach the final width calculation. This is calculated as the quantity of the difference between the final distance and the second-to-the-last distance, divided by two.

- Subsequent calculations will be performed as follows:

  - Calculate each discharge for each subsection by multiplying the width of the subsection times the depth times the velocity.

  - Sum the discharges for each subsection to arrive at total discharge for the entire cross-section.

- Check your math by summing the subsection widths. Their total should equal the value obtained by taking the difference between the left and right bank station distances from initial point.

- Initial at the line "Comp. by" to identify yourself as the person responsible for performing the discharge calculation.

5.2 VOLUMETRIC METHOD

The volumetric method is a simple and accurate method for measuring flow from small discharges such as gravity flow discharges from pipe outlets.

5.2.1 Theoretical Considerations

This method involves measuring the time required to fill a container of known capacity, or the time required to partly fill a calibrated container to a known volume. Alternatively, in the case of measuring discharge remotely in a sump or standpipe setting, the volumetric method may be performed by capturing flow in a container for a set period of time. This volume of water is then measured and discharge is determined.

5.2.2 Required Measurement Conditions

Conditions must be such that all discharge from an outlet can be captured in the volumetric container during the period of measurement.

5.2.3 Equipment

The bucket and stopwatch technique is particularly useful for the measurement of small flows. Equipment required to make this measurement is a calibrated container and a stopwatch. Calibrated containers of varying sizes will include:

- 5-gallon bucket
- 2-liter graduated cylinder
- 1-liter graduated cylinder
- 1-liter bucket
- 500-milliliter beaker
- 250-milliliter beaker

5.2.4 Maintenance and Calibration Procedures

Graduated cylinders are incremented in terms of milliliters and can be easily converted to gallons. The incremental volume of a 5-gallon bucket can be determined by adding known volumes of water and recording the depth after each addition.

5.2.5 General Considerations

Upon arrival at the site, the sampling personnel will evaluate the flow conditions to select the appropriate method for flow measurement. If flow conditions are appropriate for volumetric measurement, the sampling personnel will observe and use judgment in approximating the flow volume and will select an appropriately sized volumetric container.

Sampling personnel will use a stopwatch to measure the time required to fill a volumetric container. The sampler will time flow into the container for a minimum of 10 seconds. Three consecutive measurements will be made and noted, and the results will be averaged to determine the discharge.

5.2.6 Discharge Calculations

Discharge will be determined initially in gallons per second (gal/s) or in milliliters per second (ml/s). These values will be noted, but the average value will be reported in cubic feet per second. Calculations will be performed as follows:

- Record each of the three measurements in terms of gallons per second or milliliters per second, depending on the volumetric container.

- If one of the three measurements is 50 percent or more different from the other two measurements, then this value will not be used. Instead, three additional measurements will be taken and, provided that none of these three measurements differs by greater than 50 percent from the other two measurements, these values will be used.

- Average the three values.

- Convert the averaged value to cfs as follows:

  - To convert ml/s to cfs, multiply by $3.5. \times 10^{-5}$

  - To convert gal/s to cfs, multiply by 0.134

- Record discharge in cfs.

6.0 REFERENCES

Linsley R.K, Kohler, M.A., Paulhus, J.L.H. 1982. *Hydrology for Engineers*. McGraw-Hill Book Company. New York, N.Y.

Rantz, S.E., et al. 1982. *Measurement and Computation of Streamflow: Volume 1; Measurement of Stage and Discharge*. Geological Survey Water-Supply Paper 2175. U.S. Government Printing Office. Washington, D.C.

Rantz, S.E., et al. 1982. *Measurement and Computation of Streamflow: Volume 2: Computation of Discharge*. Geological Survey Water-Supply Paper 2175. U.S. Governmental Printing Office. Washington, D.C.

Robertson, J.A., Cassidy, J.J., and Chaudhry, M.H. 1988. *Hydraulic Engineering*. Houghton Mifflin Company. Boston, MA

SURFACE WATER FLOW MEASUREMENT FORM

Project:_____ **Project Number:** _____

Date: ____/_____/_____ **Time:** _____

Field Personnel: _____ **Signatures:** _____

_____ _____

SITE DESCRIPTION

Site Location: _____

Station Number:_____

GPS Coordinates Latitude N_____°_____´_____´´ **Longitude W**_____°_____´_____´´

Datum:_____ **Elevation**_____**ft.**

Description of Stream Cross-Section: _____

Total Width_____**ft R.E.W.**_____**ft L.E.W.**_____**ft**

Distance from Reference	Measure-ment #	Width	Depth	Velocity Depth (60%)	Velocity (30 secs)	Width	Depth	Velocity Depth (60%)	Velocity (30 secs)
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
	11								
	12								
	13								
	14								
	15								
	16								
	17								
	18								
	19								

Distance from Reference	Measure-ment #	Width	Depth	Velocity Depth (60%)	Velocity (30 secs)	Width	Depth	Velocity Depth (60%)	Velocity (30 secs)
	20								
	21								
	22								
	23								
	24								
	25								
	26								
	27								
	28								
	29								
	30								
	31								
	32								
	33								
	34								
	35								
	36								
	37								
	38								
	39								
	40								
	41								
	42								

Comp. by: _____ Checked: _____

SOP-NW-9.3

Collection of Sediment Samples

MWH
MONTGOMERY WATSON HARZA

SOP-NW-9.3

Collection of Sediment Samples

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH program manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

The purpose of this document is to define the standard operating procedures (SOPs) for the collection and handling of sediment samples. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of sediment sampling, and is intended to be used in conjunction with site-specific work plans or sampling and analysis plans (SAPs). Modifications to this SOP may be made with the approval of the program manager and the quality assurance (QA) manager.

2.0 DEFINITIONS

None.

3.0 RESPONSIBILITIES

3.1 Field Sampling Team Member

The field sampling team member is responsible for sample collection, sample custody in the field, sample preservation, field testing, total and accurate completion of data sheets, sample shipment and delivery of data to the project manager and designated project secretary, all as described in this technical procedure. All staff are responsible for reporting deviations or nonconformance of the procedure to the field team leader, project manager, program manager, or QA manager, in compliance with the governing work plan or SAP requirements.

3.2 Field Team Leader

The field team leader is responsible for supervising the field sampling team members. Supervision includes ensuring that samples are collected, documented, preserved, field analyzed, handled, and shipped to the appropriate laboratory as specified in project work planning documents and this technical procedure.

3.3 Project Manager

The project manager has overall management responsibilities for the project, is responsible for designing the sampling program, for arranging the logistics of the program, and for providing any required clarifications in the use of this procedure. The project manager may assume the responsibilities of the field team leader on smaller projects.

The project manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, sediment sampling forms, generated data, and other associated and pertinent project information.

The project manager is also responsible for reporting project status to the program manager and obtaining permission from the program manager for any changes to the SOP.

3.4 Program Manager

The program manager has overall management responsibilities for the program and will advise project managers on design and logistics. The program manager is also responsible for reviewing and approving SOPs.

3.5 QA Manager

The QA manager is responsible for developing and managing procedures outlined in the SOPs and in site-specific SAPs, QA plans, and/or workplans.

4.0 DISCUSSION

The methods described by this procedure may be used to acquire sediment samples for chemical or radiological analysis. Methods should be selected at the discretion of the field team leader or project manager or program manager in accordance with any specific provisions of governing SAPs or work plans.

5.0 PROCEDURE

The sampling methods described in this SOP are suitable for collecting sediment samples that may be contained within the upper layers of the streambeds, seeps, or in reservoir or standing water locations (ponds). Because of the potentially high degree of heterogeneity found in sediments, the collection of representative samples requires careful planning and considerable technical judgment. Sampling locations shall be as specified in the governing work plan or SAP. However, in general, the preferred sampling strategy requires collection of a minimum of three samples from a specified sample location and compositing those samples in the field to form a single composite sample before shipment.

The methods defined in this SOP should not be used for sediment collection under dangerous flood conditions, and assumes that field personnel can safely wade a stream or sample from the shore of a stream or pond location unless a boat is to be used. All work under this SOP must be done in full conformance with the governing health and safety plan.

5.1 Equipment List

The following is a list of required equipment for performing sediment sampling:

- Balance with a 250-gram capacity calibrated to ± 0.1 grams (optional);
- Bound field notebook;
- Copy of this SOP and applicable work plan or SAP;
- Decontamination equipment;
- Detergent solution (0.1 to 0.3 percent Alconox or equivalent detergent);
- Distilled water;

- Hand-operated sediment collection device or devices as specified in the work plan or SAP;
- 100-ft measuring tape;
- 10-ft steel measuring tape (optional);
- Sample containers;
- Sample labels and seals;
- U.S. Standard Sieve No. 10 with collection pan and cover (optional);
- Site map of sampling area;
- Sediment sample collection form (see attachment); and,
- Stainless steel mixing bowl and spoon (optional).

The governing work plan or SAP may require the use of other equipment based on the scope and objective of an individual project. Project personnel will review the work plan or SAP for any equipment not listed in this SOP.

5.2 Sediment Sampling

A scooping method will be used to collect sediment samples from streams, stock ponds, or dump seeps. Streambed materials can vary spatially and temporally and can range in size from cobbles and boulders to clay. The field technicians will evaluate the site based on conditions and particle sizes, and will record site conditions and particle sizes in a field logbook as well as on the attached form. Three samples will be collected at each stream, stock pond or dump seep location and combined to form a composite sample. The samples will be collected in a manner such that the three samples will be collected within a 6 foot diameter, equidistantly spaced and offset from each other at approximately a 120 degree angle. Large debris will be removed and, after being shaken lightly to dislodge adhered sediment into the sample container, disposed and not included with the sample. After composting and removing large debris the sample will be transferred to a 1-gallon polyethylene bag, labeled and stored in a cooler on ice.

Reservoir sampling will be conducted using a Ponar dredge. The Ponar dredge will be opened and lowered until it contacts the sediment bottom. Field personnel will retrieve the Ponar dredge using a steady pulling motion to ensure closure of the dredge. Any washout of sediment samples (the Ponar does not completely close during retrieval) will require resampling. The Ponar will be placed upright and the top four inches of sediment will be removed and placed in a suitable bowl for compositing. Larger debris will be removed and shaken lightly to remove excess sediment. Three dredges will be collected, composited, and transferred to a 1-gallon polyethylene bag, labeled and stored in a cooler on ice.

The selection of sampling locations, including sample locations, shall be as specified in the applicable work plan or SAP. The sampling site shall be photographed if so specified in the governing workplan or SAP. Samples will be composited at each sample location directly after collection; compositing is described in Section 5.2.1. In addition, to remove residual organic matter and large sediment particles, each sediment sample designated for trace metals analysis may be sieved prior to shipment, if required by the governing work plan or SAP. The sieve procedure is described in Section 5.2.2.

Typical steps to be followed in collecting sediments are:

- Decontamination of sampling equipment prior to use in compliance with the governing work plan or SAP.
- Place sampling equipment on clean plastic sheeting near the sampling locations.
- Collect samples in streams, ponds, seeps, or reservoir deltas.
- Composite the samples. Use the compositing procedure described in Section 5.2.1.
- Fill sample containers as discussed in Section 5.3.
- Seal and label sampling containers and place on ice in coolers, described in Section 5.3.
- Decontaminate all sediment sampling equipment as outlined in Section 5.4.

5.2.1 Compositing

If sediment samples are collected at a particular location, the following procedure will be used for compositing:

- Remove material other than sediment if sieving did not occur, such as litter, root matter, and rocks. Shake sediment from such materials to retain sediment in the sample before discarding the undesired material.
- Combine all samples by pouring three individual samples into a 1-gallon polyethylene bag and apply labeling. All mixing will occur at the analyzing laboratory.

5.2.2 Sieving

The analytical laboratory, under more ideal conditions than the field team can provide, shall sieve sediment collected for laboratory analysis. Sieving will also occur in conjunction with weighing, homogenization, drying, and grinding before analysis is performed.

5.3 Sample Handling

Sample handling procedures and chain of custody requirements shall be as specified in the governing work plan or SAP. Typical handling procedures for sediment samples are as follows:

- If specified in the site work plan or SAP, a photograph should be taken of the sediment sample.

- Using a decontaminated stainless steel or plastic scoop, place the sediment sample in a 1-gallon polyethylene bag. If necessary, use more than additional polyethylene bags, and apportion the sample equally among each 1-gallon polyethylene bag. The sediment sample bags shall be appropriately labeled and include sample identification and analysis to be performed in accordance with the governing work plan or SAP.

- Place each sediment sample bag in an additional 1-gallon polyethylene bag, or more, as required to prevent leakage and bursting of sediment sample bags during shipping.

- Store sediment sample bags in coolers for transportation in compliance with the sample handling and chain of custody requirements specified in the work plan or SAP.

- Sample documentation and labeling requirements shall be as specified in the governing work plan or SAP.

During sediment sampling operations, the proper personal protective equipment will be worn, as described in the applicable work plan or site safety and health plan to minimize cross-contamination and ensure the safety of sampling personnel.

5.4 Decontamination

Sample acquisition and compositing tools shall be decontaminated as follows:

1. Ensure that the cleaning solutions and rinseate containers required by governing sampling plans are available

2. Scrub the sample acquisition or compositing tool with a brush and rinse with deionized or distilled water.

3. Dispose of the rinseate and wiping rags in the manner specified in governing sampling plans.

4. Wrap the decontaminated device securely in clean plastic sheeting or bags pending next use.

6.0 REFERENCES

Environmental Protection Agency. 1986. Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual. EPA Region IV Environmental Services Division, Athens, GA.

Environmental Protection Agency. 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final. Environmental Protection Agency, Washington, D.C.

Guy, Harold P. 1978. Techniques of Water-Resources Investigations of the United States Geological Survey. Book 3: Applications of Hydraulics; Chapter C1, Fluvial Sediment Concepts. U.S. Government Printing Office, Washington, D.C.

Guy, Harold P. and Vernon W. Norman. 1976. Techniques of Water-Resources Investigations of the United States Geological Survey. Book 3: Applications of Hydraulics; Chapter C2, Field Methods for Measurement of Fluvial Sediment. U.S. Government Printing Office, Washington, D.C.

U.S. Geological Survey. 1977. National Handbook of Recommended Methods for Water-Data Acquisition. Department of the Interior, Office of Water Data Collection, Washington, D.C.

U.S. Geological Survey. 1978. Techniques of Water-Resources Investigations of the United States Geological Survey. Book 5: Laboratory Analysis; Chapter C1, "Laboratory Theory and Methods for Sediment Analysis. U.S. Government Printing Office, Washington, D.C.

SEDIMENT SAMPLE COLLECTION FORM

Project_____ **Project Number:** _____

Date: _____ **Time:** _____

Field Personnel: _____ **Signatures**: _____

_____ _____

_____ _____

SITE DESCRIPTION

Site Location: _____

Station Number: M_____ **Photo. No.:** _____ **Roll No.:** _____

GPS Coordinates: **Latitude** _____°_____´_____´´ **Longitude** _____°_____´_____´´

(NAD27) **Elevation**_____

Comments/Descriptions:_____

_____

_____

_____

FIELD DESCRIPTION

Sample Identification Number:_____SEM_____

Sediment Characteristics (color, appearance, structure): _____

_____

_____

_____

Collection Method: SCOOP PONAR OTHER: _____

Sieve Analysis: Size _____N/A___ **Weight Retained** _____N/A___

Comments/Descriptions: _____

_____

_____

_____

SOP-NW-18.1

Data Validation

SOP-NW-18.1

Data Validation

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 PURPOSE

This standard operating procedure (SOP) establishes the requirements for the validation of analytical data packages generated by analytical laboratories providing chemical and radiochemical analysis of environmental samples acquired in field investigations.

2.0 APPLICABILITY

The procedure is applicable to all MWH personnel conducting validation of analytical data packages from chemical and radiochemical analysis of environmental samples. This procedure is to be used within the context of applicable Quality Assurance (QA) program plans or under the supervision of scientists experienced in the data validation requirements specified herein.

3.0 DEFINITIONS

3.1 Data Validation

As applicable to environmental investigations, data validation refers to the systematic process of independently reviewing a body of analytical data against established criteria to provide assurance that the data are acceptable for their intended use. Validation methods include, but are not limited to, review of sample holding times, instrument calibrations, instrument performance, precision measurements, and accuracy measurements. The end result of the validation effort is a report on the validity and usability of the body of data in relation to applicable project QA and technical requirements.

3.2 Data Qualification

As applicable to the data review and validation processes, qualification refers to the process of coding quantitative analytical data in a manner that describes the extent to which the data may be considered reliable or useful in characterizing the chemical and/or radiological constituents of a sample. Qualifier codes and descriptions are defined by analytical category in Section 7.0 below.

3.3 Sample Delivery Group (SDG)

A SDG is defined as a group of samples (usually 20 or fewer) received by the laboratory within a time frame of 14 days or less and reported within a single laboratory data package. Some projects may specify the SDG as the complete group of samples received by the laboratory for a given sampling period or event.

4.0 RESPONSIBILITIES

4.1 Project Manager

The MWH Project Manager has overall responsibility for coordinating data validation activities in compliance with this procedure; for assigning data validation activities to properly qualified and trained personnel; for approving final data validation reports; for coordinating any corrective action issues with the supporting analytical laboratory; and for ensuring completed data validation reports and validated analytical data packages are routed for retention in the project QA records system as directed by governing Quality Program Plans (QPPs) and project level plans.

4.2 Data Validation Specialist

The Data Validation Specialist (DVS) is responsible for performing all data validation activities in compliance with the requirements of this procedure; for documenting all results in the data validation report format required for each analytical category; for resolving all questions, data gaps, or errors with the analytical laboratory, within the guidelines of this procedure; and for advising the Project Manager and Project QA representatives of any observed problems that may affect the acceptability of the data, may require acquisition of additional samples, or that indicate quality problems with sample acquisition procedures, chain of custody, the adequacy of field decontamination procedures, laboratory performance, or other areas.

5.0 ADMINISTRATIVE REQUIREMENTS

5.1 Quality Assurance

This procedure will normally be invoked in the context of an investigation-specific Quality Assurance Project Plan (QAPP) or other project-level plan, and may be subject to periodic systems audits in compliance with the procedures referenced therein.

5.2 Training

All personnel training relative to the use of this procedure shall be conducted at the direction of the Project Manager.

6.0 EQUIPMENT AND MATERIALS

Materials and equipment necessary to complete the activities addressed by this procedure include:

- The original analytical data package to be validated with copies of all laboratory sample concentration reports (Form I's) in hardcopy and electronic format (compatible with any computer-assisted data review software);
- Copies of the applicable field sampling plans, sampling and analysis plans, or QAPPs;
- A copy of the analytical laboratory Statement of Work (SOW) for analytical services;
- A copy of the analytical laboratory's approved agreement for services or subcontract, and approved laboratory QA plan;
- Access to all analytical method references cited in the analytical laboratory agreement for services, this SOP and all other document references cited in applicable project-level plans;
- Data assessment summary forms as specified for the appropriate analytical category (see Attachments A through C);

- Computer with word processing, spreadsheet, and computer-assisted data review software capability and software instruction reference manuals as applicable to the validation requirements; and

- Office space, office supplies and calculator for the performance of validation activities.

7.0 CALIBRATION AND MAINTENANCE

No specific equipment calibration and maintenance requirements apply to the activities addressed by this procedure; certain calibration considerations applicable to analytical laboratory equipment are routinely evaluated as part of the validation protocols described herein.

8.0 PROCEDURE

This SOP is intended to provide guidance for the validation of chemical and radiological analytical data produced as a result of environmental sampling activities. The procedures described herein are applicable to both the review and validation of sample data. Validation is a specialized QA review process, and is defined in Section 3.1 above. This document shall be appended to all procurement documents for validation services; it is intended for use by trained chemists or scientists (in conjunction with the applicable project-specific work plans, QAPPs analytical method references, and laboratory agreements for services) for the review of the following types of chemical analytical data:

- U.S. EPA Contract Laboratory Program (CLP) volatile, semivolatile, chlorinated pesticide/PCB, metals and cyanide analytical data produced under the CLP statement of work (SOW) revisions 2/88 (EPA, 1988a), 7/88 (EPA, 1988b) and 3/90 (EPA, 1990a and EPA, 1990b)[1];

- U.S. EPA CLP Format A diskette report deliverables for volatile, semivolatile, chlorinated pesticide/PCB, metals and cyanide analytical data produced under the CLP SOW revisions, 2/88 (EPA, 1988a), 7/88 (EPA, 1988b), and 3/90 (EPA, 1990a and EPA, 1990b)[1];

- Volatile, semivolatile, chlorinated pesticide/PCB, phosphorus pesticide, chlorinated herbicide, metals and cyanide analytical data produced under the U.S. EPA SW-846 analytical methods;

- Polychlorinated dibenzo(p) dioxins and dibenzofuran analytical data produced using U.S. EPA Methods 8280, 8290 and 1613;

- Gamma Spectroscopy radionuclide and radiochemical analytical data produced using the U.S. EPA, 40 CFR Part 136, and HASL-300 reference methods (DOE, 1997) and reported in a format consistent with the recommendations provided in Attachment C;

- Petroleum hydrocarbons and BTEX analytical data produced using gas chromatographic methods consistent with EPA, APHA, and ASTM reference methods; and

[1] The most recent revisions to the ILMOX.X and OLMOX.X statements of work shall apply.

- Wet chemistry analytical data produced using methods consistent with EPA, APHA, and ASTM reference methods.

The procedures contained herein may be applied to other analytical methods within the context of governing QAPPs.

8.1 General Requirements

Resolution of discrepancies in the data package The Project Manager shall provide the DVS current copies of the applicable project specific work plans, sampling plans, QAPPs, laboratory statements of work, laboratory QAPPs, software reference manuals and laboratory standard operating procedures (SOPs), and shall specify the analytes of interest, reference analytical methods, contract required quantitation limits (CRQLs), and goals for analytical precision, accuracy, and completeness.

SOP Attachments A through C provide the necessary guidance for specific categories of data validation. Attachments A through C also include copies of data review documentation forms that shall be completed by the DVS.

The DVS shall complete several tasks on each sample delivery group (SDG). These tasks are summarized as follows:

- Receipt of the data package, date stamping the data package and duplication of the sample concentration reports, QC report forms, chain-of-custody forms, and diskette deliverables;

- Organization and review of the data package for completeness as described below, and documentation of the completeness of the data package on the applicable data assessment summary form;

- Review and validation of the data package according to the procedures described in the appropriate attachment, and documentation of the review using the corresponding form. Analytical results that are qualified or corrected as a result of the validation shall be noted on the as-received sample concentration forms. All changes, corrections and notations made on the sample concentration report forms shall be made in black ink and shall be initialed and dated by the DVS;

- Discovered as a result of the review by telephone contact with the laboratory and documentation of all such contacts. All documented telephone contacts with the laboratory shall be appended to the data validation report;

- After completion of the data validation, preparation of a narrative summary report discussing data quality, acceptability; and usability in the context of the applicable QAPP, SOW or other project-level plans;

- Submittal of a copy of the approved data validation report, including the narrative summary, completed forms, copies of the annotated laboratory sample concentration reports to the Project Manager within 21 days (or other project-specific schedule) after receipt of the data package from the contract laboratory. The original data validation report and all backup documentation along with the original laboratory data package shall be submitted to the project QA records in accordance with the requirements specified in Section 8.2.

8.2 Records Management

Within the context of governing QPP requirements, the DVS(s) shall have a records management and document control program established that meets the general requirements described in Section 8.1.

8.3 Data Package Completeness

After receipt of the data package, the DVS shall organize and review the data package for completeness by checking for the deliverable items listed in the appropriate data validation form, following the guidelines specified in the corresponding attachments. Observation of omitted deliverable items shall prompt the DVS to contact the laboratory by telephone to resolve discrepancies and request the necessary omitted deliverables. All telephone conversations with the laboratory must be documented and included as part of the validation report.

8.4 Documentation Requirements

8.4.1 Data Assessment Summary Forms

Each data assessment summary form described below consists of a checklist to be completed for the data validation, the action required in the case of unacceptable data, and space for comments for the DVS to include additional information as necessary to explain the validation. All checklists are located at the end of their associated attachments.

- **Organic Data Assessment Summary.** This form shall be completed during review and validation of volatile, semivolatile, chlorinated pesticide/PCB, chlorinated herbicide, phosphorus pesticide organic analysis and general GC analysis (TPH) data packages.

- **Inorganic Data Assessment Summary.** This form shall be completed during review and validation of inorganic metals, cyanide and wet chemistry analysis data packages.

- **Radiochemistry Data Assessment Summary.** This form shall be completed during review and validation of radiochemistry data packages.

8.4.2 Data Validation Reports

This section presents reporting requirements for validation reports on both a sample group and overall case basis.

After completing the data review for a specific analysis type or group of analyses, summarize the review in a narrative report that addresses data quality, usability and acceptability in terms of the QAPP requirements. Attach the applicable data assessment summary form, annotated sample concentration reports, supporting documentation, and the as-received unvalidated laboratory data package. Forward these items to the Project Manager within 21 calendar days of receipt of the completed laboratory data package (or within the schedule dictated by the governing QAP).

At a minimum, the validation report shall address the following elements as they are related to the project QA requirements and shall be provided to the Project Manager for review in the format of a technical memorandum addressing the following items:

- Introduction – This section of the memorandum shall provide a short introduction of the sample types, analyses conducted, laboratories involved, and applicable plans, specifications and references.

- Summary – This section of the memorandum shall provide an assessment of the quality control parameters reviewed during the validation activities and a summary of the data package completeness.

- Major Deficiencies – This section of the memorandum shall provide a summary of all rejected results as a result of the validation and their affect on the usability of the data.

- Minor Deficiencies – This section of the memorandum shall provide a summary of all qualified results, reasons for the qualifications and their affect on the usability of the data. This section may refer to the annotated sample concentration reports where applicable for explanatory purposes.

- Glossary of Data Qualifiers – This section of the memorandum shall provide a table listing all data qualifiers applied as a result of the validation and their explanation if the qualifiers are other than those defined in Section 8.4.3 of this procedure.

- Attachments – Attached to the data validation report should be copies of all annotated sample concentration forms and all supporting documentation related to the validation results.

8.4.3 Data Reporting Qualifiers

Data reporting qualifiers to be applied as a result of data validation are summarized below:

None - No qualifier indicates the compound or analyte was analyzed for and detected. The value reported is the constituent results corrected for sample dilution and moisture content by the laboratory. The data are usable for decision-making purposes.

U – Indicates the compound or analyte was analyzed for and not detected. The value reported is the sample quantitation limit corrected for sample dilution and

moisture content by the laboratory. The data are usable for decision-making purposes.

UJ – Indicates the compound or analyte was analyzed for and not detected. Due to a quality control deficiency identified during data validation the value reported may not accurately reflect the sample quantitation limit. The associated value is considered estimated but the data are usable for decision-making purposes.

J – Indicates the compound or analyte was analyzed for and detected. The associated value is estimated but the data are usable for decision-making purposes.

R – Indicates the compound or analyte was analyzed for but due to an identified quality control deficiency, the data are considered unusable for decision-making purposes.

UR – Indicates the compound or analyte was analyzed for but reported as undetected by the analytical laboratory. Due to an identified quality control deficiency, the data are considered unusable for decision-making purposes.

NJ – Indicates presumptive evidence of a compound at an estimated value. The data are usable for decision-making purposes.

N – Indicates presumptive evidence of a compound. The data are usable for decision-making purposes.

9.0 RECORDS REQUIREMENTS

Records required as the result of the validation of analytical laboratory data include completed validation summary forms (see Attachments A through C), supporting documentation (such as telephone contact records and correspondence) and all associated annotated sample concentration reports and as-received laboratory data packages. All records shall be routed to the project QA records files as specified by governing QAPPs or QPPs.

10.0 REFERENCES

APHA 1992, *Standard Methods for the Examination of Water and Wastewater, 18th Edition, American Public Health Associates,* Washington, D.C.

DOE, 1997, *EML Procedures Manual,* HASL-300-28th Edition, Environmental Measurement Laboratory, U.S. Department of Energy, New York, New York. February 1997. Available from National Technical Information Service as Product No. PB97-162549LTN or online at http://www.eml.doe.gov/publications/proman/.

DOE, 1990, *Quality Control Requirements for Field Methods,* DOE/HWP-69/R1, U.S. Department of Energy, Oak Ridge Operations Office, Oak Ridge, Tennessee.

DOE, 1994, *Methods for Evaluating Environmental and Waste Management Samples,* DOE/EM 0089T, Rev 2., U.S. Department of Energy, Washington, D.C.

EPA, 1977, *Handbook for Analytical Quality Control in Radioanalytical Laboratories,* EPA 600/4-77-088, U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C.

EPA, 1979, *Radiochemical Analytical Procedures for Environmental Samples,* EMSL-LV-0538 17, U.S. Environmental Protection Agency/Environmental Monitoring and Support Laboratory, Las Vegas, Nevada.

EPA, 1983, *Methods for Chemical Analysis of Water and Wastes,* EPA-600/4-83-020, U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio.

EPA, 1980, *Prescribed Procedures for the Measurement of Radioactivity in Drinking Water,* U.S. Environmental Protection Agency, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio.

EPA, 1984, *The Determination of Inorganic Ions in Water by Ion Chromatography, Method 300.0,* U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1986a, *Test Methods for Evaluating Solid Waste (SW-846), Third Edition,* U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1986b, *Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water,* U.S. Environmental Protection Agency/Environmental Monitoring and Support Laboratory, Cincinnati, Ohio.

EPA, 1988a, *USEPA Contract Laboratory Statement of Work for Organics Analysis, Multi Media, Multi-Concentration,* SOW 2/88, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1988b, *USEPA Contract Laboratory Statement of Work for Inorganics Analysis, Multi Media, Multi-Concentration,* SOW 7/88, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1989a, *Method 8290, Determination of Polychlorinated Dibenzo-p-Dioxins and Polychlorinated Dibenzofurans by High-Resolution Gas Chromatography/High Resolution Mass Spectrometry (HRGC/HRMS),* Revision 0, October 1989, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C.

EPA, 1989b, *Removal Program Quality Assurance/Quality Control Interim Guidance, Sampling QA/QC Plan and Data Validation Procedures,* OSWER Directive 9360.4-01, February 2, 1989, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Washington, D.C. 20460.

EPA, 1990a, *USEPA Contract Laboratory Program, Statement of Work for Organics Analysis, Multi-Media, Multi-Concentration,* OLM02.1, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1990b, *USEPA Contract Laboratory Program, Statement of Work for Inorganics Analysis, Multi-Media, Multi-Concentration,* ILM03.0, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1994a, *USEPA Contract Laboratory Program, National Functional Guidelines for Inorganic Data Review,* EPA 540/R-94-013, February 1994, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1994b, *USEPA Contract Laboratory Program, National Functional Guidelines for Organic Data Review,* EPA 540/R-94-012, February 1994, U.S. Environmental Protection Agency, Washington, D.C.

Karnofsky, 1994a, *Radiochemistry Data Validation,* Draft #5, 7/93, Revised 9/93, 10/93, 11/94, 9/94, Joel Karnofsky, Berkeley, California, (under contract to DOE EM-263).

Karnofsky, 1994b, *Performance Objectives and Criteria for Performing Validation of Radiochemistry Data,* Draft #1, 9/27/94, Joel Karnofsky, Berkeley, California, (under contract to DOE EM-263).

ORAU, 1990, *Laboratory Procedures Manual for the ORAU Environmental Survey and Site Assessment Program,* March 1990, Oak Ridge Associated Universities, Oak Ridge, Tennessee.

WDOE, 1992, *Total Petroleum Hydrocarbons, Analytical Methods,* State of Washington, Department of Ecology/Toxics Cleanup and Solid & Hazardous Waste Programs, Olympia, Washington.

DATA QUALITY ASSESSMENT FORMS

INORGANIC DATA ASSESSMENT SUMMARY

PROJECT:	SITE:
LABORATORY:	SDG:
SAMPLES/MATRIX/ANALYSES:	

DATA ASSESSMENT SUMMARY

REVIEW ITEM	ICP	AA	HG	CYANIDE	OTHER
1. Data completeness					
2. Holding Times					
3. Calibration					
4. Blanks					
5. ICS					
6. LCS					
7. Duplicate RPD					
8. Spike Recovery					
9. MSA					
10. Other QC					
11. Field Duplicates					
12. Result Verification					
13. Overall Assessment					

O=Data had no problems/or qualified due to minor problems.
M=Data qualified due to major problems.
NA=Data review item not applicable.
X=Problems but do not affect data.
Z=Data unacceptable.

Comments/Qualified Results:

_____
_____
_____
_____
_____
_____

Verified and Validated by: _____ Date: _____
Reviewed and Approved by:_____ Date: _____

INORGANIC DATA ASSESSMENT SUMMARY

Acceptable

Yes No

1. Data package completeness (check if present) ___ ___

___Case narrative
___Chain of custody
___Sample Results
___ICV/CCV Results
___Blank Results
___ICP Interference Check Results
___Spike Recovery Results
___Duplicate Results
___LCS Results
___Standard Addition Results
___ICP Serial Dilution

___Instrument Det. Limits
- ___ICP Correction Factors
- ___ICP Linear Ranges
- ___Preparation Logs

___Analysis Run Logs
___ICP Raw Data
- ___GFAA Raw Data
- ___Hg Raw Data
- ___Cyanide Raw Data
- ___Other_____

Comments/Qualified Results:

_____
_____
_____
_____
_____
_____
_____
_____
_____

2. Holding times (check all that apply) ___ ___

___ICP/GFAA metals completed in <6 mos from collection
___Mercury analyzed in <28 days from collection
___Cyanide completed in 14 days from collection

Qualify as estimated (J, UJ) all results analyzed past the holding times listed but within 2x times the limit. Qualify detects as estimated (J) and non-detects unusable (UR) for results analyzed greater than 2x above the limit. If soil data are qualified based on water holding time criteria, note.

Comments/Qualified Results:

_____
_____
_____
_____
_____
_____
_____
_____
_____

INORGANIC DATA ASSESSMENT SUMMARY

Acceptable

Yes No

---

3. Calibrations (check all that apply) ___ ___

___GFAA/Hg correlation coefficient <0.995, results estimated (J, UJ)
___ICV/CCV %R, ICP 89-111%, Hg 30-120%, Cn 85-115%, results unacceptable
___ICV/CCV %R, ICP 75-89%, Hg 65-79%, Cn 70-84%m results <IDL estimated (UJ)
___ICV/CCV %R, ICP <75%, Hg <65%, Cn <70%, results unusable (R)
___ICV/CCV %R, ICP >125%, Hg >135%, Cn >130%, results >IDL unusable (R), <IDL acceptable
___ICV/CCV %R, ICP 75-89% or 111-125%, Hg 65-79% or 121-135%, Cn 70-84% or 116-130%, results >IDL estimated (J)

Comments/Qualified Results:

_____
_____
_____
_____
_____
_____

4. Blanks (check all that apply) ___ ___

___Detects reported ICB/CCB, list:

_____
_____
_____

___Detects in preparation blanks, list:

_____
_____
_____

___Detects in field blanks, list:

_____
_____
_____

Qualify as undetected (U) all sample concentrations ≤5X any blank concentrations.

Comments/Qualified Results:

_____
_____
_____
_____
_____
_____
_____

INORGANIC DATA ASSESSMENT SUMMARY

Acceptable

Yes No

---

5. Interference Checks (check all that apply) ___ ___

___ICS A/B Recoveries Acceptable
___Al, Ca, Fe, Mg sample concentrations >ICS concentrations
___ICS %R> 120%, results > IDL estimated (J)
___ICS %R 50-79%, results>IDL estimated (J), possible false negative
___ICS %R 50-79%, results <IDL estimated (UJ)
___ICS %R <50%, results >IDL and <IDL rejected (R/UR)
___ICS %R>120, results <IDL acceptable

Comments/Qualified Results:

_____
_____
_____
_____
_____
_____

6. Laboratory Control Samples (check all that apply) ___ ___

___LCS %R 80-120 (Ag, Sb no limits)
___LCS %R 50-79% or >120%, results>IDL estimated (J)
___LCS %R 50-79% and results <IDL estimated (UJ)
___LCS %R <50% and all results rejected (R/UR)
___LCS %R >120%, results <IDL acceptable

Comments/Qualified Results:

_____
_____
_____
_____
_____

7. Duplicate (check all that apply) ___ ___

___Duplicate RPD $\leq$20% for waters ($\leq$35% for soils) for results >5X CRDL
___Duplicate Range is within $\pm$CRDL ($\pm$2xCRDL for soils) for results $\leq$ 5X CRDL
___Qualify positive results estimated (J) if the above criteria were not met.

Comments/Qualified Results:

_____
_____
_____
_____
_____

INORGANIC DATA ASSESSMENT SUMMARY

Acceptable

Yes No

---

8. Spike Recovery (check all that apply) ___ ___

___Spike %R with 75-125%
___Spike %R 30-74%, >125%, results >IDL estimated (J)
___Spike %R 30-74% results <IDL estimated (UJ)
___Spike %R <30%, results <IDL rejected (UR)
___Field blank used for spike analysis
___Spike % R >125%, results <IDL acceptable
___Sample concentration exceeds spike concentration by a factor of >4x, acceptable

Comments/Qualified Results:

_____
_____
_____
_____
_____
_____

9. GFAA Performance (check all that apply) ___ ___

___Duplicate injection RSD<20%
___Duplicate injection RSD>20%, results >CRDL estimated (J)
___Analytical spike %R 85-115%
___Analytical spike %R 40-85%, results >IDL estimated (J)
___Analytical spike %R 10-40%, results <IDL estimated (UJ)
___Analytical spike %R <10%, results <IDL rejected (R)
___Analytical spike %R <40%, results >IDL estimated (J)
___MSA required but not run, results estimated (J)
___MSA run at incorrect level, results estimated (J)
___MSA correlation coefficient <0.995, results estimated (J)

Comments/Qualified Results:

_____
_____
_____
_____

10. Serial Dilution (check all that apply) ___ ___

___Serial Dilution %D within 10% for sample results >50x the IDL
___Serial Dilution %D greater than 10%, results >50x the IDL estimated (J)

Comments/Qualified Results:

_____
_____
_____
_____
_____

INORGANIC DATA ASSESSMENT SUMMARY

Acceptable

Yes No

---

11. Field Duplicates (check all that apply) ___ ___

___Field duplicate RPD ≤20% waters (≤35% for soils)
___Field duplicate range is within ±CRDL (±2x CRDL for soils) for results <5xCRDL

Note: There are no qualification requirements for field QC samples exceeding limits.

Comments/Qualified Results:

12. Result Verification (check all that apply) ___ ___

___All results supported in raw data

Comments/Qualified Results:

13. Overall Assessment ___ ___

SOP-NW-19.0

Collection of Vegetation Samples

MWH
MONTGOMERY WATSON HARZA

SOP-NW-19.0

Collection of Vegetation Samples

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

The purpose of this document is to define the standard operating procedure (SOP) for vegetation sampling performed by MWH personnel. This SOP is intended to be used in conjunction with the governing project-specific workplan or sampling and analysis plan (SAP).

2.0 DEFINITIONS

None.

3.0 RESPONSIBILITIES

The Project Manager or Field Team Leader is responsible for assigning project staff to perform vegetation sampling activities. The Field Team Leader is also responsible for assuring that these and any other appropriate procedures are followed by project personnel.

The project staff assigned to perform vegetation sampling activities are responsible for completing their tasks according to these and other appropriate procedures. All staff are responsible for reporting deviations or nonconformance of the procedure to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing workplan or SAP requirements.

4.0 DISCUSSION

The methods described by this procedure may be used to acquire vegetation samples for chemical or radiological analysis. Methods should be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or workplans.

5.0 PROCEDURE

The following section presents a list of equipment and procedures necessary for vegetation sampling.

5.1 Equipment List

The following is a list of equipment that may be necessary to perform vegetation sampling:

- Bound field notebook
- Copy of this SOP and the governing workplan or SAP
- Detergent solution (0.1 to 0.3 percent Alconox)
- Distilled water
- Hand scoop, trowel, or shovel

- 100-foot long tape measure with 0.1-inch subdivisions
- Plant identification handbook
- Protective gloves
- Stainless steel scissors or other equivalent cutting instrument
- Sample analysis request forms
- Sample containers (polyethylene bags having at least an one-quart capacity)
- Sample labels and seals
- Sample location maps or sketches
- Balance with a 250-gram capacity calibrated to ±0.1 gram
- Balance calibration mass
- 35-millimeter camera
- Vegetation sample collection form (see attachment)

The governing workplan or SAP may require the use of other equipment based on the scope and objective of an individual project. Project personnel will review the workplan or SAP for any equipment not listed in this SOP.

5.2 Vegetation Sampling

Vegetation sampling locations and vegetation types to be sampled at each location shall be as specified in the governing workplan or SAP. If specified by the workplan or SAP, sampling locations shall be photographed prior to sample acquisition. Plant samples must be identified, collected, and sorted by individual species unless otherwise indicated in the workplan or SAP. It may be important to accurately identify the plants to be sampled. Individual species may take up and accumulate contaminants and naturally occurring substances at dissimilar rates and may store these constituents in different plant tissues. Samples will be collected of each species sampled, as described in the workplan or SAP. Minimum sample weights required by individual laboratories should be reviewed prior to field sampling.

If the workplan or SAP requires dust-free samples, the samples must be washed gently in the field with distilled water containing 0.1 to 0.3 percent Alconox and rinsed twice with distilled water to remove dust or other potential contaminants that may interfere with tissue concentration results. Plant samples should not to be washed if the investigation goals are to determine potential contamination transfer to animal food chains under existing site conditions. Specific collection requirements for herbaceous and woody species is presented in the following subsections.

Specific collection requirements for herbaceous and woody plant species are presented in the following subsections.

5.2.1 Herbaceous Species

Herbaceous species include grasses, sedges, forbs, and other non-woody plants. Samples are collected and processed either as whole plants or as selected plant tissues, as specified in the workplan or SAP.

Whole Plants. If a whole plant is required, manually excavate the entire herbaceous plant from the ground using a hand trowel or shovel while taking care to obtain a majority of the root system. Once the plant is excavated, dislodged loose soil from the roots and rinse the roots with distilled water to remove any remaining soil. Rinse fluids shall be disposed of as specified in the governing workplan or SAP. Place and seal plant samples in appropriately sized and labeled polyethylene bags. Record sample data on the sample analysis request form and on the sampling log (see attachment). Store the samples in a cooler maintained at 4°C or less prior to sample deliver to the analytical laboratory.

Specific Plant Tissues. Specific plant tissues are collected either by cutting the desired parts from the plant with stainless steel scissors or shears or by manually breaking the parts off the plant. The number of plants, the amount of plant tissue, and the sample area is defined in the governing workplan or SAP. Fold, cut, or break sample plant tissues so that the plant tissues fit into a plastic bag. Weigh and store sample as previously stated. Clean or replace scissors or shears after collecting each sample.

To collect a root tissue sample, follow the same procedure described above for washing of roots in whole plant samples. As much extraneous soil or substrate contamination as possible must be removed in the field. Follow similar sample processing and labeling as described for whole plant samples.

If the specific plant tissue requires washing to remove surface dust or contamination, then wash the tissues before cutting them. If retention of investigation derived waste (IDW) is required, all wash and rinse fluids shall be captured and returned to the decontamination staging area for disposal. Field weigh the washed samples with the hand-held spring balance or other measuring device to the nearest 0.1 gram after shaking off residual wash water.

5.2.2 Woody Species

Woody species include trees and shrubs. Samples are normally of specific plant tissues such as branches and leaves of the current year's growth rather than the entire plant since individual plants are too large to be considered for whole-plant analysis. Typically, target plant tissues are leaves, stems, and mature fruits. Specimens for woody species require a minimum 12-inch length of the current year's stem with mature leaves, flowers, and/or fruits attached.

Specific Tissues. Follow the same general procedures for collecting the leaf and stem tissues from woody plants as those described for herbaceous tissue samples. Refer to the workplan or SAP regarding whether to

combine or segregate leaf and stem tissues for a single sample. If stems and leaves will be analyzed separately, manually cut, break, or separate the individual leaf from the branch and leaf stem. The leaves would then constitute one sample and the stems without leaves would constitute another. Because woody plants are larger and the individuals are more widely spaced than herbaceous plants, the radius of sampling may be significantly larger than the radii for herbaceous plants. Field personnel will consult the governing workplan or SAP for project-specific sampling protocols.

Collect mature fruits such as nuts, berries, drupes, and seeds manually and separately store, label, and process the individual plant types. If required by the workplan or SAP, photograph the fruits as they are naturally attached to the parent plant or attached to a single branch cut from the tree or shrub using a close-up lens.

5.3 Sample Identification

If required by the governing workplan or SAP, a reference specimen of each sampled plant species shall be collected, labeled, dried, and stored in a plant press using standard herbarium techniques. Specimens for herbaceous species require a complete and mature plant that includes at least 40 percent of the root system, mature flowers and/or fruits, stems, and leaves. Specimens for woody species require a minimum 12-inch length of the current year's stem with mature leaves, flowers, and/or fruits attached. If reference specimens are not practical, photographs will be taken of representative samples. Each reference specimen will be assigned an identification number. The identification number, corresponding sample identification number(s), and any reference photograph numbers will be recorded in a field logbook. If species verification is required, the reference specimens or photographs can be sent to others for confirmation of identification.

5.4 Sample Handling

Sample handling procedures and requirements shall be as specified in the governing workplan or SAP.

5.5 Decontamination

Decontamination procedures for sampling shall be as specified in the governing workplan or SAP.

VEGETATION SAMPLE COLLECTION FORM

Project: _____

Project Number: _____

Date: _____ **Time:** _____

Name of Field Personnel: _____

Signatures: _____ _____

SITE DESCRIPTION

Study Area: South Idaho Phosphate Resource Area

Site Location: _____

Facility Location: _____

Station Number: _____

GPS Coordinate: _____

Subquadrant Coordinates: x-coordinate: _____ y -coordinate: _____

Approximate Slope Angle (circle): 0° - 10° 10° - 30° 30° - 40° > 45°

Aspect (direction of slope): N NE E SE S SW W NW

Vegetation Ground Coverage: < 25% 25% - 50% 50% - 75% > 75%

Notes (plants of interest):

_____

_____

_____

SAMPLE DESCRIPTION

Sample Identification Number: _____

Sample Type (circle): whole plant stem leaf

Sample Genera: _____

Sample Weights: Tare _____

Total _____ _____ _____ _____ _____

Net _____ _____ _____ _____ _____

Notes: _____

_____

SOP-45

Collection of Fish Samples: Electrofishing and Netting

MWH
MONTGOMERY WATSON HARZA

SOP-45

COLLECTION OF FISH SAMPLES: ELECTROFISHING AND NETTING

Note: This document is proprietary, revision controlled, and is intended strictly for use by MWH and its teaming partners or subcontractors in support of specific contractual responsibilities. Copying and further dissemination in any manner is not permitted without written authorization by the responsible MWH Project Manager, except as may be agreed upon by MWH and its clients in the terms and conditions of applicable contracts.

1.0 SCOPE

The purpose of this Standard Operating Procedures (SOP) is to define standard methods for the collection of freshwater fish specimens and their subsequent preparation, handling, and shipment for chemical analysis. This SOP applies to any work performed by MWH or subcontractor personnel for any portion of freshwater fish sampling, and it is intended to be used in conjunction with a site-specific work plan (WP) or sampling and analysis plan (SAP). Modifications to this SOP may be made as necessary to meet specific project needs, but such changes must be appropriately documented and approved by the Project Manager and the Quality Assurance (QA) Manager.

2.0 DEFINITIONS

None.

3.0 RESPONSIBILITIES

3.1 Field Sampling Engineer

The Field Sampling Engineer is responsible for sample collection, sample custody in the field, sample preparation and preservation, field testing, total and accurate completion of field logbooks, sample shipment, and delivery of sampling data to the Project Manager as described in this SOP. All field staff are responsible for reporting procedural deviations or nonconformance to the Field Team Leader, Project Manager, or Quality Assurance (QA) Manager, in compliance with the governing WP or SAP requirements.

3.2 Field Team Leader

The Field Team Leader is responsible for supervising the Field Sampling Engineers. Supervision includes ensuring that samples are collected, documented, preserved, handled, and shipped to the appropriate laboratory as specified in project work documents and this SOP.

3.3 Project Manager

The Project Manager has overall responsibilities for managing the execution of the project, and is typically responsible for designing the sampling program, for program logistics, and for providing any required clarifications in the use of this SOP. The Project Manager may assume the responsibilities of the Field Team Leader on smaller projects.

The Project Manager is also responsible for maintaining project files and filing project documents, project correspondence, chain of custody forms, field logbooks or project-specific sampling forms, generated data, and other associated and pertinent project information.

3.4 QA Manager

The QA Manager is responsible for assisting in the development of (and monitoring performance to) site specific SAPs, QA plans, and/or WPs.

4.0 DISCUSSION

The methods described by this procedure may be used to acquire fish specimens and tissue samples for chemical, live laboratory, or radiological analysis. Methods shall be selected at the discretion of the Field Team Leader or Project Manager in accordance with any specific provisions of governing SAPs, QA plans, and/or WPs.

5.0 SAMPLE COLLECTION PROCEDURE

Fish collection activities will include the use of electrofishing, and blocking nets where practicable. When necessary, netting using pop, gill, or fyke nets will also be deployed where practicable. Only target species identified in the workplace or SAP and the scientific collection permit will be retained for chemical analyses. Fish tissue samples will be analyzed for constituents as described in the WP or SAP. All target species outside of the preferred size range, and non-target species, will be released back to the water unharmed. Collection efforts will follow the general procedures presented below and must also adhere to all provisions outlined in applicable scientific collection permits.

5.1 Equipment List

The following list of equipment and materials should be made available for fish sampling activities, as appropriate for the requirements of individual investigations:

- Boat (s);
- Backpack and boat-mounted electrofishing equipment;
- Blocking nets;
- Species identification references, as required;
- Dip nets;
- Arm-length insulated waterproof gloves;
- Chest waders;
- Buckets/live wells;
- Life Jackets;
- Sample containers;
- Labels;
- Field sampling data sheets;
- Camera;
- Insulated coolers with ice;
- Chain-of-custody forms and custody seals; and
- Field logbook

5.2 General Considerations

- Fishes will be collected using electrofishing and netting techniques.

- Acquisition of fish specimens of special concern (e.g., threatened or endangered species) shall be documented and the fishes immediately released on site.

- Attempts shall be made to minimize the natural variability within the target population. Since measurements of environmental contaminants in biota typically exhibit a wide range due to natural variations in the samples, specimens of comparable size and age should be collected whenever possible to minimize such variability.

- During collection activities all samples will be held in a live well. After sampling at a given location is completed, the live well will be drained and the fishes will be

sorted by species and transferred to a cooler for storage on ice until shipment to the laboratory for analyses.

- For each fish sample retained for chemical analyses, the following information will be recorded in the field notebook and on data collection forms.
    - Date and time;
    - Sampling location (include waterbody name);
    - Sample number;
    - Sampling method (include estimated area fished);
    - Species collected;
    - Total length; and
    - Sampling personnel (including any oversight personnel).

5.3 Fish Collection Techniques

5.3.1 Boat-Mounted and Backpack-Mounted Electrofishing

This section describes the specific electrofishing procedures to be used for the collection of fishes from streams, rivers, and shallow lake/reservoir locations. The following equipment will be used during electrofishing from a boat or with a backpack unit.

- Electrofishing boat;
- Backpack-mounted electrofishing unit;
- Electrodes, cables, anode array or ring;
- Gasoline powered generator;
- Control equipment to regulate voltage and current to the electrodes;
- Wiring to provide safe transmission of current under operating conditions;
- Switching, including a switch that keeps the circuit open unless actively and continuously closed (i.e., a “dead man’s” switch);
- Live well, if necessary;
- Dip nets with handles of non-conductive material;
- Ice and insulated coolers; and
- Safety equipment as specified by the applicable health and safety plan, but at a minimum including life preservers, footwear with non-conductive soles or chest waders, hearing protection, and non-conductive gloves

The field crew will set up and test electrofishing equipment in accordance with procedures specified in the manufacturer’s operating manual for the unit(s) employed at the site.

The field crew leader will be responsible for control of the boat/backpack and operation of the control equipment and generator. Field crew member(s) will be responsible for control of the dead-man's switch and capturing the fishes.

To collect the fishes, apply current to the water by closure of the dead-man's switch while the generator and control equipment are operative. Two electrofishing passes will be made through a representative section of stream. As fishes float to surface, collect target species of appropriate size in dip nets. Retain fishes in the live well or on ice in an insulated cooler. Electrofishing at each sampling site will continue until appropriate numbers of fishes have been captured or until the decision is made that no fishes occupy the stream reach. Stream reaches to be sampled should be at least 100 yards in length, or the entire reach of any stream less than 100 yards in length. If the required numbers of fishes are collected, the entire reach need not be sampled.

Sampling will be temporarily halted when any person, pets, or livestock are observed in the water or on the shore within approximately 50 feet of the backpack electrofishing unit. If any other boat comes within 150 feet of the boat-mounted electrofishing unit the sampling effort will also be temporarily halted.

5.3.2 Netting

This section describes the specific netting procedures for the collection of fishes from deep and shallow water. These procedures may be applicable for deeper rivers, reservoirs and lakes. The following equipment will be used during the netting activities.

- Sampling boat;
- Pop, gill, and fyke nets;
- Anchors, floats, rope;
- Chest waders;
- Live well;
- Ice and insulated coolers;
- Fish collecting equipment such as dip nets; and
- Life preservers and other safety equipment specified by the applicable project health and safety plan, including life preservers.

The field crew will reconnoiter the sampling location to determine the proper net type to use and the best locations for net placement. It is anticipated that the netting technique will be depth dependent. In shallower waters (less than 12 feet deep), the pop or fyke nets will be used. In deeper waters, the gill nets may be used.

5.3.2.1 Pop Nets

Pop nets will be set up in shallow habitat including weed beds. Pop nets are configured in a box-like shape. They will be flattened and lowered into the water in a square configuration, taking care not to trigger the net. Buoys will be used to mark the net location. After the net is triggered, the nets rise almost instantly to the surface. The site will be vacated for approximately 6 to 8 hours to allow fishes to re-occupy the area. After the six to eight hour "colonization" period, the sampling team will return and trigger the

nets. Target specimens will be collected from within the net enclosure using dip nets and transferred to a live well or insulated cooler for storage.

5.3.2.2 Gill Nets

Gill nets will be checked every ½ hour while the net is deployed. Fishes will be collected by lifting the net out of water and handpicking the fishes from the net into an appropriately sized holding tub. Fishes will be sorted and target species of appropriate size will be retained in a live well or on ice in an insulated cooler.

5.3.2.3 Fyke Nets

Fyke nets will be deployed along the nearshore environments, with the assistance of a boat and onshore personnel. Fyke nets will be set perpendicular to shore, and anchored as appropriate. Floats at the top of the netting will be used to mark the location. The net will be allowed to fish for ~3 hours at a time, before field crews return to examine captured fishes. Target specimens will be retained for analysis, and non-target species will be released unharmed.

5.4 SAMPLE HANDLING

- After collection, fishes will be retained in a live well or on ice in an insulated cooler.
- Place each fish in an individual polyethylene freezer bag (1 or 2 gallon capacity).
- Label each individual fish sample with sample identification number in pen.
- Specify on the chain-of-custody form the tissue sample preparation (e.g., skin-on fillets or whole-body composite) and the chemical analysis or analyses required.
- Samples will be prepared and packaged for shipment to the laboratory following the appropriate handling and chain-of-custody procedures presented in the SAP.

During the fish sampling operations, proper personal protective equipment will be worn, as described in the applicable WP or site safety and health plan to minimize health risk to field personnel and cross-contamination of the samples.

5.5 DECONTAMINATION

Sample acquisition and tools shall be decontaminated as follows:

- Ensure that the cleaning solutions and rinseate containers required by governing sampling plans are available.
- Scrub and wash the sample acquisition tools with an alconox, or equivalent soap, and rinse with deionized or distilled water.
- Dispose of the rinseate and wiping rags in the manner specified in governing sampling plans.

- Wrap the decontaminated device in clean plastic sheeting or bags and tape securely pending next use.

5.5 DOCUMENTATION

Field information (e.g., sampling location, sample numbers, personnel onsite, weather conditions, sample numbers, species and length) shall be recorded on a project-specific field sampling form and/or bound field logbook, as specified in govenring SAPs, QA Project Plans, or project work plans.

6.0 REFERENCES

Environmental Protection Agency, 1999. *Revision to Rapid Bioassessment Protocols for Use in Streams and Rivers: Periphyton, Benthic, Macroinvertebrates, and Fish*. Environmental Protection Agency, Office of Research and Development, Washington D.C. EPA 841-D-97-002.

USGS, 1993. Methods for Sampling Fish Communities as Part of the National Water-Quality Assessment Program. U.S. Geological Survey, Raleigh, North Carolina. Open File Report 93-104.

Appendix C
Quality Management Procedures

MP-9.2, “Technical Review”
MP-10.1, “Surveillance Inspection”
MP-14.1, “Corrective and Preventive Action “
MP-16.1, “Management of Quality Records”

MP-9.2

Technical Review

Record of Revisions

Revision Level -2-

Page	*Section*	*Description*
All	All	Completely rewritten
All	All	Updated to MWH

MP-9.2

TECHNICAL REVIEW

1. SCOPE AND PURPOSE

When invoked by applicable quality plans, this procedure establishes minimum requirements for formal evaluation of the technical adequacy and quality of written and/or drafted documents prepared as deliverable work products by Montgomery Watson Harza (MWH) or its subcontractors. It generally applies to all reports, recommendations, data summaries, procedures, plans, drawings, or other deliverable that contains engineering or environmental data or technical recommendations.

2. DEFINITIONS

2.1 Author

For the purposes of this procedure, the author is defined as the individual primarily responsible for the preparation of the document being reviewed.

2.2 Independent Technical Review

An ***independent technical review*** is an independent, documented, in-depth critical review of a document to verify the accuracy of calculations, examine the applicability of references and source documents, examine the adequacy of the technical approach, ensure the completeness and accuracy of data, and to ensure conformance with applicable client requirements, Work Instructions (WIs; see MP-9.1, "Work Instructions"), and/or applicable regulatory guidelines. The scope of a technical review may be focused on specific issues or areas of a document, at the direction of the Project Manager.

2.3 Independent Technical Reviewer

The ***independent technical reviewer*** is the individual assigned the primary responsibility for independently checking, reviewing, or otherwise verifying that document content is correct and accurate. Independent technical reviewers may be designated by the responsible Project Manager via WIs or other means. They should have qualifications similar to those of authors, but shall have no direct responsibilities for the production of the document being reviewed. Project Managers may assume the role of independent technical reviewers provided that independence requirements are met.

2.4 Mandatory Comment

Mandatory comments in an independent technical review identify areas in a document that, in the opinion of the reviewer, require a change in order to ensure technical acceptability. Formal

resolution of all mandatory comments is required in compliance with this procedure prior to deliver of the document to the client.

2.5 Non-Mandatory Comment

A ***non-mandatory comment*** is defined as a comment made in a technical review that corrects punctuation, or offers improvements in understanding or corrections of syntax, but does not affect the technical content of the reviewed document. Non-mandatory comments may be documented on the Review Comment Form (RCF, see Figure 2) if comment discussion is necessary for understanding, or by marking the reviewed text of the document, or both. Non-mandatory comments may be incorporated at the discretion of the author of the document. Documentation of non-mandatory comment resolution and acceptance is not required.

2.5 Review Comment Form

The ***Review Comment Form*** (RCF) is a standard form used for documenting independent technical review activity. When included with the as-reviewed drafts and final draft of a document and approved by the quality manager, the RCF provides traceability of all formal mandatory review comments and the comment resolution process.

2.6 Document

For the purposes of this procedure, the ***document*** is interpreted as the MWH or subcontractor report, recommendation, data summary, plan, procedure, drawing, or other technical representation that is submitted to a client as a deliverable.

2.7 As-reviewed Draft

The ***as-reviewed draft*** is defined as the version of the document presented by the author for independent technical review.

2.8 Final Draft

The ***final draft*** is defined as the approved and updated document, with all changes incorporated from the comment resolution process.

2.9 Calculation Check

A ***calculation check*** is a documented examination by the technical reviewer to confirm the accuracy of calculations. For hand calculations, examination may be done by reproducing the calculations as originally performed, or by performing alternate calculations that will yield equivalent results from the same data. For spreadsheets and other computerized calculations, examination may be made by an alternate method, usually a hand calculation or an independently derived spreadsheet. As a general rule, 100% of all calculations shall be checked, although spot-checking or alternate checking schemes may be authorized by the Project Manager if circumstances warrant.

3. RESPONSIBILITIES

3.1 Author

The document author is responsible for:

- producing documents in full compliance with client and WI requirements;
- ensuring that draft documents are as complete as possible prior to entering the review process;
- ensuring that all calculations have been documented and checked for accuracy; and for
- resolving all mandatory comments with the independent technical reviewer, the Project Manager, and/or Project Quality Manager.

3.2 Independent Technical Reviewer

The independent technical reviewer is responsible for:

- confirming the accuracy of calculations, either by re-performing the calculations in their entirety, or by performing checks as defined in governing WIs as applicable;
- reviewing applicable schedules and ensuring the adequacy of allotted review time, and for providing appropriate scheduling recommendations to the responsible Project Manager;
- performing critical reviews of documents as directed by this procedure and any governing WIs;
- providing documented mandatory comments and actively participating in the process of comment resolution as described by this procedure; and for
- providing non-mandatory comments to the author where appropriate for improvements or corrections in syntax, punctuation, or usage.

3.3 Project Manager

The Project Manager (or their designee) is responsible for:

- initiating document preparation and establishing the scope of independent technical review activities through the WI process, internal directives, or other appropriate methods;

- selecting independent technical reviewers based on qualifications and experience;
- defining any required emphasis or special considerations for individual reviews;
- ensuring that adequate review time is scheduled to complete the review;
- approving results of technical reviews and providing additional overchecks as required;
- resolving comment resolution conflicts between the author and independent technical reviewer; and
- assessing the calculation needs of the project or task, and if appropriate for the complexity of the calculations, issuing WIs or other directives to initiate and define calculation and checking requirements.

3.4 Project Quality Manager

The Project Quality Manager [or designated Quality Assurance (QA) reviewer] is responsible for reviewing and approving the RCF and its supporting documentation to ensure that all mandatory comments have been resolved and incorporated into the final text of the document. The Project Quality Manager is also responsible for ensuring that any specific QA requirements applicable to the document have been adequately and appropriately addressed.

4. PROCEDURE

The following steps describe the procedure for performing technical review on project documents, and are summarized in a flowchart in Figure 1.

4.1 Calculations and Calculation Checks

The Project Manager shall assess the calculation needs of the project or task. Calculations determined to be simple and straightforward may be performed by project personnel and checked by the independent technical reviewer without additional instructions. If further definition is required because of the complexity of the calculations, the Project Manager shall direct the performance of calculations and independent checks by issuing an internal memorandum or a WI in compliance with MP-9.1, "Work Instructions." The memo or WI shall identify the individuals responsible for performing the calculations and the independent technical reviewer, and, as appropriate, shall define the objective of the calculations, the calculation method, the checking method, and the document or activity to which the calculations apply.

Unless otherwise specified, calculation check methods must constitute re-performance, in order to confirm the accuracy of the original calculations. Checks shall be performed by the independent technical reviewer as part of their review. Checks may be documented on standard

MWH engineering graph paper or a functional equivalent; computer output sheets or tables may be appended as appropriate. Each sheet shall be initialed and dated by the technical reviewer. If errors are identified during the checking process, the calculations shall be re-performed by the author or preparer of the document and re-documented.

4.2 RCF Initiation and Comment Documentation Process

The document shall be completed prior to initiation of the technical review process. The independent technical reviewer shall be as designated by the Project Manager. The number of any WI governing the preparation of the document shall be noted on the RCF form (Figure 2), along with other pertinent information as listed below, keyed to the numbers in the blanks on the RCF form.

1. Project Name: (Author) Insert the commonly understood name of the project.

2. Project No.: (Author) Insert the applicable MWH job or task number.

3. Page: (Reviewer) Pages are consecutively numbered by individual reviewers; total number of pages is added by QA when the RCF is completed.

4. Document Title: (Author) Insert the document title.

5. Review Date: (Reviewer) Insert the review date.

6. Author(s): (Author) Identify the author or authors of the document under review.

7. Reviewer: (Author) Enter the name of the independent technical reviewer.

8. WI No: (Author) Enter any WI number initiating the review of the document, with revision level; if no WI has been issued, enter N/A.

9. Comment No.: (Reviewer) Enter the number of each comment, as identified in the reviewed draft.

10. Page, Line, Para.: (Reviewer) Enter the information necessary to locate the comment.

11. Mandatory/Non-mandatory: (Reviewer) Check the appropriate column for each comment.

12. Review Comment: (Reviewer) Enter the review comment/and/or comments marked in the as-reviewed text.

13. Comment Resolution: (Author) Enter the resolution of each comment as agreed upon between the author and reviewer (required for all mandatory comments).

14. Resolution Accepted (Reviewer) Initial and date each resolved mandatory comment.

15. Approval: (Author, Reviewer, QA Reviewer, Project Manager/Other Reviewer as applicable) Sign and date approval in spaces provided; if multiple authors have been involved, a lead author may sign for all.

The independent technical reviewer shall review the draft document. The first sheet of the draft document shall be marked "As-reviewed Draft" along with the reviewer's name and the review date. The reviewer shall:

- check the calculations in accordance with applicable WIs or other directives;
- examine the technical approach, evaluate the adequacy of references, figures, tables, or drawings; and
- perform other review activities as appropriate for document type, or as otherwise specified by the responsible Project Manager.

If calculations have not been completed to the satisfaction of the reviewer, the problem shall be documented as a comment on the RCF and resolved accordingly.

All mandatory comments shall be documented on an RCF as previously described, and shall be numbered and categorized as mandatory or non-mandatory. Text sections affected by comments shall be numbered in the review draft to correspond with the RCF comments. Review comments may be made by hand or electronically, using the redline function. Comments not requiring additional explanation or discussion may be marked directly in the text/redlined without specific discussion on the RCF.

4.3 Comment Resolution

When all comments related to calculations have been resolved, or if acceptable as originally presented, the reviewer shall initial the RCF in the space provided to indicate that calculation checks have been verified.

The reviewer and author shall resolve all of the reviewer's mandatory comments. A concise description of the resolution of each comment shall be recorded on the RCF. All "no-action required" resolutions require brief justification in the resolution column on the RCF. The author shall produce a new version of the document incorporating the reviewer's comments, which may consist simply of accepting the redlined changes. The reviewer shall initial each mandatory comment on the RCF to indicate acceptance of the comment resolution. Non-mandatory comments may be resolved at the author's discretion.

4.4 QA Review

The Project Quality Manager or designee shall evaluate the as-reviewed draft, the updated draft, supporting calculation check documentation and the RCF for compliance with this procedure and for any specific QA concerns. If the review package is acceptable, the RCF shall be signed by the quality reviewer to indicate approval. If QA comments must be resolved, the QA

reviewer shall document comments under the review comment section of the RCF as described in Section 4.2. The RCF shall be routed back to the author who shall resolve any mandatory QA comments. The resolution shall be documented as indicated in Section 4.3. The QA reviewer shall initial each mandatory comment to indicate acceptance of the resolution, and a corrected draft shall be prepared. If the corrected document is acceptable, the QA reviewer shall sign the RCF to indicate approval and the final document may be released for reproduction and submittal.

4.5 Documentation

Documentation supporting the technical review process shall, at a minimum, consist of the signed RCF, the calculation worksheets, the as-reviewed draft, and the final submitted document. All review documentation shall be routed to the appropriate quality records file in compliance with MP-16.1, "Management of Quality Records."

5. REFERENCES

- MWH Management Procedure MP-9.1, "Work Instructions"
- MWH Management Procedure MP-16.1, "Management of Quality Records"

Figure 1: Technical Review

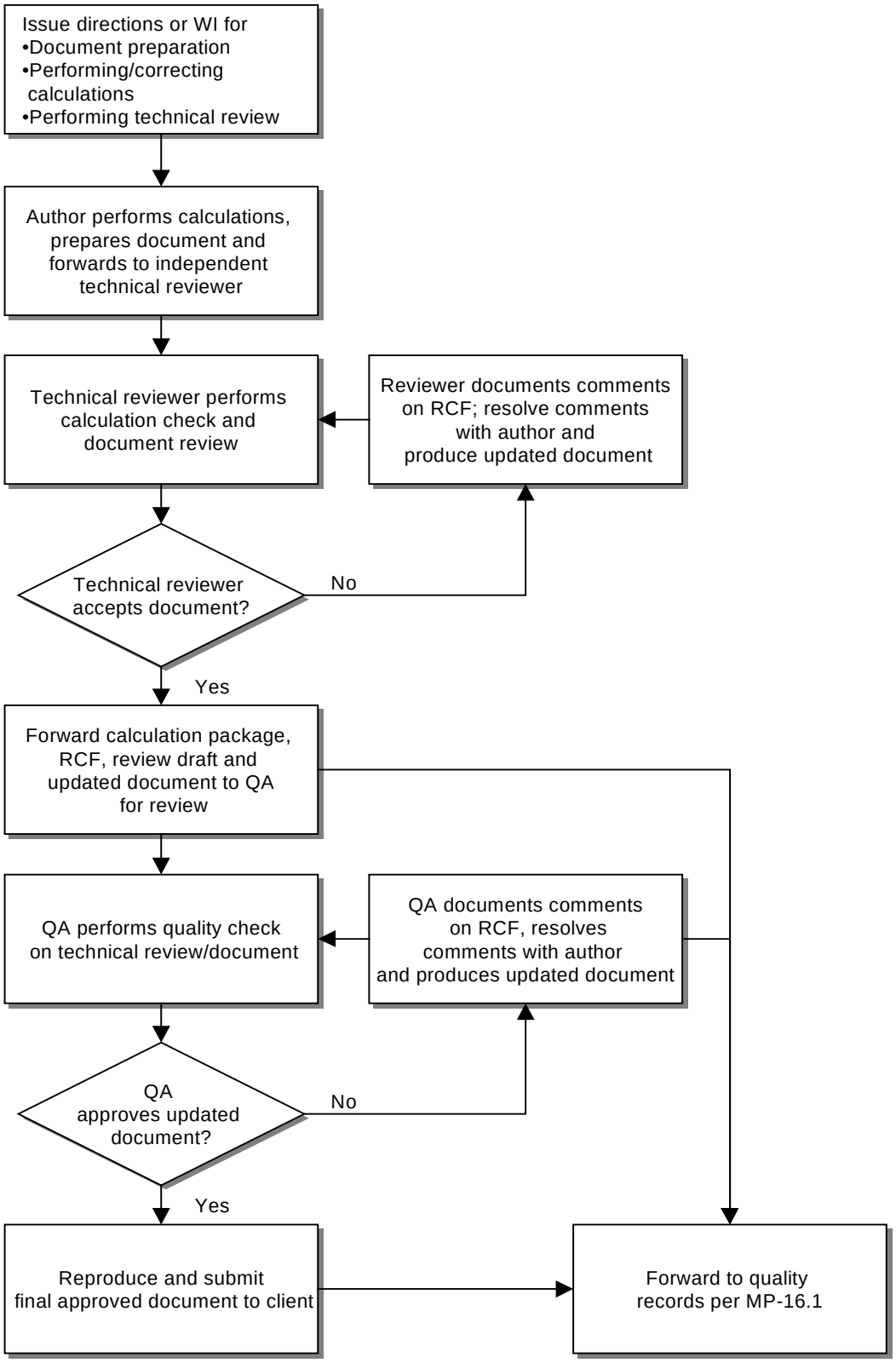


Figure 2: Review Comment Form (RCF)

MWH
MONTGOMERY WATSON HARZA

Review Comment Form (RCF)

Project Name _____ (1) _____ _ Delivery Order No. _____ (2) _____ Page ___ of ___ (3)

Document Title _____ (4) _____ _ Review Date _____ (5) _____

Author(s) _____ (6) _____ _ Reviewer _____ (7) _____ SWI No. _____ (8) Rev. _____ (8)

Comment No.	Page, Line, Para., Section No	Mandatory?	Non-mandatory?	Review Comment	Comment Resolution	Resolution Accepted
(9)	(10)	(11)	(11)	(12)	(13)	(14)

Author(s) _____ (15) _____ Date _____	Quality Assurance _____ (15) _____ Date _____
Reviewer _____ (15) _____ Date _____	Other Reviewer _____ (15) _____ Date _____

MP-10.1

Surveillance Inspection

Record of Revisions

Revision Level -2-

Page	*Section*	*Description*
All	All	Completely rewritten
All	All	Updated from Montgomery Watson to MWH

MP-10.1

SURVEILLANCE INSPECTION

1. SCOPE AND PURPOSE

When invoked by applicable quality plans, this procedure defines the minimum requirements applicable to Montgomery Watson Harza (MWH) personnel who may be requested to perform surveillance inspections of field, laboratory, or other in-process activities requiring conformance with established plans., procedures, or methods. This procedure may also be used to implement "systems audit" requirements when invoked by project-level quality plans prepared for environmental investigations.

2. DEFINITIONS

2.1 Surveillance Inspection

Surveillance inspection is a management tool that may be applied in the course of project activities to verify that work in process is being performed in accordance with specified plans, procedures, methods, or instructions. Surveillance inspections are also used to identify and correct both real and potential deficiencies or nonconformances in order to minimize adverse impacts on the quality of the work performed. Surveillance inspection is applicable to a wide range of activities, including development of procedures, study plans, or other project documents; field activities, including instrument installations, testing, and sampling; and laboratory activities, including testing and calibration of measurement and test equipment. Surveillance inspection methods are applicable to both internal and subcontracted activities.

2.2 Systems Audit

In environmental investigations subject to US Environmental Protection Agency (EPA) quality requirements or guidelines (or derivative State standards), a ***systems audit*** is usually defined as a qualitative onsite evaluation of laboratories, field sampling operations, or other organizational elements of an environmental measurement system for conformance established plan and procedure requirements.

2.3 Nonconformance

A ***nonconformance*** is defined as a deficiency in characteristic, documentation, or procedure rendering the quality of material, equipment, or services unacceptable. When the deficiency is of a minor nature, does not effect a permanent or significant change in quality if it is not corrected, and can be brought into conformance with immediate corrective action, it is not categorized as a nonconformance. However, if the nature of the deficiency is such that if it is not corrected it may result in a permanent and significant impact on the quality of items, equipment, materials, tests, or contractual deliverables, it must be brought to the attention of

the Project Manager and Project Quality Manager for resolution and concurrence on the scope of required corrective and preventive action.

3. RESPONSIBILITIES

3.1 Project Quality Manager

The Project Quality Manager is responsible for establishing surveillance inspection requirements in accordance with client quality requirements and the technical needs of the project. The Project Quality Manager is also responsible for performing or directing the performance of surveillance inspections; for reviewing and approving inspection checklists prior to the activity; and for coordinating appropriate inspection schedules with Project Managers, assigned Project Managers or Engineers, field supervisors, Laboratory Managers, and/or subcontractor representatives. The Project Quality Manager may delegate inspection responsibilities to qualified personnel who are independent from the work being examined; designated inspectors must be trained in the requirements of this procedure.

3.2 Designated Inspector

The designated inspector has primary responsibility for conducting surveillance inspections in accordance with this procedure. The designated inspector is responsible for confirming surveillance inspection schedules with the Project Quality Manager and affected Project Managers, their designees, and/or subcontractor representatives; making detailed arrangements to witness specific portions of an activity; preparing appropriately detailed inspection checklists; documenting inspection results; assignment of action items and monitoring action item resolution; and for reporting nonconformances.

3.3 Project Managers/Laboratory Managers

Project Managers, their designees, or subcontractor Laboratory Managers are responsible for coordinating surveillance schedules with the Project Quality Manager and the designated inspector. If additional controls or a suspension of activities must be temporarily imposed as a result of surveillance inspection activities, Project Managers/Laboratory Managers are responsible for complying in a logical and orderly manner that will protect the safety of personnel, the integrity of the data already obtained, and/or that will prevent further damage or loss. Project Managers/Laboratory Managers are also responsible for ensuring that action items and Corrective and Preventive Action Request (CPAR) resolutions (see MP-14.1, “Corrective and Preventive Action”) are properly implemented.

4. PROCEDURE

The procedure for planning, conducting and documenting Surveillance Inspections is detailed below and summarized in Figure 1.

4.1 Surveillance Inspection Scheduling

Project activities, including document preparation, records management, field testing, and laboratory work may be subjected to periodic surveillance inspections. It is the intent of this procedure that the surveillance inspection be scheduled and conducted with minimal impact on the technical work being evaluated. ***Surveillance inspections shall in no case compromise the safety of personnel or adversely affect data acquisition activities.*** Reasonable advance notice shall be provided to the Project Manager, field personnel, subcontractor Laboratory Manager, or other subcontractor representative, who shall provide schedule information, procedure documentation, or such other support as required. Frequency and scheduling of surveillance inspections shall be determined by the Project Quality Manager based on applicable quality plan requirements, project schedules, type of activity, and results of past surveillance inspections or quality audits (see MP-17.1, "Quality Audits").

4.2 Preparation and Approval of Inspection Checklists

Brief checklists shall be prepared that define the scope of the surveillance inspection; they may be prepared by either the Project Quality Manager or the designated inspector. In the latter case, however, the scope and areas of emphasis of the surveillance inspection shall be defined to the designated inspector by the Project Quality Manager, and the checklist shall be reviewed and approved by the Project Quality Manager prior to use.

Unless otherwise specified by the Project Quality Manager, inspection checklists may be prepared in any convenient format, provided that they meet the minimum content requirements of this Section. At a minimum, surveillance inspections shall verify conformance of the activity with applicable plans, procedures, methods, and instructions. The following additional items shall be considered during surveillance inspections of laboratory or field testing activities:

- equipment or instrumentation calibration status and general condition;
- status or stage of completion of the test or activity must be apparent from test data sheets or logs;
- test operations and sequencing for the phase of the activity observed must conform with approved procedure requirements; and
- test data sheets and records required by the test plans or procedures must be filled out properly, to the extent necessary for the phase of the test observed.

4.3 Nonconformances

Nonconformances shall be documented on CPAR forms and resolved as described in procedure MP-14.1, "Corrective and Preventive Action." Deficiencies of a minor nature that would not affect a permanent or significant change in quality if not corrected and that can be brought into conformance in a timely manner shall not be categorized as nonconformances, but shall be identified as action items requiring resolution as described in Section 4.4. If a nonconformance requires imposing additional controls or suspending related activities until corrections are complete in order to prevent future discrepancies, danger to personnel, loss of data, or similar problems, the designated inspector shall immediately notify the Project Quality Manager, obtain concurrence, and issue appropriate instructions. The affected Project Manager, assigned Project Manager or Engineer, Laboratory Manager, or subcontractor representative shall be immediately notified of the condition.

4.4 Action Items

Minor deficiencies as described in Section 4.3 shall be identified as action items on the Surveillance Inspection Report (SIR; see Figure 2) and shall be assigned to appropriate individuals for resolution within a specified time period. An informational copy of the SIR with any action items identified shall be provided to the Project Quality Manager at the completion of the inspection for interim review. The designated inspector shall track action items through completion and shall attach documentation supporting action item closure as appropriate, prior to submitting the completed SIR to the Project Quality Manager for final review and closure.

4.5 Closure

The Project Quality Manager shall review the draft SIR for the adequacy of proposed action items, and as appropriate, shall provide direction to the designated inspector whenever modifications to action item requirements are required. The Project Quality Manager shall review the final SIR with supporting documentation, and if acceptable, shall sign to indicate closure.

4.6 Documentation

An SIR form shall be filled out by the inspector for each surveillance. At a minimum the report shall contain the following information:

- name of the inspected activity or test, with associated job number;
- personnel contacted and or observed during the surveillance inspection;
- date and start/stop times of the surveillance inspection;
- references to governing plans or procedures inspection;
- observations of equipment condition and calibration status;
- general observations and comments;
- copies of the completed checklist(s) used to make the inspection;

- CPAR numbers for any nonconformances resulting from the surveillance inspection;
- discussions of any immediate action taken to correct minor deficiencies or to suspend or place additional controls on activities;
- action items requiring correction; and
- signature of designated inspector and inspection date, and the signature of the project quality manager and action item closure date.

Closed SIRs and supporting closure documentation shall be routed for filing in accordance with MP-16.1, "Management of Quality Records."

5. REFERENCES

- MWH Management Procedure MP-14.1, "Corrective and Preventive Action"
- MWH Management Procedure MP-16.1, "Management of Quality Records"
- MWH Management Procedure MP-17.1, "Quality Audits"

Figure 1: Surveillance Inspection Process

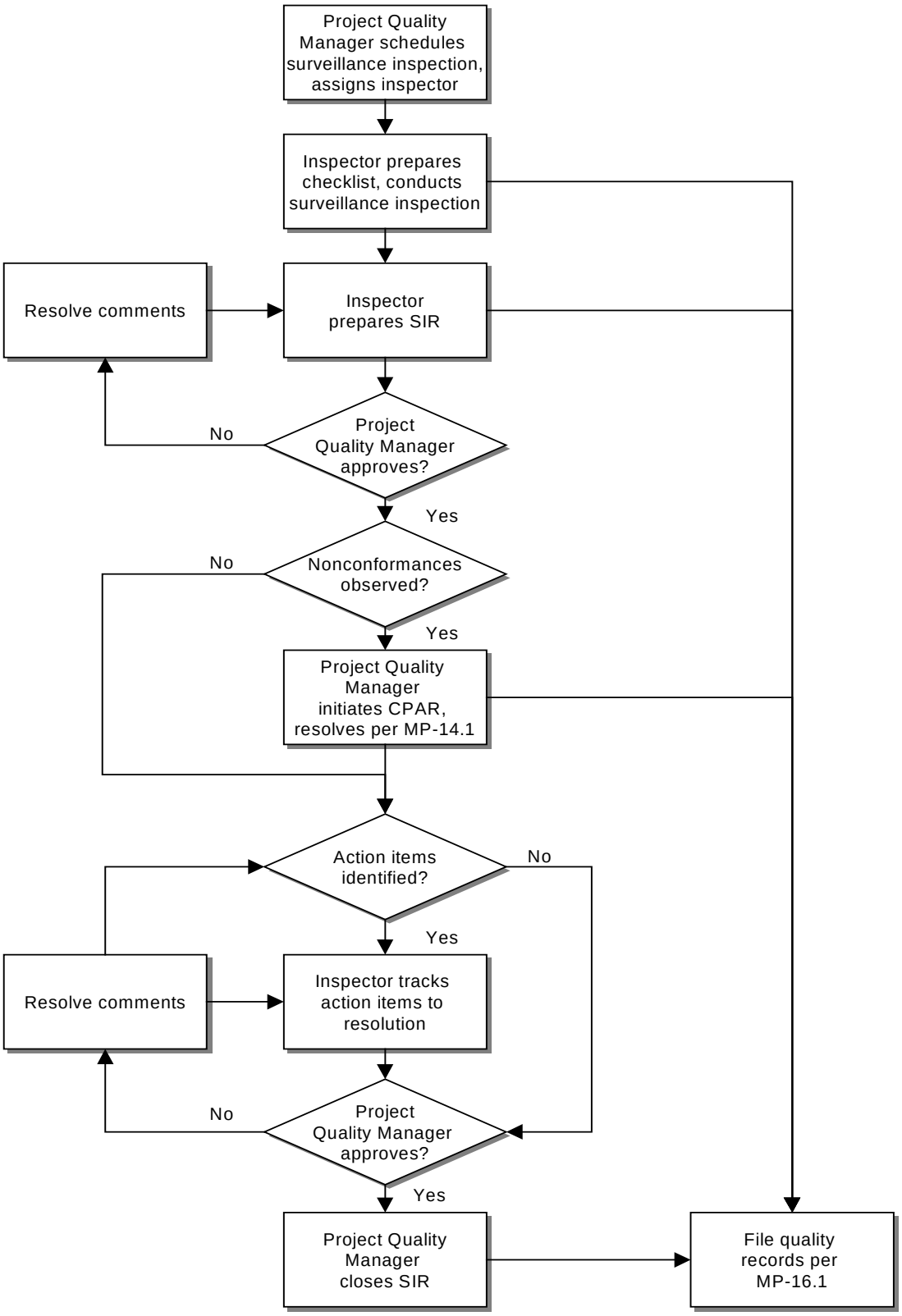


Figure 2: Surveillance Inspection Report Form

SURVEILLANCE INSPECTION REPORT

Page 1 of ____	**SIR NO:**	
Inspected Project/Activity:		
Contract/Delivery Order Number:		
Personnel Contacted:		
Reference Requirements:		
Insp. Date:	Start Time:	End Time:
Equipment Condition/Calibration Status:		
Observation and Comments (Use Extra Sheets as Required):		
CPAR Reference (if any):		
Action Items Requiring Correction (Use Extra Sheets as Required):		
Inspector:	Date:	
Closed By:	Date:	
Action Item Closure Date:		
Comments:		

MP-14.1

Corrective and Preventive Action

Record of Revisions

Revision Level -2-

Page	*Section*	*Description*
All	All	Completely rewritten
All	All	Updated from Montgomery Watson to MWH

MP-14.1

CORRECTIVE AND PREVENTIVE ACTION

1. SCOPE AND PURPOSE

When invoked by applicable quality plans, this procedure defines the process for selection and implementation of the actions necessary to correct immediate nonconforming conditions or mandatory action items, and to reduce or preclude the recurrence of the identified condition. This procedure applies to nonconforming conditions which have been identified through Montgomery Watson Harza (MWH) inspection, surveillance, auditing, or management assessment activities, or that may be observed by project staff during the routine performance of work.

2. DEFINITIONS

2.1 Corrective and Preventive Action

Corrective and Preventive Action is defined as the measures taken to ***correct*** a condition adverse to quality, and to ***prevent***, reduce, or preclude the recurrence of the condition based on the identification of the root cause of nonconformance.

2.2 Disposition or Corrective Action

For the purposes of this procedure***, disposition*** is synonymous with ***corrective action***, and is defined as the action taken to correct the immediate adverse condition (e.g., reperformance of an independent technical review, resampling, or returning defective equipment to the manufacturer for rework or replacement). Such actions are generally categorized as "reject", "accept as-is", "re-grade", or "rework." These categories are further described as follows:

- ***"Reject***" is an appropriate disposition when a nonconforming item is not acceptable, cannot be repaired or reworked such that it complies with the original requirements, or re-graded for alternate applications.

- ***"Accept as-is"*** is an appropriate disposition when a nonconforming item performs its intended function properly, with or without repair, even though it does not comply with original requirements. Technical justification for the acceptability of the item shall be included in the documentation. Repaired items shall be reinspected prior to acceptance in accordance with governing procedures.

- ***"Re-grade"*** is an appropriate disposition when an item that is not in compliance with original requirements can be shown to be in conformance with requirements for an alternate application.

- ***"Rework"*** is an appropriate disposition when a nonconforming item can be physically altered or repaired in an acceptable manner and thereby conform with original requirements.

2.3 Nonconformance

A ***nonconformance*** is defined as a deficiency in characteristic, documentation, or procedure which renders the quality of material, equipment, or services unacceptable. When the deficiency is minor, will not effect a permanent or significant change in quality if it is not corrected, and can be brought into conformance with immediate corrective action, it shall not categorized as a nonconformance. However, if the nature of the condition is such that if it is not corrected it may result in a permanent and significant impact on quality, it must be brought to the attention of the responsible Project Manager and Project Quality Manager for resolution and concurrence on the scope of required corrective and preventive action.

3. RESPONSIBILITIES

3.1 Project Quality Manager

The Project Quality Manager is responsible for documenting nonconforming conditions and mandatory action items on Corrective and Preventive Action Request forms (CPARs; see Figure 2); for participating in the disposition of nonconformances, the determination of root causes, and the selection of appropriate preventive actions; and for verifying satisfactory completion of corrective and preventive actions. The Project Quality Manager is also responsible for assignment of CPAR tracking numbers and monitoring all CPARs through completion and closure (see Figure 3).

3.2 Project Manager

The responsible Project Manager shall participate in the disposition of nonconformances, the determination of root causes, and the selection of appropriate preventive actions.

3.3 Lead Auditors

Lead Auditors are responsible for participating in disposition of nonconformances and in the determination of root causes and selection of appropriate preventive action for findings and observations resulting from internal quality audits performed in compliance with MP-17.1, "Quality Audits," and for confirming the satisfactory completion of all corrective and preventive actions associated with such audits.

3.4 All Personnel

All personnel are responsible for notifying the responsible Project Manager or the Project Quality Manager when nonconforming conditions are observed.

4. PROCEDURE

The corrective and preventive action process is summarized as a flowchart in Figure 1; specific steps in the process are described in the following sections.

4.1 Identification of Conditions Requiring Corrective Action

Nonconforming conditions may be identified through inspection (see procedures MP-10.1, "Surveillance Inspection"), auditing (see MP-17.1,"Quality Audits"), management assessment activities, or may be directly observed by any MWH staff member during the routine performance of work. Project personnel shall inform the Project Quality Manager of potential nonconforming conditions, and the Project Quality Manager shall determine whether or not a nonconformance exists. If the condition constitutes a nonconformance, it shall be documented on a CPAR form(see Figure 2) and uniquely numbered and logged for tracking purposes (see Figure 3). The log shall identify the CPAR number; the initiating document, if applicable (audit report, inspection report, or management assessment report); the recipient; and the closure date. The Project Quality Manager shall monitor the progress of CPARs from initiation through closure.

4.2 Root Cause Analysis

The Project Quality Manager, Lead Auditor (as applicable), and responsible Project Manager shall cooperatively evaluate each CPAR to determine the root cause of the condition. The root cause is the fundamental cause that is under management control that, when corrected, should prevent recurrence of the adverse condition. The root cause shall be recorded on the CPAR, and approved by the Project Quality Manager, the responsible Project Manager, and, as applicable, Lead Auditor.

4.3 Determination of Corrective and Preventive Action

After the root cause of the condition has been determined, the Project Quality Manager, Lead Auditor (if applicable), and the responsible Project Manager shall jointly determine the appropriate corrective and preventive action to be taken and action completion date. Measures shall be selected that include disposition of the immediate condition and, where possible, preventive actions to prevent (or reduce the likelihood of) future occurrences of the condition. The level of effort required shall be commensurate with the seriousness of the condition, and shall be realistic in terms of the resources that will be required for proper implementation. Previous occurrences and/or trends of similar conditions shall be considered in the determination of appropriate corrective and preventive actions. The effectiveness of previous actions for similar conditions shall be investigated and shall be factored into the selection of corrective and preventive actions with a level of effort that is appropriate for the current condition. Final corrective and preventive action determinations shall be recorded on the CPAR and approved by the participants.

4.4 Corrective and Preventive Action Implementation and Verification

Corrective action items shall be assigned to appropriate individuals by the responsible Project Manager. When the required action is complete, the assigned individual shall notify the Project Quality Manager, who will verify completion. Wherever possible, objective evidence shall be included with the CPAR that demonstrates that the required action is complete. If the nonconformance was observed during a quality audit (see MP-17.1, Quality Audits), confirmation of satisfactory completion shall also be obtained from the Lead Auditor prior to forwarding the CPAR to the Project Quality Manager. When the activities have been verified as complete and satisfactory, the Project Quality Manager shall sign the CPAR to document its closure.

Original closed CPARs and completed CPAR log sheets shall be maintained as quality records in compliance with MP-16.1, "Management of Quality Records." Copies of closed CPARs shall be forwarded to the assigned individual, the Project Manager, and Lead Auditor, as appropriate.

5. REFERENCES

- MWH Management Procedure MP-16.1, "Management of Quality Records"
- MWH Management Procedure MP-17.1, "Quality Audits"
- MWH Management Procedure MP-10.1, "Surveillance Inspections

Figure 1: Corrective and Preventive Action Process

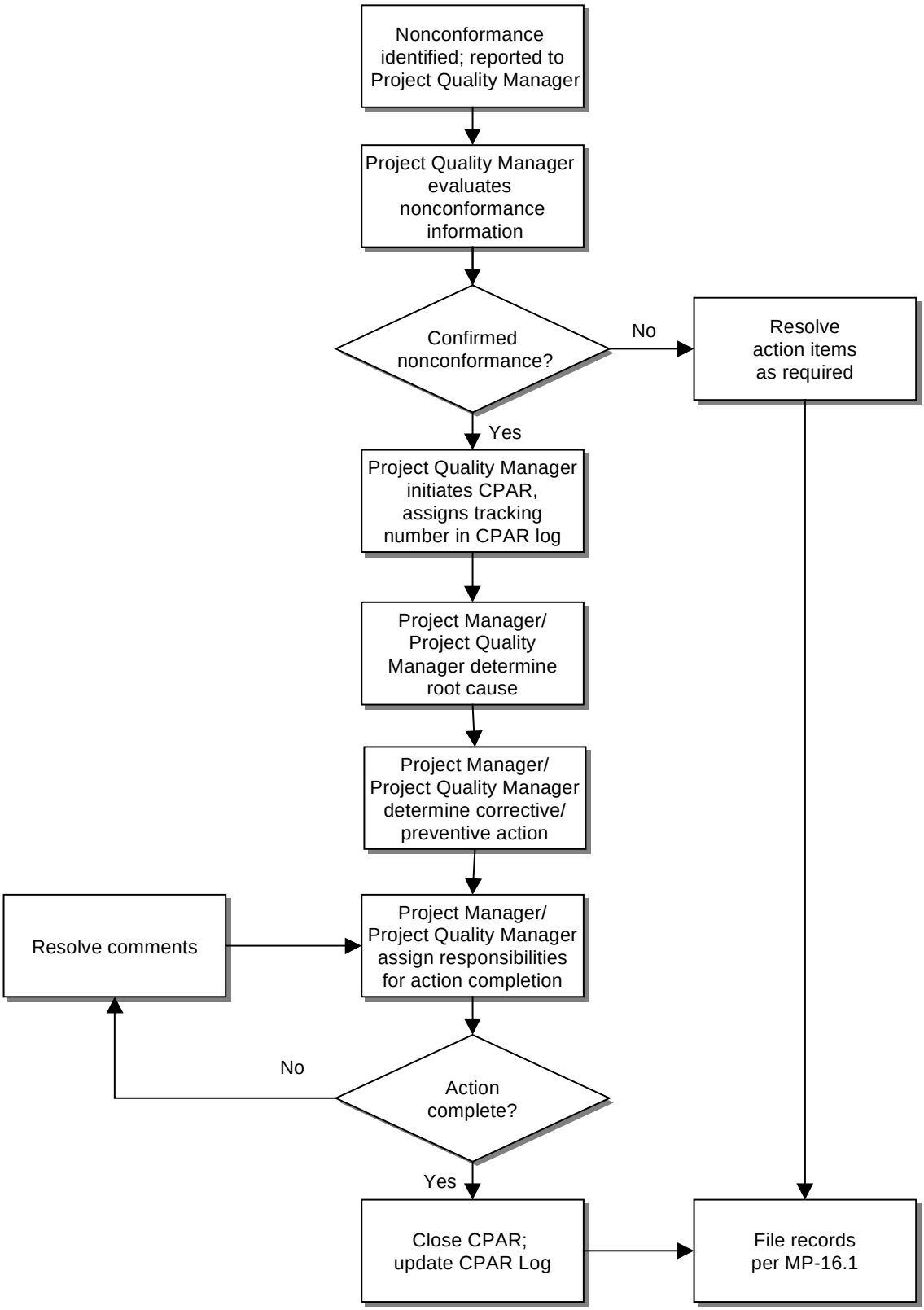


Figure 2: Corrective and Preventive Action Request

MWH ***CORRECTIVE / PREVENTIVE ACTION REQUEST (CPAR)***	Control No. _____ Issue Date:_____ Reported By:_____

Action Assigned to: **Complete the Corrective and Preventive Actions below and forward this CPAR to the Project Quality Manager by:**	
Source/Reference Requirement:	
Description of Nonconformance (describe or attach additional information):	
Root Cause:	
Corrective Action/Disposition: (describe or attach additional information)	Complete by:
Preventive Action: (describe or attach additional information)	Complete by:
Approved: _____Date: _____ Project Quality Manager	Approved: _____Date: _____ Project Manager
Closure Verified: _____Date: _____ Project Quality Manager	Closure Verified: _____Date: _____ Other
Comments:	

Figure 3: CPAR Status Tracking Log

CPAR STATUS TRACKING LOG MWH						
CPAR Number	***Date Issued***	***Subject/Source***	***Recipient***	***C/A Due Date***	***P/A Due Date***	***Verif./ CPAR Closure Date***

MP-16.1

Management of Quality Records

Record of Revisions

Revision Level -2-

Page	*Section*	*Description*
All	All	Minor editorial changes throughout
All	All	Updated from Montgomery Watson to MWH

MP-16.1

MANAGEMENT OF QUALITY RECORDS

1. SCOPE AND PURPOSE

When invoked by applicable quality plans, this procedure provides minimum requirements for the collection, storage, maintenance, retrieval and, as applicable, turnover of Montgomery Watson Harza (MWH) project quality records. The requirements of this procedure apply to all completed documents that provide evidence of the quality of items, services, or other activities affecting quality.

2. DEFINITIONS

2.1 Project Quality Records

Project quality records are defined as completed, legible documents furnishing objective evidence of the quality of items or services, activities affecting quality, or the completeness and quality of data, as maintained for a specific project. Examples of such records include completed contractual documents, incoming and outgoing correspondence, completed project deliverables and associated technical review documentation, field notes or logbooks, chain of custody (COC) forms, training records, sample data sheets, and other project documents.

2.2 Records Index or Filing Plan

A ***records index or filing plan*** is defines the location of specific categories of records within the filing system for a specific project Its structure is based on MWH corporate standard, as interpreted by the Records Index/Filing Plan Setup Sheet provided as Figure 2.

3. RESPONSIBILITIES

3.1 Project Manager

The responsible Project Manager or (or designee) shall establish the project quality records filing structure, either by marking applicable filing categories on a Records Index/Filing Plan Setup Sheet (referred to hereafter as the Setup Sheet; see Figure 2) or by defining an alternate filing structure at the start of each assigned project or task. Within the structural requirements so defined, the records index shall be tailored to meet the specific needs of the individual project or task.

3.2 Project Secretary

The designated Project Secretary is responsible for preparing and updating the project quality records index, based on the Setup Sheet or filing structure provided by the Project Manager. The Project Secretary is responsible for reviewing records for overall completeness, validation, filing, and maintaining access control for the project quality records from all assigned projects.

3.3 Project Personnel

All project personnel are responsible for submitting ***completed*** documents to the responsible Project Secretary in a timely manner, for validation and filing.

3.4 Project Quality Manager

The Project Quality Manager (or designee) is responsible for reviewing and approve any alternate filing structures not based on the Setup Sheet (Figure 2).

4. PROCEDURE

The procedure for managing Project Quality Records is described in section 4.1 and summarized in Figure 4-1.

4.1 Project Quality Records Index

At the beginning of each project or task a Project Quality Records Index shall be prepared that establishes the basic filing system structure. The Project Quality Records Index shall be based on a Setup Sheet or alternate file structure prepared by the Project Manager or their designee. The Standard Setup Sheet in Figure 2 is based on MWH corporate filing standards; it identifies the potential types of records anticipated for the project, and assigns a predetermined location in the filing system for each type. Headings that are not applicable or appropriate for a particular records system should remain unchecked; the corresponding headings in the subsequently developed index shall be marked "N/A" or "Not Applicable". Regardless of the underlying filing structure that may be used as the project progresses, the index shall be updated as appropriate to include increasingly specific information under the defined headings. At a minimum, the Project Quality Records Index shall include:

- the MWH Project Manager (or designee responsible for completing the Setup Sheet or alternate filing structure);
- the MWH job or task number;
- a short title for the project or task;

- numerical headings for each file, based on the numerical structure of the Setup Sheet; and

- the title of the file associated with each numerical heading, in enough detail to permit easy retrieval and filing of records.

The Index shall be updated on a regular basis, and a copy provided to the Project Quality Manager with each update.

4.2 Collection and Validation

Project personnel who generate documents in support of a project shall submit the completed documents to the assigned Project Secretary, who shall briefly evaluate each document to ensure that completeness is indicated at the level required by the appropriate quality procedure (e.g., all required signatures are present). Each document shall be legible, identified with the project number, and contain sufficient information to permit identification of the document to the activity to which it applies. If problems are identified, the document may be returned to the preparer for resolution. The Project Secretary shall also assign a file number to the first sheet of the records copy of the document, based on the Index, and shall validate each record by applying a dated stamp or by initialing and dating. Validated documents shall be filed in the appropriate location in the project quality records files. Completed documents awaiting validation and/or entry into the project quality records shall be temporarily stored during non-working hours in a locking file cabinet or access-controlled file room.

4.3 Storage and Access Control Requirements

Project quality records shall be stored in a manner which will prevent deterioration or damage from natural disasters or environmental conditions. Records shall be stored in binders, folders, or envelopes in metal cabinets. Project quality records files shall be organized separately by project and/or task in compliance with the applicable Project Quality Records Index. Special alternate-media records such as photographs, negatives, or magnetic disks or tapes shall not be stored in stacks and shall be protected from excessive light, electromagnetic fields, and excessive temperatures and humidity, as appropriate for the record type.

Access to all quality records shall be limited to those personnel who have a specific need. The designated Project Secretary shall prepare a list of personnel authorized direct access to the project quality records, and the list shall be posted on the affected filing cabinets. Other personnel shall request records access through the Project Secretary. Key control to records storage areas or cabinets shall be provided by the Project Secretary.

4.4 Records Retrieval

Individual users may request that files or individual records be retrieved by the Project Secretary; outcards shall be inserted in the files that indicate the individual to whom records have been released. Users shall maintain the organizational and physical integrity of files released to their custody; working copies of records shall be made wherever possible, and originals returned immediately to file.

4.5 Corrections and Revisions

Records may be corrected by drawing a single line through the incorrect information and initialing and dating the new entry. Records requiring formal change control [e.g., plans, procedures, Work Instructions (WIs; see MWH Management Procedure MP-9.1, "Work Instructions") shall be revised in accordance with the governing quality plan or Management Procedure (MP). Approval of all corrected records must be equivalent to the level and/or type of approval required for the original document.

4.6 Retention Time

All project quality records are considered permanent until turned over to the client or until the close of the contract, as determined by the Project Manager. After that time, the Project Manager shall determine the disposition of the remaining records unless specific direction is provided by the client. Records remaining in MWH's possession after contract closeout shall be archived at the direction of the responsible Project Manager; archive retention times shall be as defined by MWH's legal counsel.

4.7 Records Turnover

Project quality records shall be turned over to the client at their request, with the concurrence of the responsible Project Manager. Once turned over, they shall be considered the property of the client and are no longer subject to the requirements of this procedure.

Records to be turned over to the client shall be packaged securely for shipping. Each package of records shall contain an index of the records in that package and shall be clearly labeled as to client, project number, and the total number of packages in the shipment.

5. REFERENCES

- MWH Management Procedure MP-9.1, "Work Instructions"

Figure 1: Project Quality Records Management Process

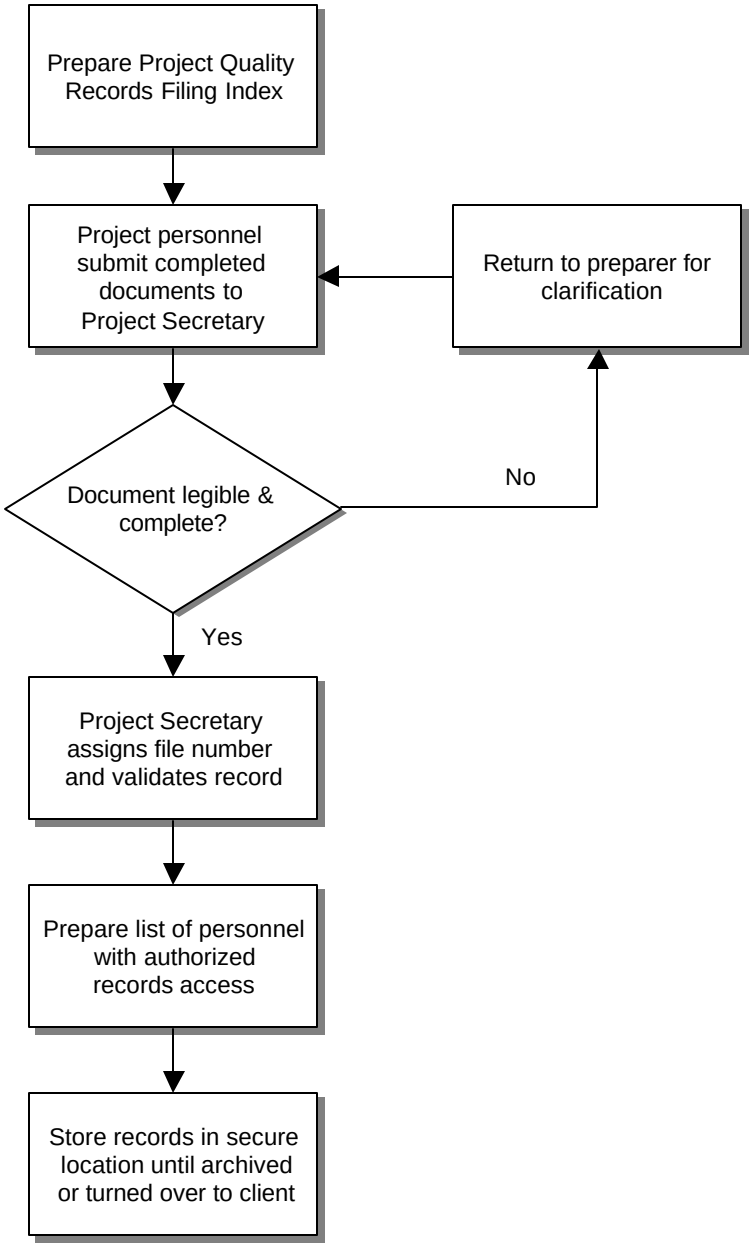


Figure 2: Records Index/Filing Plan Setup Sheet

Monsanto Records Index and Filing Plan
Last updated: _____ By:_____

File No.	Section/ File Location	Source of Records Requirement	Description of Record	Retention, archiving, and/or disposal times
1.				
2.				
3.				
4.				
5.				
6.				
7.				

Appendix D
Laboratory Quality Assurance Plan (ACZ)

ACZ LABORATORIES, INC.

QUALITY ASSURANCE PLAN

SOPAD018.03.03.10

Revision 10

Effective Date: March 14, 2003

Approval Signatures and Dates

Review/Revisions By: _____ Date: __03/14/03_____
Kristen Russell, QA/QC Officer

Authorized By: _____ Date: __03/14/03_____
Ralph Poulsen, President - CEO

2773 Downhill Drive
Steamboat Springs, CO 80487

(970) 879-6590
www.acz.com

TABLE OF CONTENTS

1 INTRODUCTION 3
2 QUALITY SYSTEM OBJECTIVES & COMPONENTS 4
3 ETHICAL AND LEGAL RESPONSIBILITY 12
4 PERSONNEL AND RESPONSIBILITY 13
5 TECHNICAL DIRECTORS 20
6 SAMPLING PROCEDURES 21
7 SAMPLE HANDLING & CUSTODY 22
8 PROCUREMENT PROCEDURES AND CONSUMABLE SUPPLIES 24
9 INSTRUMENTATION & PREVENTATIVE MAINTENANCE 26
10 INSTRUMENT CALIBRATION 27
11 ELEMENTS OF QUALITY CONTROL 28
12 DATA QUALITY ASSESSMENT 33
13 DATA REDUCTION, VALIDATION AND REPORTING 35
14 DETECTION LEVELS 38
15 SAMPLE DILUTIONS 39
16 ERROR CORRECTION PROTOCOL 40
17 COMPUTER/AUTOMATED PROCESSES VERIFICATION (GALP) 41
18 SUBCONTRACTS 43
19 DATA CONFIDENTIALITY 44
20 CUSTOMER SERVICE/CLIENT COMPLAINT POLICY 45
APPENDIX A …..SAMPLE CONTAINERS, PRESERVATION, & HOLDING TIME 46
APPENDIX B …..CURRENT NELAP CERTIFICATE & METHODS 50
APPENDIX C…….CURRENT ARIZONA CERTIFICATE & METHODS .. ……...…….. 55
APPENDIX D……..…CURRENT DATA QUALIFIERS 62
APPENDIX E……REFERENCES UTILIZED BY ACZ 66

1 INTRODUCTION

ACZ Laboratories, Inc. is an independent analytical testing laboratory operating from a single location in Steamboat Springs, CO. We specialize in the analysis of environmental samples for organic, inorganic, and radiochemical parameters in a variety of matrices. The 13,000-ft^2 facilities were built in 1990 with special design attention given to sample flow and handling, airflow and data transfer. ACZ expanded its facility in 1999 by adding 9,000 ft^2. A class 100-clean room was the primary focus of this new addition, and is used to achieve part per trillion trace metal detection limits.

Our technical staff is provided with automated instrumentation to improve reproducibility and increase productivity. Qualified environmental scientists head each department with more than 40 years of combined hands-on laboratory experience. We have a full time Quality Assurance Officer, two full-time Project Managers, two full-time document control/report production personnel and several Client Service Representatives. Our chemists and laboratory technicians devote more than thirty percent of their time fulfilling specific and regulation-mandated quality control-related tasks outlined in this document. The results of the QC sample analyses are subjected to ACZ's multi-level review process in the same manner as our clients' samples, with particular attention paid to any irregularities or deficiencies in the quality control data.

In addition to this QAP, ACZ has developed a specific Radiochemistry Quality Assurance Plan, *SOPAD019*. This plan details the instruments, quality control checks and other quality assurance objectives for our Radiochemistry Department.

1.1 Quality Policy Statement

This Quality Assurance Plan (QAP) has been developed with considerable attention given to the regulatory requirements of the EPA, other government entities such as the Department of Energy, specific state requirements, and the National Environmental Laboratory Accreditation Program (NELAP), as well as to our clients' needs and provides guidelines to ensure that ACZ employees and management work to produce analytical data that is legally defensible, accurate, and impartial. The management of ACZ is fully committed to the continual development and improvement of the Quality System and ensures that all aspects of the day to day laboratory operations are conducted following the requirements outlined in our QAP.

1.2 Quality Assurance Plan Revisions

This version of the QAP incorporates further expansion of the Quality System (Section 2) with emphasis on Corrective Actions. Changes have been made to the organizational chart to include individual department supervisors and the Director of Production, and Section 5 has been revised to accurately reflect current technical directors. Additional ACZ and NELAP quality control requirements have been added to the appropriate sections. A copy of ACZ's NELAP and Arizona DHS certificates are included as appendices. Updates to any of the appendices will be made as needed; however, the document ID will not be updated and continuing training will not be conducted. In an attempt to streamline this document, some text has been deleted and replaced with a reference to the appropriate SOP available on ACZ's intranet. ACZ's QAP is reviewed and revised annually, and all employees attend a training session on the revised document following upper management's final review and approval. If specific areas within this document are not adequately addressed, please feel free to contact us.

2 QUALITY SYSTEM OBJECTIVES & COMPONENTS

ACZ's Quality System encompasses all quality assurance (QA) policies and quality control (QC) procedures that guide all technical and administrative laboratory operations and dictate specific protocols to control both the short-term and long-term activities influencing the quality of our testing services. Our QA/QC plans and protocols provide a framework that guides our chemists and technicians, as well as administrative personnel, to achieve our Data Quality Objectives (DQOs), ensuring the precision, accuracy, completeness, and consistency of the analytical data. We strive for consistent standards of quality that conform to each client's overall project quality control requirements. Quality control limits are established and published for most EPA methodology. State agencies and clients will occasionally set limits different from those in the published methods. We attempt to adhere to the most stringent of the QC limits as a method of meeting all agency and/or client requirements. If a client has data quality objectives that require modification of our guidelines, we may deviate from those guidelines, but only if more stringent controls are requested.

Our Quality System is comprised of six key elements that are effectively audited and continually improved:

1) Document Control/Record Keeping & Storage
2) Methodology & Standard Operating Procedures
3) Training
4) Audits
5) Corrective Actions
6) QA/QC Reports to Management

ACZ's management ensures that the objectives of the Quality System are communicated to and understood by all ACZ employees. The management team, along with the QA/QC Officer, is responsible for establishing procedures for feedback and/or corrective action whenever a deviation from standard protocol, as outlined in this document, occurs at any level of the Quality System. This process enables ACZ Laboratories, Inc. to address system deficiencies in order to make the necessary changes that will allow the company to set and meet higher goals. All aspects of the Quality System have an impact on our ability to provide our clients with data of exceptional quality that is generated by well-trained and qualified analysts and delivered in an efficient and timely manner.

2.1 Document Control/Record Keeping & Storage

All controlled documents, such as Standard Operating Procedures and Forms are maintained through ACZ's Labweb Document Control. This intranet based system allows all employees access to the most current SOPs and forms from any computer throughout the facility. Documents can only be changed, altered, overwritten, or saved as a different document by senior level employees who have Domain Administer computer rights. Expired SOPs and Forms are controlled through this system as well, so that it can be easily determined which documents and/or forms were being used at any given time. See ACZ's SOP, *Document Control System* (SOPAD033) for further details about document control.

All records are maintained in ACZ's custody for a minimum of five years. Records are kept on site, and access is controlled and limited. Records are defined as electronic data (tapes, disks, extra hard drives and other electronic media), hard copy data, instrument logs, maintenance logs/work orders, Quality Assurance logs and standard/reagent logs. Data is defined as all raw data, workgroup (analytical) data, client reports, state reports and performance evaluation data. See ACZ's SOP, *Control and Storage of Records and Documents* (SOPAD014) for further details.

2.2 Methodology & Standard Operating Procedures

This document does not address the specific QA/QC requirements associated with the numerous analytical methods or laboratory processes utilized by ACZ. Method-specific requirements are addressed in the SOP for that method or process. We consider our SOPs proprietary documents and prefer not to distribute them freely. All SOPs referenced in this document can be reviewed at our facility as part of a site visit or lab audit. SOPs are written for all aspects of the laboratory operations from sample log-in through sample disposal. The most current version of any SOPs is available to all employees through ACZ's Document Control System (Labweb). Current SOPs are reviewed annually with the aid of a SOP review form (FRMQA035). Any proposed revisions are first noted on a SOP revision form (FRMQA030) and then reviewed by the QA/QC Officer to ensure the SOP continues to meet all method requirements. Each employee is trained using the most current version of all SOPs pertinent to their position in addition to any supporting administrative SOPs, and continuing training for any revised SOPs is documented. Anyone reviewing analytical workgroups (AREV or SREV) must have continuing training to document the most current SOP has been read (FRMQA023), even if the reviewer does not perform the analysis. Uncontrolled copies of SOPs are not permitted.

ACZ Laboratories, Inc. is predominantly an environmental testing laboratory that provides data to clients for regulatory purposes. Consequently, we are required to utilize methods prescribed by the US EPA, USGS, USDOE and other state/federal agencies. Samples are generally analyzed for compliance with RCRA, SDWA, SMCRA, TSCA, CWA and CERCLA. These federal regulations state that we must adhere to methods published specifically for their application. ACZ uses only a fully documented and validated test method where a test method is employed. ACZ Laboratories, Inc. develops Standard Operating Procedures (SOPs) from these methods. The SOPs are written in conformance with EPA outline requirements stated in the EPA method of reference. ACZ has a review process in place when there is not a published method or an internal SOP available for a procedure requested by a client. ACZ makes sure that the procedure can be performed in the most accurate manner as possible. This detailed process assures that a proposed procedure is performed, that it will be done properly, and that it will have valid quality control criteria. Quality control criteria will be based on the quality control criteria discussed in Section 13 of this QAP. For more details see ACZ's SOP *Method Acceptance & Criteria Development* (SOPAD035).

2.3 Training

All new employees attend a QA/QC orientation session on their first day of employment. This training is based on the most current version of the QAP. Areas of the QAP related to the position are discussed, and are noted on an Initial QAP Training Form (FRMQA034), which is kept in the employee's training file after it is signed by the trainee and the QA/QC Officer. The employee is encouraged to look over the entire QAP once he/she becomes more familiar with their job responsibilities and to use the QAP as a reference at any time. A hardcopy of the QAP is included in each laboratory's SOP binder as a controlled document, and the electronic version is available to all employees on Labweb.

New laboratory personnel are thoroughly trained in the analytical techniques and operating principles of the regulatory methods utilized by ACZ. A designated analyst or the department supervisor assists every new employee until he/she exhibits proficiency in accepted laboratory techniques. This process includes reading related SOPs and other associated references, fine-tuning basic laboratory skills, learning equipment maintenance and operating procedures, and creating and reviewing workgroups through LIMS. All initial method training is documented using an Initial Method Training Form (FRMQA004), which is reviewed by the QA/QC Officer before it is filed in the employee's training file. Once an analyst demonstrates a technological aptitude within the framework of our Quality Assurance Program, he/she performs a Demonstration of Capability (DOC) study and a Method Detection Level (MDL) study (if applicable). DOC and/or MDL performance is documented for each method and all paperwork, including raw data, is maintained in the employee's training file. Continuing training includes certifying that the analyst has read and understands a new or revised SOP. Continuing DOCs are required to be performed annually. An annual MDL study is not required for each analyst; however, one member of the work cell must perform a MDL study as specified by the method or every 12 months if not addressed in the method.

ACZ recognizes the necessity and ultimate benefit of continuing education and encourages employee participation in advanced training courses, seminars, and professional organizations and meetings. Additionally, we conduct laboratory meetings to discuss procedures, work schedules and problems requiring immediate attention. We encourage all employees to become actively involved in the laboratory's operations and believe this is a tremendous benefit to analysts, managers and administrators.

For further details regarding ACZ's training program please see ACZ's SOP, *Training for General and Analytical Procedures* (SOPAD008).

2.4 Audits

The use of a quality assurance audit program is necessary to monitor and review the Quality System and to assure that it is continually being improved on all levels. The purpose of the audits is to verify both the compliance and performance of accepted QA/QC procedures and to identify and correct discrepancies.

2.4.1 Internal Audits

The internal audit program encompasses both a *system audit*, used to qualitatively evaluate the operational details of the QA program, and a *proficiency audit*, used to quantitatively evaluate the accuracy of data generated by the laboratory staff. The following audit programs do not include the real-time review of laboratory raw data or final reports for normal QC sample verification.

2.4.1.1 System Audits

A system audit is performed at least quarterly by the QA/QC Officer or an assistant. Each system audit is assigned a major CAR number to allow for effective tracking and follow-up (see section 2.5). The system audit is documented through the use of a memo format with all supporting documentation attached, and a copy of the memo is distributed to applicable staff members as well as upper management. Examples of system audits include logbook audits to confirm consistent and correct use of logbooks and support equipment audits to confirm all support equipment is checked each work day or as required.

2.4.1.2 Proficiency Testing Audits

Performance audits are facilitated through the introduction of blind samples on a routine basis. These samples are purchased from outside vendors (ERA or APG for example). PT samples are logged-in to the LIMS in the same way as client samples. The sample is prepared by the analyst according to the manufacturer's instructions and then analyzed according to the procedure outlined in the method SOP. The data is compiled and summary reports are made to management, laboratory supervisors and chemists. Department supervisors must address any unacceptable results, indicating possible causes, and the QA/QC Officer orders a follow-up sample (analyzed as a single-blind study) to confirm the system deficiency has been corrected.

For NELAC and many state certifications, ACZ analyzes for accredited parameters twice a year through a National Institute of Standards (NIST) certified proficiency testing provider. These tests are analyte and matrix specific (i.e. WS/WP), not method specific. Reports are sent to ACZ's NELAC Accrediting Authority (State of California), other state agencies, and clients upon request.

A list of single blind studies that ACZ participates in is as follows:

- Water Supply (SDWA) and Water Pollution (CWA) Proficiency Testing Programs. Each study is performed twice per year.
- ERA's Radiochemistry Proficiency Testing Program. We analyze each radiochemistry parameter twice per year.
- ERA's Soil PT Program. Samples are analyzed twice per year.

2.4.2 Onsite Audits

ACZ participates in a number of federal, state and private QA programs, submitting its operations to both performance and system audits. These audits are usually a major part of their certification programs. Audit results are available for review at the laboratory.

ACZ is periodically audited on-site by the following organizations:

- Various state certifications requiring audits (i.e. Arizona performs an annual audit).
- State of California for NELAP accreditation
- Numerous consulting firms and private companies in the industry
- Governmental agencies
- Insurance Carriers

2.4.3 External Audits of Data

Periodically ACZ hires a third party auditing firm to perform a full level audit of analytical data, either on-site or off-site. The auditing firm provides ACZ management with a report on their audit findings. After review of these findings with by management, the QA/QC Officer, and the laboratory supervisor, CAR's are created for any deficiencies that require correcting.

2.4.4 Management Audits

On an annual basis, ACZ's upper management must audit ACZ's Quality System. This audit covers the review and corrective actions for Proficiency Test Results, State Audits, Internal Audits, and Client Complaints, and Training Record Documentation. Please refer to ACZ's SOP *Management Review of Its Quality System* (SOPAD034) for more details.

2.5 Corrective Action

Analytical, training, and company-wide protocol errors are discovered as the result of a solid quality assessment program. When any system problem is identified, a corrective action is necessary. Corrective actions are the backbone of our QA/QC Program, as a successful Quality System depends not only on identifying deficiencies but also establishing protocols that allow for troubleshooting and the timely implementation of an effective contingency plan. Is the responsibility of the QA/QC Officer to notify laboratory management in writing of departures from the Quality System, and it is the responsibility of the laboratory management to ensure that any corrective action that arises is discharged within a two (2) week time frame. The need for an extension is communicated to the QA/QC Officer.

ACZ has two types of corrective action reports (CAR): Major and Minor:

- A minor corrective action is one that any ACZ employee may initiate to resolve an immediate problem that is isolated or may impact only one workgroup or several related workgroups. Minor corrective actions document a deviation from the method or SOP and do not require QA/QC follow-up (for example, a reagent is prepared incorrectly but there is insufficient stock to remake it). A report for a minor corrective action (FRMQA001) must be filled out as soon as it is initiated. It is the responsibility of anyone who initiates a minor corrective action to fill out section 1 of the CAR explaining the situation, have the department supervisor fill out section 2, and then have the QA/QC Officer fill out section 4, if necessary. In some situations, it may be necessary for the Project Manager to fill out section 3. See Figure 2-1. A copy of any minor corrective action is given to the QA/QC Officer so that issues can be tracked to determine if a trend has developed that may warrant a major corrective action. The original CAR document is maintained by the department in a designated place, and a copy is included with each affected workgroup before the workgroup is scanned; otherwise, the workgroup must be retrieved and rescanned. If appropriate, minor CAR's are addressed in the case narrative of a complete data package.

- Major corrective actions address system-wide errors that require tracking and additional documented follow-up. Examples of circumstances requiring a major corrective action include, but are not limited to:
    - Lab contamination continually found in blanks above acceptable levels
    - Spikes, surrogates and lab control samples continually outside acceptance limits
    - Client inquiries about data anomalies
    - Review of Proficiency Testing sample results and follow-up
    - Results of internal or external audits
    - Results of any system audit
    - Discrepancies observed at any stage of data review
    - Trends observed on control charts

The QA/QC Officer, upper management, department supervisors, and Project Managers may initiate a major corrective action (the QA/QC Officer will assign a number). The QA/QC Officer has full responsibility of tracking major corrective actions, and is the only one who may close a major corrective action. Each major corrective action report (FRMQA001) is assigned a unique number for tracking purposes. The QA/QC Officer fully documents each Quality System deviation/deficiency as a major CAR so that ACZ maintains a complete and accessible record of all Quality System deviations and subsequent resolutions (all supporting documentation, including related e-mail, is kept with the CAR).

ACZ's LIMS Corrective Action Report has been replaced by an electronic system called Issue Wizard. Issue Wizard is a part of the in-house LIMS2000 application used by all employees. If an employee encounters a problem with any software, hardware or instrument that requires attention from the IT department, then that employee will submit a change request to the ACZ LIMS2000 Issue Wizard. The request is given a priority and is assigned to an appropriate employee for resolution. This system allows ACZ to track all changes made to computer systems since all issues are tracked in a database created for this purpose. Reports are routinely generated to find the status and eventual resolution of all computer issues since the system came on-line January of 2003.

2.6 QA/QC Reports to Management

The QA/QC Officer is responsible for implementing and maintaining all aspects of the Quality System. One of the QA/QC Officer's primary responsibilities is to keep the laboratory management team informed and up-to-date on the state of the Quality System and to work directly with management on further development and improvement of the Quality System. The QA/QC Officer meets with the members of ACZ's management team once a month to discuss the following:

- Problems discovered in previous weeks and the corrective actions initiated.
- Results of recent PT study analyses
- Review of recent external lab audits performed by federal, state agencies and industrial clients
- Review of internal audits
- Inform lab managers of upcoming audits and/or PT samples
- Presentation of ideas to improve quality of service/data to clients
- Review of current control charts
- Review and discussion of open major CAR's
- Status of state certifications

3 ETHICAL AND LEGAL RESPONSIBILITY

All employees of ACZ Laboratories, Inc. have an ethical and legal responsibility to produce data that is accurate and legally defensible. ACZ has developed a proactive program for the prevention and detection of improper, unethical or illegal actions. All aspects of this program are addressed in SOPAD039, including ACZ's zero tolerance policy, which is strictly enforced. All employees are educated with regards to ACZ's Code of Ethics and are required to sign a Code of Ethics Statement (FRMAD025) on the first day of employment. The original form is kept in the employee's training file, and a copy is given to the employee.

ACZ employees receive initial ethics training and are introduced to the company's Ombudsman on their first day of employment. Each employee is encouraged to speak directly to their department supervisor or to the Ombudsman or use the "Comments" box located in the lunchroom whenever they are confronted with a dilemma. ACZ provides a way for any individual facing an ethical problem or other concern to address it anonymously if they wish to do so. Each situation is handled independently, and situations determined to affect all employees may be made public; however the person originating the complaint/concern will still remain unknown to other company personnel.

Unethical activities are defined as intentional falsification of records. Records may be personal credentials, resumes or educational transcripts, instrument logbooks, maintenance logbooks, raw data and data reports. Scientific misconduct is defined as intentionally not adhering to the prescribed method or Standard Operating Procedure (SOP). Common falsifications include, but are not limited to:

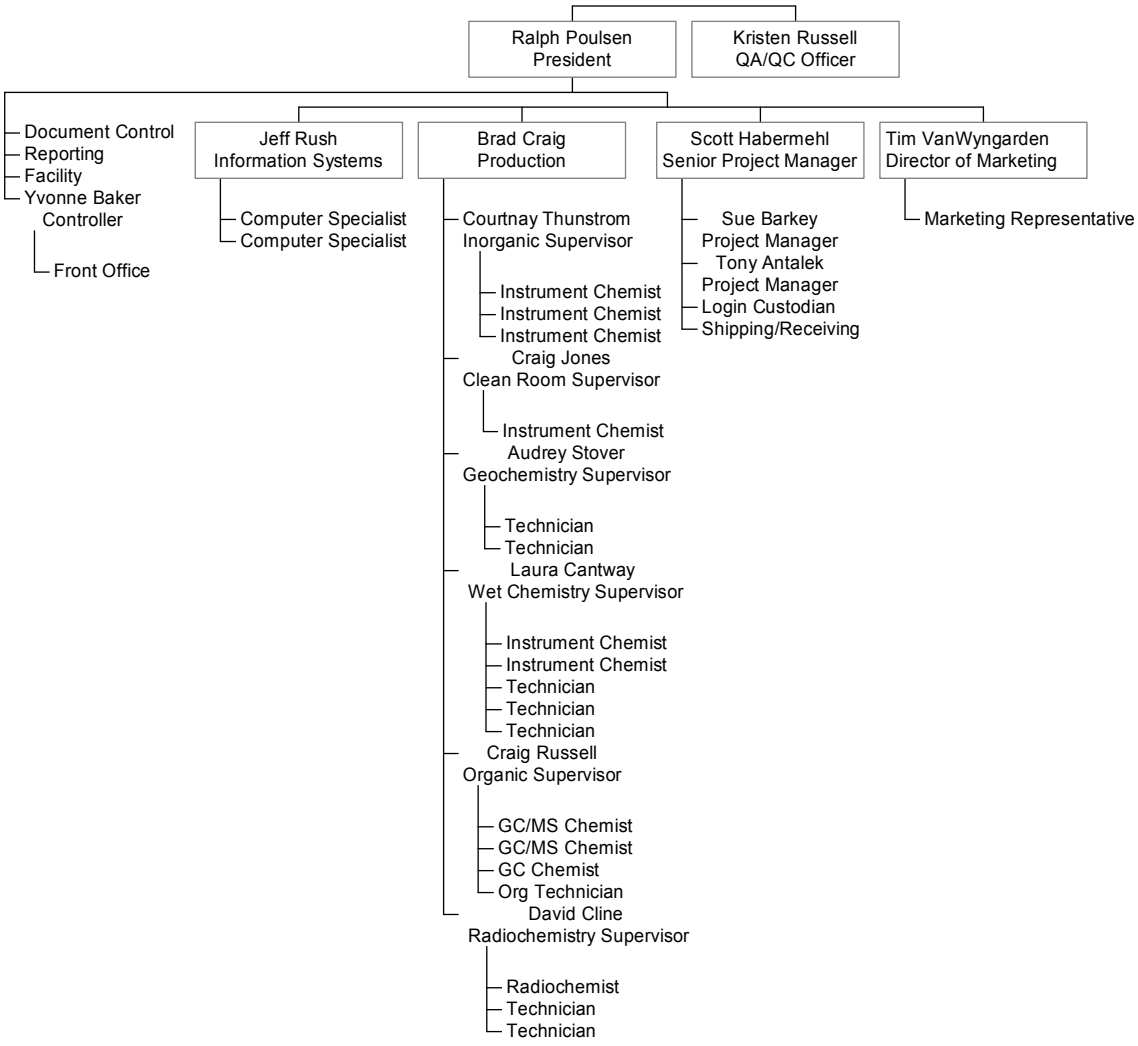
- **Falsifying data** – The process of making up/creating data without performing the procedure.
- **Improper peak integration** – Intentionally integrating data chromatograms so quality control samples meet acceptance criteria. This is also known as peak shaving or peak enhancing.
- **Improper clock setting** – Readjusting the computer clock so that it appears samples were analyzed within hold times. This is also known as time traveling.
- **Improper representation of Quality Control samples** – This includes misrepresenting analytical spikes as matrix (digested) spikes, analyzing a blank or LCS without processing it using the correct prep procedure, and treating a QC sample differently from a client sample.
- **Improper calibration** – Manipulating the calibration or tune so that it meets QC criteria. Examples are deleting/discarding calibration points along a curve or forging tuning data so that it appears to have met calibration criteria.
- **File Substitution** – Substituting invalid calibration data with valid data from a different time so that the analysis appears to be successful.
- **Hiding or concealing a problem** – Concealing a known analytical or sample problem or ethical problem.

ACZ will not tolerate these or any other unethical or improper activities or behavior. Violation of this policy may lead to repercussions ranging from a severe reprimand to immediate termination, and possible criminal prosecution if warranted by the situation. ACZ has access to many other resources which may be utilized at any time to help clarify a situation determined to be a "gray area." Employees are strongly encouraged to seek further guidance whenever doubt is raised.

4 PERSONNEL AND RESPONSIBILITIES

Figure 4-1 is ACZ's employee organizational chart. The individuals named in the chart can be contacted by phone at (800) 334-5493 or (970) 879-6590 (extensions are included) or by e-mail. The central FAX number is (970) 879-2216.

Figure 4-1. ACZ Laboratories' Employee Organizational Chart



4.1 President/CEO – Ralph Poulsen (x100 or ralphp@acz.com)

General duties involve budgeting for all departments, making decisions on capital equipment and automation; developing company policies and benefits; addressing personnel issues such as hiring, firing, and promotions; and working with clients on various matters. Day-to-day responsibilities include providing direction to all laboratory departments including laboratory operations, accounting, marketing, QA/QC, and customer service. The President also serves as Technical Director for the Inorganic and Organic departments.

Additional responsibilities:

- Define the minimal level of qualification, experience, and skills necessary for all positions in the laboratory.
- Ensure all technical staff has demonstrated capability in the activities for which they are responsible and ensure that the training of each member of the technical staff is kept up-to-date.
- Provide managerial staff the authority and resources needed to discharge their duties.
- Specify and document the responsibility, authority, and interrelationship of all personnel who manage, perform or verify work affecting the quality of calibrations and tests.
- Implement appropriate and current guidelines for all lab methods and procedures to ensure data quality and efficiency of analyses. Ensure all method protocols utilized by ACZ meet the QC requirements as established by EPA or other governing agency.
- Document all analytical and operational activities of the laboratory.
- Provide hands-on support to analysts when necessary to ensure timely completion of all laboratory work, and develop contingency plans to ensure workflow progresses as planned.
- Work with QA/QC Officer to develop and improve training protocols, conduct department work sessions to address specific problems and questions.
- Meet monthly with QA/QC Officer to discuss current state of Quality System.

4.2 Director of Production – Bradley W. Craig (x104 or bradc@acz.com)

General duties involve working with analytical department supervisors to prioritize client projects and tracking sample analyses on a daily basis in order to maintain acceptable turn-around-times for project completion. The Director of Production also addresses personnel, instrumentation, and reagent/supply issues that may affect the completion of the scheduled work.

- Conduct weekly meeting with analytical department supervisors to discuss current and upcoming workload.
- Schedule QA/QC work (MDL studies, DOC's, PT sample analysis, SOP revisions, etc.) with department supervisors in order to maintain QA/QC requirements.
- Meet monthly with President & QA/QC Officer to discuss current state of Quality System.
- Communicate with Project Managers regarding project/instrument status. Inform PM's if problems exist that may affect the project completion date.
- Perform checks of sample status using LIMS provided information to help the laboratory staff meet all established hold times and to determine that analyses can proceed as scheduled to meet required turn around times.
- Provide hands-on support to analysts when necessary to ensure timely completion of all laboratory work, and develop contingency plans to ensure workflow progresses as planned.
- Work with QA/QC Officer to develop and improve training protocols, conduct department work sessions to address specific problems and questions.
- Schedule quarterly electronic reviews of Organic data with third-party auditor.

4.3 QA/QC Officer – Kristen Russell (x108 or kristenr@acz.com)

The QA/QC Officer reports directly to the President of ACZ; however, the QA/QC department is considered a separate entity from operations and production. The main focus of the QA/QC Officer is to develop, implement, and manage all aspects of ACZ's Quality System. The major job responsibilities for the QA/QC Officer are as follows:

- Provide QA/QC orientation to new employees and refresher courses to experienced employees.
- Meet monthly with upper management to discuss current state of Quality System.
- Organize all external laboratory audits. Notify supervisors and management of any deficiencies and track corrective actions.
- Perform annual internal audits of all aspects of the Quality System. Notify supervisors and management of any deficiencies and track corrective actions.
- Review and approve all SOPs (may designate review of some SOPs to qualified employee).
- Conduct meetings with department supervisors (quarterly or more often) to provide QA/QC updates and to respond to related questions/concerns.
- Manage Proficiency Testing Program
- Review and validate a management-determined percentage of all data packages.
- Work with marketing/client service representatives on QA/QC aspects of proposals.
- Coordinate and maintain all government and client certification programs, including NELAC.
- Maintain records/documentation for employee training, PT samples, audits, state certification programs and other QA/QC issues, including major corrective action reports (CAR).

4.4 Analytical Department Supervisor

The analytical department supervisors are in charge of daily operations for their respective department. This includes sample tracking, instrument troubleshooting, data review, and training for new analysts (the department supervisor may elect to assign training duties to a proficient technician). Each department supervisor must conduct a monthly meeting with all analysts in their department to address training issues, client projects, upcoming QA/QC deadlines, corrective actions, and any other pertinent issues. Analysts are encouraged to participate actively in the meeting in order to facilitate communication. ACZ's Director of Production meets once a week with the department supervisors to discuss scheduling, priority projects, instrument problems, and any other pressing matters. The department supervisors meet once a month with the QA/QC Officer and must work with the QA/QC Officer and Director of Production to ensure all method and regulatory mandated QA/QC requirements are met by the determined due date. In addition, each department supervisor is responsible for investigating and responding to any audit deficiency within the agreed time frame.

ACZ employs a supervisor for each of the following analytical departments: Clean Room Prep/Instrument, Inorganic Prep/Instrument, Radiochemistry Lab, Wet Chemistry Manual/Instrument, Geochemistry, and Organic Prep/Instrument

4.5 Director of Marketing –Tim VanWyngarden (x103 or timv@acz.com)

ACZ's Client Service Representatives conduct all marketing and sales efforts on behalf of ACZ with potential, new and existing clientele. Each client service representative develops and maintains long-term relationships with our customers by handling all client service requests as well as investigating and resolving any problem brought to ACZ's attention by the customer. ACZ's Client Service staff is authorized to review all contractual agreements with clients as well as review all proposals and develop price quotations for analytical projects.

4.6 Project Managers –Scott Habermehl (x101 or scotth@acz.com), Sue Barkey (x110 or sueb@acz.com), Tony Antalek (x107 or tantalek@acz.com)

The Project Managers serves as the primary laboratory contact for each ACZ client. In order to provide consistency, each PM is assigned a list of clients, and it is the primary responsibility of each PM to ensure all of their client project needs are managed on a day-to-day basis and are met in a timely manner and that all data submitted to the client is of high quality. The needs of a project may vary from standard reporting to reporting packages that may also include QC Summaries, Case Narratives, etc. The supervising Project Manager is responsible for overseeing the PM department as well as Log-In/Shipping.

4.7 Information Systems Director –Jeff Rush (x105 or jeffr@acz.com)

The Information Systems Director is responsible for the installation and maintenance of ACZ's computer network and all hardware and software and related equipment deployed on the premise. This department is also responsible for developing and maintaining, and improving custom written applications for laboratory automation and efficiency as well as for ACZ's Oracle database, ACZ's Intranet (Labweb), Internet and electronic diskette deliverables (EDDs).

4.8 Responsibilities of Instrument Operators

These positions involve the analysis of various matrices for trace level contaminants using specialized and technical instrumentation. The operator must possess advanced knowledge in chemistry, analytical instrumentation and data interpretation. This work is predominantly intellectual and involves the continuous use of professional judgment on the part of the operator. The employee must meet or exceed EPA requirements for generation of litigation-quality data. All data generated by the employee must meet or exceed the quality control acceptance levels established by EPA or other accepted regulation. The employee must demonstrate continuous improvement regarding the operation and troubleshooting of the assigned instrument(s) and the interpretation of the data. These improvements should be attainable through ongoing and specialized efforts both in-house and at off-site locations.

Duties or Responsibilities:

- Operate, maintain and troubleshoot the assigned instrument(s)
- Successfully analyze a demonstration of capability (DOC) prior to analyzing client samples
- Perform successful analysis of environmental samples utilizing the assigned instrument(s)
- Read, understand and adhere to appropriate methodology as it applies to the assigned instrument(s)
- Meet or exceed EPA and ACZ quality control requirements
- Maintain cleanliness of work area to prevent or minimize sample contamination
- Adhere to ACZ policies on Safety, Hazardous Waste Management and Disposal Practices
- Use professional judgment to address the varied problems encountered with trace analysis instrumentation
- Utilize Lab Information Management System (LIMS) and supervisor's schedule to prioritize sample analyses
- Perform timely review of data and update LIMS product status daily to aid in overall lab operations
- Communicate with supervisor regarding supply needs to maintain reasonable inventory of standards, parts, reagents, etc.
- Utilize service contracts for expeditious problem-solving and for scheduling Preventative Maintenance visits
- Train new instrument operators using most current ACZ SOP and regulatory methodology. Discuss all items addressed on ACZ's Initial Method Training Form (FRMQC004) with new instrument operator.

Qualifications:

- BA or BS in Chemistry or related science
- Minimum of 3 years laboratory experience in lieu of science degree
- Successful completion of training period by supervisor or proficient instrument operator
- Successful completion of specialized instruction and study

4.9 Responsibilities of Technician

Technicians are responsible for preparing samples for further analysis by Instrument Operators. The technician will also complete routine analyses on various matrices using wet chemistry techniques and direct-reading meters. The technician must possess knowledge in chemistry and mathematics along with reasonable common sense and mechanical skills. The technicians work directly under the laboratory supervisor and seek professional judgment from the supervisor. The employee must meet or exceed EPA requirements for sample preparation tasks and routine analyses and should demonstrate continuous improvements with the assigned tasks. These improvements should be attainable through ongoing training efforts by laboratory supervisor, senior level chemists, and/or administrative advisory staff.

Duties or Responsibilities:

- Adhere to the daily schedule provided by the department supervisor for prioritizing analyses (overtime may be necessary in order to meet short hold times)
- Successfully prepare/analyze a demonstration of capability (DOC) prior to analyzing client samples
- Utilize current ACZ Standard Operating Procedures (SOPs).
- Meet or exceed EPA and ACZ quality control requirements
- Adhere to ACZ policies on Safety, Hazardous Waste Management and Disposal Practices
- Maintain overall cleanliness of the assigned work areas
- Review data and update LIMS product status daily to aid in overall lab operations
- Communicate with supervisor on supply needs to maintain reasonable inventory of standards, parts, reagents, etc.
- Communicate with instrument operators on sample preparation status
- Train new technician using most current ACZ SOP and regulatory methodology. Discuss all items on ACZ's Initial Method Training Form (FRMQC004) with new technician.

Qualifications:

- BA or BS in Chemistry or related science is preferred but not required
- Minimum of 2 years laboratory experience in lieu of science degree
- Successful completion of training period by supervisor or proficient technician (90 day Introduction)

5 TECHNICAL DIRECTORS AND SIGNATORY LIST

The following personnel are technical directors in their area of expertise for ACZ Laboratories, Inc. These directors have the responsibility of monitoring the data quality, confirming the validity of performed analyses, helping laboratory staff to produce quality data, and ensuring all staff receives proper training. Deputy Technical Directors are considered backups whenever the Technical Director is absent. All technical directors have the authority to approve and report data from their specific area of testing. Document Control maintains the signature list.

Name	Title	Years of Experience	Area of Expertise
Ralph Poulsen	Technical Director	25	Inorganic & Organic
Craig Russell	Deputy Technical Director	10	Organic & Radiochemistry
David Cline	Technical Director	10	Radiochemistry
Brad Craig	Deputy Technical Director	11	Inorganic & Quality Assurance
Kristen Russell	Technical Director	8	Quality Assurance

6 SAMPLING PROCEDURES

Sampling procedures are well documented by EPA and other agencies. Our clients are aware of the necessity to provide ACZ with representative samples whenever possible. A project manager or client service representative helps clients with specific sampling requirements when necessary (drinking water, Method 1631). ACZ provides containers and shipping materials in order to maintain sample integrity from the time of collection through analysis. We prefer to discuss sampling plans with our clients prior to shipping sample containers to ensure that a proper volume of preserved sample is collected and to verify that the requested methods meet regulatory guidelines. Our project managers and client service representatives have access to various regulatory agency phone numbers in case any methodology questions arise. The following sections include information on sample containers, preservatives and holding times. These areas are essential components in maintaining the chemical and physical properties possessed by the sample at the time of collection.

6.1 Sampling Containers and Preservatives

The U.S. EPA and other agencies strictly outline sample container types, sample volume and preservation requirements. ACZ inventory includes various sizes of plastic and glass containers with different levels of cleanliness. We stock containers which range from pre-sterilized to certified-clean by the supplier. The level of cleanliness is determined by the nature of the project. Amber bottles are used when specified in the method. We purchase all glass containers from vendors that specialize in the sales of environmental sample containers. All non-certified bottles are purchased from reputable lab/industry vendors. ACZ does not reuse any sample containers.

All sample containers shipped to our clients are new, pre-charged with the appropriate preservatives, and color-coded to identify the type of preservative. Containers are carefully packed in clean ice chests with bottle labels, ice packs, sampling information, chain of custody record and return shipping labels. Trip blanks and rinsette water are included when requested (trip blanks are included for all projects requiring Volatile Organic analyses). Temperature blanks are included in every cooler and should not be removed from the cooler.

6.2 Holding Times

After the samples are collected and preserved, the samples are cooled to 4°C (39°F). The EPA has conducted lengthy studies of degradation versus time to establish holding times. The results of these studies are compiled into holding-time tables to provide guidelines for litigation purposes. Samples analyzed outside of the established holding times are the most difficult to defend in court. Holding times will vary slightly from regulation to regulation, thus further emphasizing the need for pre-collection consultation with laboratory personnel. The holding time begins from the date/time of collection in the field. Most samples are shipped to the lab by overnight services to maintain sample integrity and to provide the laboratory as much time as possible before holding times are exceeded. Appendix A outlines method holding times.

If ACZ Laboratories, Inc. receives samples past holding times or near the expiration of the holding time, it is the client's discretion to analyze the sample. In cases where the holding time has expired, written authorization for the analysis is required and is so noted in the final report. Analyses performed outside of holding time will be flagged with the appropriate qualifier on the final report. Holding times $\leq$ 72 hours are calculated based on the hour of the sample date/time. Holding times > 72 hours are calculated based on the day of the sample date/time.

7 SAMPLE HANDLING & CUSTODY

ACZ Laboratories, Inc. provides strict sample custody enforcement conforming to the guidelines in "EPA Handbook for Analytical Quality Control in Water and Wastewater Laboratories, EPA-600/4-79-019" and "Test Methods for Evaluating Solid Waste, EPA SW-846." Laboratory operations are designed for efficient flow of samples through the facility. Sample custody begins with the shipment of sample containers to a client and continues through the documentation of proper sample disposal. There are many key elements to sample custody including laboratory security, chain of custody records, sample storage, internal transfer logs, sample tracking within the laboratory and sample control of subcontracted work.

7.1 Laboratory Security

A secure facility is essential to maintaining sample/data integrity and providing safety to employees and visitors. Controlling access and limiting this access to only authorized personnel assure security. ACZ has an electronic security system based on anti-pass back protocols. All entryways are armed and a proximity reader allows access to an employee only after he/she passes a card. The following steps have been taken to ensure this security:

- Public access points into the laboratory are secured by lab personnel (receptionist and sample custodian) stationed near buzzer-activated doors.
- Building access is limited to specific hours of the employee's shifts.
- Employees may enter/exit through only two doors. All employees are required to use their access cards to enter and exit the building, even during breaks taken off-site.
- If any employee forgets to bring their security card, they must notify the controller as soon as possible and sign in and out during the day using the register at the front desk. This is necessary so that a record is maintained of which personnel were in the building when analyses were performed (ensures legally-defensible data).
- If employees fail to use their security card, the anti-pass back system denies access for that card the next time it is used. The employee must report to the controller if this occurs.
- Visitors must sign the register at the front desk to enter and exit laboratory.
- Lab personnel must escort visitors as long as they remain on the premises.
- Emergency Exit doors are to be used only for emergency purposes. If a door is opened, a siren alerts the entire facility of the emergency.
- It is against company security policy to loan or transfer access cards to anyone, including other ACZ employees. <u>Employees may not allow a non-shift employee to enter the building.</u>
- Vendors and delivery services entering the building via the west/shipping entrance must sign the register located at this entry point.
- The back door at log-in must be locked each night.

7.2 Sample Receipt and Log-in

Upon delivery of samples to ACZ, a sample custodian evaluates the condition of the cooler and custody seals. The custody seals are then broken to gain access to the cooler and to retrieve the Chain of Custody Records (COC). The COC is signed by the sample custodian to document the samples are now in his/her possession. Once a cooler is opened, the sample custodian creates a Sample Receipt Form (in LIMS) for the project. Each sample and sub-sample is checked for pH to verify the sample meets EPA preservation requirements. These checks are documented on the Sample Receipt Form along with cooler temperature, radioactivity screen and other pertinent sample information. Any problems, such as expired hold times, lack of preservative or improper cooler temperature, are noted on the Sample Receipt Form. The client is also immediately notified by telephone and a contingency plan is initiated. Samples are now ready to be logged-into ACZ's Laboratory Information Management System (LIMS) as outlined in the SOP *Sample Integrity and Log-In Procedure* (SOPAD016).

Smooth sample flow through the laboratory is facilitated by the use of an Oracle-based LIMS developed by Automated Compliance Systems (now known as Lab Vantage Solutions) and powered by a quad-Pentium SCO UNIX mini-computer. Standard client parameter lists are assigned "Parent Products" which eliminate data entry errors. When a particular Parent Product is entered during log-in, parameters/products corresponding to that code are automatically assigned to the sample. After the log-in process is completed, two print jobs are initiated. One is the Internal Chain of Custody (ICOC) that contains all pertinent sample information. The second is the sub-sample labels bar-coded for each sub-sample container that are attached to the corresponding bottles before the bottles are dispatched to an assigned storage area.

7.3 Internal Transfer Logs

Some clients may specify additional custody tracking of the samples once they have been properly labeled and stored for analysis. If requested, a logsheet (FRMQA015) shall accompany the samples from log-in through completed analysis. The person responsible for the work signs and dates each entry and/or page in the logbook. When all data from a sample set is compiled, copies of all logbook entries shall be included in the documented report package provided to the client. For projects requiring internal custody, ACZ will adhere to the chain of custody procedures outlined in Exhibit F of the EPA's CLP Statement of Work.

7.4 Sample Tracking

Every product (requested analysis) logged into the LIMS for a sample has a specific, pre-determined department path. All products have default paths of at least Login Review and Reporting. Between these two departments, a product may go through, for example, Soil Prep and Metal Analysis or Soil Prep, Organic Prep and GC Analysis. At each department step in a product's path, the status can be updated and viewed at any time. Product statuses are as defined:

NEED	Analysis needs to be started
WIP	Analysis is started or is Work In Progress
PREP	Sample is prepped and is ready for analysis
UPLD	Analytical data has been uploaded into LIMS
AREV	Analyst has reviewed and accepted analytical data
SREV	Supervisor has reviewed and accepted analytical data
DONE	Analysis or task has been completed
REDO	Analysis has been sent back for retest (reanalysis)
REDX	Analysis has been sent back for re-digestion/extraction

8 PROCUREMENT PROCEDURES AND CONSUMABLE SUPPLIES

8.1 Procurement/Inventory

ACZ Laboratories, Inc. has an in-house developed, Microsoft Access-based purchase ordering (PO) and inventory system. This database stores all vendors and their products (supplies). All vendors are evaluated based on service, quality, response time, and price. Access to the PO System is limited. Refer to ACZ's SOP *Purchase, Receipt, and Storage of Consumable Materials for Technical Operations* (SOPAD037) for more detail.

All incoming chemicals and standards are assigned a Primary Control Number (PCN) for tracking and trace ability purposes. Original containers must be labeled with an expiration date. Chemicals, standards, and other laboratory consumables are stored in the Chemical & Supply Room. Access to this room is limited to analysts and ACZ's Purchasing Agent.

Material Safety Data Sheets (MSDS) and/or a Certificate of Analysis are requested for all chemical purchases and when a calibrated device is ordered. Certificates of Analysis for provide ACZ with a traceable record of the standard to a NIST standard. Chemical Certificates of Analysis (for non-standards) provide information on its constituents and concentrations in the chemical.

8.2 Glassware

ACZ Laboratories, Inc. uses only laboratory grade glassware and supplies purchased from nationally known supply houses. Prior to use, our technicians wash all laboratory glassware using Alconox® or Chemsolve® and rinse with Type I water. Glassware used for trace metals analysis is rinsed in a 50% Nitric Acid solution before being rinsed with Type I water. Nutrient analysis glassware is rinsed in 10% Hydrochloric Acid followed by a Type I water rinse. All organic analyses glassware is washed with Alconox®, rinsed with de-ionized water and baked in a kiln. Glassware not used immediately after cleaning is stored in a clean environment.

8.3 Standards and Reagents Trace ability

ACZ prepares calibration standards from stock standards purchased from reputable chemical vendors. Stock standards and certified reference materials (CRM) are of an analyzed grade and are traceable to NIST standards. All working standards and reagents are tracked by a system of control numbers. A Secondary Control Number (SCN) is created from the PCN's when a working standard is made from multiple reagents or when a single element solution is a dilution of a concentrated stock standard. This SCN is electronically created in the ACZ's own software program. All initial volumes and concentrations are entered into the computer program and the final concentrations are automatically calculated. This system verifies the reagent or standard being used has not expired. The printouts of these electronically created SCN's are placed in the department "Standard and Reagent Log Book." Stock standards are used for one year from receipt or until manufacturer's expiration date is reached, whichever is sooner. NELAP standards require all containers of prepared reagents and standards to be labeled with the SCN (or a unique identifier) and expiration date. Lot numbers of chemicals or reagents found to be contaminated are disposed of immediately, and a replacement is ordered for overnight delivery.

For more information regarding reagents and standard preparation, refer to individual method SOPs.

8.4 Type II Water

Type II water is prepared by sending tap water through a Culligan five-cartridge system. The first two cartridges are mixed-beds, the third is a cation cartridge, the forth is an anion cartridge and the last is a carbon filter cartridge. Type II water from this system should have a conductivity of less than 2 umhos/cm.

8.5 Type I Water – Metals/Wet Chemistry/Radiochemistry Analysis

Type II water is passed through a Labconco four-cartridge system for final polishing. The resistivity of the Type I water is ~18 megaohms/cm with a low limit of 16.6 megaohms/cm. Resistivity is recorded daily (except weekends and holidays) –if resistivity drops below 16.6 megaohms/cm, the cartridges are replaced.

8.6 Type I Water – Organic Analysis & Clean Room Analysis

Type II water is passed through a Barnsted Easypure UV four-cartridge system for final polishing and removal of trace level organic contaminants. Resistivity of the Type I water normally runs 18 megaohms/cm with a limit of 16.6 megaohms/cm. Resistivity is recorded daily. If resistivity drops below 16.6 megaohms/cm, the cartridges are replaced. This system produces water with < 2 ppb TOC.

9 INSTRUMENTATION, EQUIPMENT & PREVENTATIVE MAINTENANCE

ACZ has a significant number of scientific instrumentation and computer hardware throughout the lab. The complete list of equipment is maintained in ACZ's Statement of Qualifications (SOPAD036).

ACZ department supervisors have numerous combined years of experience with routine maintenance issues for all instruments within their departments. Daily and routine maintenance responsibilities are delegated to the analysts – we believe routine maintenance improves productivity by minimizing instrument downtime. All routine maintenance must be documented in the instrument logbook. See ACZ's SOP *Control, Calibration and Maintenance of Measuring and Test Equipment* (SOPAD013) for more detail. In a situation where the analyst is unable to rectify a problem with the instrument, the supervisor or another "senior level" analyst may step in to help before a service call is placed with the manufacturer. If an instrument is temporarily out of service then FRMAD029 must be attached to indicate the instrument is waiting for repair and cannot be used for sample analyses.

Many of our instruments are under service contract with the manufacturer and in most cases involve preventative maintenance checks by a service technician. Most service contracts are written with a guaranteed 48-72 hour response time to a service call. All maintenance is documented in the maintenance logbooks to be used as a source of information in solving future instrument problems. Refer to SOPAD013 *Control, Calibration and Maintenance of Measuring and Test Equipment* for instruments with service contracts.

We stock many parts considered consumable (spare nebulizer for the ICP, extra contact rings for graphite furnace and spare columns for gas chromatographic techniques) in order to minimize downtime. We also have solid relationships with our vendors to provide for overnight shipment of parts that do not require manufacturer installation. In addition to service contracts, qualified analysts, and inventory of spare parts, ACZ utilizes equipment redundancy when possible. In the event one instrument goes down, another instrument is available to meet hold times and client due dates.

Support equipment is monitored regularly to confirm proper functioning. The temperature of all drying ovens, refrigerators, freezers, and incubators must be checked each working day (not on weekends or holidays). The accuracy of each thermometer associated with a piece of support equipment is checked annually using calibrated thermometers (log-in thermometers are checked quarterly). For more information regarding support equipment refer to the SOP *Control, Calibration and Maintenance of Measuring and Test Equipment* (SOPAD013).

10 INSTRUMENT CALIBRATION

All laboratory instruments are calibrated in accordance with the manufacturer's analytical guidelines and method requirements to eliminate or minimize any bias. Calibration frequency and acceptance criteria are established by the analytical method (or by specific client contract stipulations in non-routine analyses). In all cases, instruments are calibrated with NIST traceable standards to provide accurate and valid data. The calibration is verified using a second-source standard. **

> ** *If a second source standard is not available, a different lot(s) of the same standard(s) may be used. If a different lot of the reagent is not available, then the calibration verification standard may be prepared by an analyst who did not prepare the calibration standards.*

All analytes reported must be present in the initial and continuing calibrations. All results reported must be within the calibration range of the instrument or established upper linear range. All calibration procedures, method procedures, and method criteria including specific QC limits are clearly detailed in the individual instrument SOPs. Immediate corrective action must be taken if the instrument calibration is outside of the method acceptance criteria. NELAP standards allow for subsequent analysis of the same method analyte(s) with the same matrix using a continuing calibration. A maximum of two attempts for a continuing calibration are permitted. If both the first and second attempts fail then the instrument must be recalibrated before any samples are analyzed.

Verification calibration check samples must be analyzed on a periodic basis (method-specified) to ensure the calibration has not significantly changed. Each individual method specifies the frequency and acceptance limits of this check sample. In order to check the range of the calibration curve, the verification check samples must vary between at least two different concentrations unless the instrumentation utilized internal standards. For ICP calibrations, a Practical Quantitation Verification standard (PQV) is analyzed immediately following the ICB of each calibration (or first CCB of a continuing calibration analysis). The level of the analytes in the PQV is equal to the PQL for each analyte. For all other instrument analyses, the concentration of the low calibration standard is equal to the PQL unless accepted by the instrument manufacturer.

Intermediate standards and instrument calibration and check standards are prepared using clean Class A volumetric glassware. Analysts may use either Class A pipettes, fixed volume pipettes, or an adjustable volume pipette to dispense reagent aliquots. Accurate delivery of fixed pipettes is checked weekly and accurate delivery for mechanical adjustable pipettes is verified daily. See ACZ's SOP *Pipette Calibration* (SOPWC023) for more detail. Calibration of analytical balances are checked daily as outlined in ACZ's SOP *Control, Calibration, and Maintenance of Measuring and Test Equipment* (SOPAD013). Storage conditions and shelf life for standards are specified in the specific method SOP. In general, ACZ allows a six- month shelf life for any standard with an analyte concentration greater than or equal to 10 mg/L, and a 30-day shelf-life for any standard with an analyte concentration less than 10 mg/L, <u>unless stated otherwise in the method.</u>

11 ELEMENTS OF QUALITY CONTROL

The overall focus of our internal quality control plan involves monitoring measurement processes to determine matrix effects and laboratory performance. Quality control samples are analyzed with every batch of samples for every analytical method. Performance control samples demonstrate the precision/accuracy of the analytical run and expose out-of-control events. Matrix-specific control samples document the effect of the matrix on method performance and also qualifies data as in or out-of-control. Required QC samples and acceptance limits are detailed in the SOP for each analytical method.

The EPA or other agencies generally specify acceptance criteria for all lab performance and matrix-specific quality control samples on a method-to-method basis. ACZ uses historical data as an additional guideline. Data from these control samples are plotted on control charts to establish control limits. Data that is out-of-control dictates corrective action ranging from re-extraction/re-analysis to reporting data with qualifiers.

Internal quality control consists of the following:

- Proper instrument calibration (see Section 12)
- Use of high-quality, NIST traceable standards (see Section 9)
- Analysis of laboratory quality control samples for each batch of samples

11.1 Definition of a Batch

Every batch of samples for prep and analytical work is assigned a unique numerical identifier (a traceable six digit number called the LIMS Workgroup Number). A batch is a set of client samples of like matrix, not to exceed 20 in a workgroup. All required QC samples must be analyzed with the batch at the frequency required by the method, even if there are less than 20 client samples in the batch. If a bench sheet has four samples, then the analytical batch would include one full set of QC samples. If the workgroup has more than 20 samples, it must be analyzed with sufficient batch QC for every 10 or 20 samples as indicated in the SOP. Solid matrices must be prepped with the same matrix only so that the quality control samples analyzed are evaluated for the particular matrix.

11.2 Control Samples

11.2.1 LCSW (Water) or LCSS (Soil)

The performance of many analytical methods is monitored by a laboratory control sample (LCS). The LCS is matrix specific and may be prepared in the laboratory or purchased pre-made from a vendor. The analysis and review of the LCS allows for the verification of the precision and accuracy of the analytical process. If the LCS fails, the entire batch is prepped and retested. For solid matrix preparation by Method 3050B, 3051, or Hg by 245.5/7471A, a LCSS and a LCSS Duplicate are prepared and analyzed. Associated samples are re-prepped and retested if the LCSS/D RPD is > 20 or if the recovery of both the LCSS and LCSS DUP is outside of the manufacturer's acceptance limits. For 3050B or 245.5/7471A preparations, the data is acceptable if either the LCSS or LCSS DUP is within the acceptance limits and the RPD is $\leq$ 20.

11.2.2 Laboratory Fortified Blank (LFB)

A Laboratory Fortified Blank (LFB) is analyzed in lieu of the LCS for methods that do not require analysis of a LCS but do require analysis of a fortified matrix (spike). The LFB is an aliquot of reagent water to which known quantities of the method analytes are added. It is treated exactly like a sample, and its purpose is to determine whether the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements. Successful analysis of the LFB indicates correct spiking technique. Any spike failure is attributed to sample matrix and the associated data is appropriately flagged on the final report if the LFB recovery and all instrument QC passes.

11.3 Blanks

11.3.1 Method Blanks (Prep Blanks)

Method/Prep blanks are analyzed to evaluate the effect of background interferences and/or laboratory contamination on sample results. A method blank is type I water to which all reagents are added in the same volumes as used in the analytical process. A method blank is prepared with every analytical batch and is processed and analyzed in the same manner as the client samples. The maximum permissible level of analyte in the method blank is method specific and is stated in each individual SOP. Because of the variability of contamination sources, reference to the individual method SOP should be made to determine if the sample preparation and analysis needs to be repeated or if the data can be reported with a qualifier.

NELAP standards require that the source of contamination be investigated and measures taken to correct, minimize or eliminate the problem if

i) The blank contamination exceeds a concentration greater than 1/10 of the measured concentration of any sample in the associated sample batch or,

ii) The blank contamination exceeds the concentration present in the samples and is greater than 1/10 of the specified regulatory limit.

Corrective action shall be performed to eliminate the source of contamination prior to proceeding with analysis. After the source of contamination has been eliminated, all samples in the analytical batch shall be re-prepped and reanalyzed. No analytical data shall be corrected for the presence of analytes in blanks. When an analyte is detected in the method blank and in the associated samples and corrective actions are not performed or are ineffective, the reported data is appropriately flagged.

11.3.2 Trip Blanks

The trip blank consists of a VOA sample vial filled in the laboratory with ASTM Type I Organic laboratory grade water that is transported to the sampling site in the sample cooler and returned to the laboratory for analysis. Trip blanks are not opened in the field. Trip blanks are prepared when requested by the client (i.e. for Cyanide in water) or when VOA samples are to be analyzed only for VOA analytes. The trip blank is analyzed in the same manner as a client sample. When an analyte is detected in the trip blank the appropriate validation flag is applied to all sample results from the samples shipped to ACZ in the same cooler as the affected trip blank.

11.3.3 Rinsette/Equipment Blanks

An equipment blank is a sample of ASTM Type I Organic laboratory grade water poured into or over or pumped through the sampling device, collected in a sample container and transported to the laboratory for analysis. Equipment blanks are used to assess the effectiveness of equipment decontamination procedures.

The frequency of collection for equipment blanks is in the project field-sampling plan. Equipment blanks shall be collected immediately after the equipment has been decontaminated. The blank shall be analyzed for all laboratory analyses requested for the environmental samples collected at the site. When an analyte is detected in the equipment blank the appropriate validation flag is applied to all associated sample results.

11.3.4 Ambient Blanks

The ambient blank consists of ASTM Type I Organic laboratory grade water poured into a volatile organic analysis (VOA) sample vial at the sampling site (in the same vicinity as the associated samples). It is handled like an environmental sample and transported to the laboratory for analysis. Ambient blanks are prepared only when VOA samples are to be analyzed only for VOA analytes. Ambient blanks are used to assess the potential introduction of contaminants from ambient sources (e.g., active runways, engine test cells, gasoline motors in operation, etc.) to the samples during sample collection. The frequency of collection for ambient blanks is specified in the field-sampling plan for each project. Not all projects require an ambient blank.

11.4 Matrix-Specific Quality Control Samples

The effect of different matrices on the performance of the analytical methods can be profound. ACZ analyzes matrix spikes, matrix duplicates, and matrix spike duplicates and surrogate compounds to evaluate matrix effects on data quality. The SOPs for the analytical methods contain more specific information regarding the evaluation and usage of matrix-specific QC samples.

ACZ's LIMS is set up to allow for random selection of samples for spiking and/or duplication. Samples are selected for a batch by due date or priority –not by client. Twenty samples or less are pulled into a batch by project number. The analyst is presented with sample numbers and sample ID only (sample identification in no way indicates what matrix interferences are possible). Samples are presented in the batch in increasing numerical order according to project number. A client's samples will be grouped together within the batch –in this way, the analyst cannot favor a single client, because QC must be performed at the method-specified frequency within the batch. For example if the method specifies a matrix spike for every 10 samples in the batch, the analyst must choose one sample from each set of ten samples within that batch. Unless all 20 samples are from the same project, two different client samples will be spiked.

ACZ also recommends that the analyst, to the best of his/her ability, select samples to spike or duplicate that are representative of the workgroup, and analysts are not to associate QC with a client sample believed to be any type of blank (based on sample ID). Several exceptions exist regarding this matter. First, sample volume must be considered. A sample is not chosen for spiking or duplicating if the sample volume is low. If no other option is available, the sample and the QC are prepared and analyzed on the same dilution. The second exception is that occasionally a client will request that one of their samples be spiked. The analyst is notified that QC must be performed (log-in personnel include this notice when the sample is entered into LIMS). Certainly, if a client

requests that one of their samples is duplicated, ACZ is obliged to accommodate the client, and their designated sample will be the sample duplicated in that batch. The third exception applies to analyses where TDS value must be considered. If a sample must be diluted prior to analysis due to high TDS, the sample may not be selected for spiking. Making multiple dilutions of the sample increases the likelihood of introducing an error due to pipeting, and it is possible that spike recoveries may be incorrectly influenced by this error; however, situations do exist where a sample with high TDS must be spiked. A high TDS value will not influence whether or not a sample is duplicated. A fourth exception to consider is the nature of the sample. A reactive sample is unpredictable, and is therefore a poor choice for matrix spiking or duplicating.

ACZ provides analytical services to numerous and varied clients, the possibility of favoring one client is unlikely. Over the course of time no one matrix type will be consistently spiked or duplicated, and no one client will be selected for a high percentage of spiked or duplicated samples. If either of these occurs, it is due entirely to chance.

11.4.1 Matrix Spike Samples

ACZ uses matrix spike samples to determine the level of bias (accuracy) associated with a sample's matrix. The spikes are prepared by adding a known quantity of the analyte of interest to a replicate sample. Matrix spike samples are analyzed at a frequency specified by the method, and the results, expressed as a percent recovery (%R), are checked against the control limits. If the recovery is outside of these limits, all samples associated with the matrix spike are appropriately qualified.

11.4.2 Matrix Duplicates/Matrix Spike Duplicates

The matrix-specific precision associated with the analytical methods is determined and verified through the use of matrix duplicates and/or matrix spike duplicates. These are performed at a frequency specified by the method. The method also dictates which type of duplicate is used (matrix or matrix spike). The results are compared by calculating the relative percent difference (PRD) and percent recovery. The matrix effect on precision and accuracy can then be determined.

Data for a matrix duplicate is evaluated only if the concentration of analyte in the sample is greater than 10 times the MDL for that analyte. A failed duplicate RPD for a sample concentration less than 10 times the MDL is qualified. Percent recovery is considered for all matrix spike duplicates. Data is acceptable if the RPD is $\leq$ 20 and if, at a minimum, either the matrix spike (MS) or matrix spike duplicate (MSD) percent recovery is within the acceptance limits. If both the MS and MSD have percent recoveries outside of the acceptance criteria, all data associated with the MS/D is qualified if the RPD is $\leq$ 20. Associated samples must be reanalyzed if the RPD for the MS/D is > 20.

11.4.3 Surrogates

Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but that are not normally found in environmental samples. Surrogates are used to evaluate accuracy, method performance and extraction efficiency and shall be added to environmental samples, controls and blanks, in accordance with the method requirements.

Whenever a surrogate recovery is outside the acceptance limit, corrective action must be performed. After the system problems have been resolved and system control has been reestablished, the sample should be re-prepped and retested. If corrective actions are not performed or are ineffective, the appropriate validation flag is applied to the sample results.

11.5 Internal Standards

Internal Standards (IS) are used for all Organic GC/MS calibrations as well as ICP-MS calibrations. Internal standards are measured amounts of certain compounds added after preparation or extraction of a sample. Internal Standards are used in a calibration method to correct sample results affected by column injection losses, purging losses or viscosity effects. The IS shall be added to environmental samples, controls and blanks, in accordance with the method requirements.

When the IS results are outside of the acceptance limits, corrective actions shall be performed. After the system problems have been resolved and system control has been reestablished, all samples analyzed while the system was malfunctioning shall be reanalyzed. If corrective actions are not performed or are ineffective then the reported data is flagged.

12 DATA QUALITY ASSESSMENT

Our Quality Control Program requires the analysis of performance and matrix-specific QC samples. Laboratory Control Samples (LCS), Certified Reference Materials (CRM) and Matrix Spike samples (MS) are analyzed to demonstrate accuracy (bias) associated with both the analytical method and sample matrix. Duplicate samples (DUP) and Matrix Spike Duplicates (MSD) are analyzed to demonstrate precision. QC data is evaluated graphically by way of Control Charts.

12.1 Accuracy

Defined by Taylor as "the degree of agreement of a measured value with the true or expected value of the quantity of concern."* LCS and Spiked samples are analyzed with every batch of samples or as stipulated by the specific method to assess accuracy and matrix effects. Analysis of performance evaluation samples is also used to determine the accuracy of the analytical data being produced.

- Percent Recoveries (%R) for LCS samples are calculated as follows:

$$\%R = \frac{MS_x}{S_p} \times 100$$

Where: MS_x = Measured or observed concentration of the LCS sample
S_p = True value of the LCS.

- Percent Recoveries (%R) for Spike samples are calculated as follows:

$$\%R = \frac{MS_x - S_x}{S_p} \times 100$$

Where: MS_x = Measured concentration of the spiked sample
S_x = Measured concentration of the sample aliquot
S_p = True value of the spike concentration

For specific methods, accuracy control limits may be generated by the ACZ Control Chart Program once a minimum of 20 data points is available (control limits are established from historical data or can be can be generated for a specific time period). Accuracy control limits are set at +/- 3 times the standard deviation from the mean percent recovery, which represents the 99% Confidence Limit. Regulatory limits, per each method, are also plotted on the control chart. The ACZ Control Chart application is accessed through LIMS2000 and is used by analysts/management throughout the lab. Refer to ACZ's SOP *Control Charting Application and Procedure* (SOPAD041) for further details.

* "Quality Assurance of Chemical Measurements," Taylor, J., 1987

12.2 Precision

Defined by Taylor (1987) is "the degree of mutual agreement characteristic of independent measurements as the result of repeated application of the process under specified conditions."* Sample Duplicates and Matrix Spike Duplicates are analyzed with every batch of samples and the Relative Percent Difference (RPD) is calculated as follows:

$$RPD = \frac{|X_1 - X_2|}{\left(\frac{X_1 + X_2}{2}\right)} \times 100$$

Where: X_1 = Measured conc. of the first sample aliquot
X_2 = Measured conc. of the second sample aliquot

Precision control limits may be generated by the ACZ Control Chart Program once a minimum of 20 data points is available. Control limits are established from historical data or can be can be generated for a specific time period. The ACZ Control Chart application is accessed through LIMS2000 and is used by analysts/management throughout the lab. Refer to ACZ's SOP *Control Charting Application and Procedure* (SOPAD041) for further details.

12.3 Other QC Calculations

Other calculations utilized routinely in the quality assurance process are as follows:

Mean (used to determine average value of measurements):

$$\overline{X} = \frac{\sum X_i}{n}$$

Where: X = mean
X_i= individual observation
n = number of samples

The Standard Deviation of Percent Recoveries:

$$S = \sqrt{\frac{\sum (X_i - \overline{X})^2}{n-1}}$$

Where: S = standard deviation
X = mean
X_i= individual observation
n = number of samples

Data is determined to be out-of-control if any QC measurement point is outside the Control/Regulatory Limits. If the analyst is unable to determine the cause of the problem, it is presented to the department supervisor and/or the QA/QC Officer, and a corrective action is initiated, if necessary.

* "Quality Assurance of Chemical Measurements," Taylor, J., 1987

13 DATA REDUCTION, VALIDATION AND REPORTING

ACZ Laboratories incorporates a multi-level data validation process to assure that the reported analytical data meets the client's data quality objectives. As the data quality objectives change from project to project, so does the intensity of the data validation process. For additional details of the data reduction, review, and validation process, please refer to ACZ's SOP *Data Review Process* (SOPAD032). At a minimum, the process consists of the following steps:

- Prior to performing an analysis, the analyst checks that holding times have not been exceeded.
- Prior to analyzing the samples, the analyst checks the set-up and operation of the instrument.
- Analyst verifies correct PCNs and/or SCNs have been entered when the workgroup is created.
- Analysts verify proper sub-sample is being prepped/analyzed (green dot, yellow dot, etc). Analysts must notify department supervisor and PMs as soon as possible if a sample cannot be located and therefore cannot be analyzed.
- Analysts compare sample ID on container to the client ID on the bench sheet.
- Auto sampler cups are clearly labeled to identify the sample, including dilution factor if > 1x.
- Analysts thoroughly document any observations about samples or analysis that may be useful in recreating an accurate history of events related to the client, project, etc. Complete and accurate documentation is critical to the production of legally-defensible data.
- Data is entered into LIMS database either by automatic instrument upload or by manual upload. Data is then submitted to a variety of process chains, such as internal calculations, rounding, and application of data qualifiers.
- Calculations are performed on the raw data and documented when specified by the SOP. Final results are rounded according to EPA's rounding rule where all data is rounded to the nearest even number. If the digit left of the "5" is even, then round down to the even number; if the digit left of the "5"is odd, then round up to the even number (for example, 6.45 rounds to 6.4 and 6.55 rounds to 6.6).
- The analyst calculates the final QC value by rounding the raw data or QC value in accordance with the method detection limit using EPA rounding rules. If the method criteria for %R is ±25, then limits would be 75% –125%. Example: a raw recovery of 74.56% rounds to 75% and would be considered acceptable while a raw recovery of 74.50% rounds to 74% and would be unacceptable. If the method states the limit for %R as ±25.0, then the limits would be 75.0% – 125.0% and both examples cited above (74.56 and 74.50) would be outside the acceptance limits.
- All data is 100% reviewed by the analyst. This Analyst REVview step of the data verification process is performed in LIMS and utilizes an in-house Visual Basic computer program (AREV) that automatically performs all quality control calculations and visually displays all sample and quality control results. The analyst uses a data review checklist to check the following items: instrument calibration, blank values, %R or RPD of all quality control data, and anything else pertinent to the analysis. Sample data is also reviewed to ensure that all values are within the

working range of the instrument and that no apparent anomalies exist. Any non-compliances and the corrective action(s) taken are noted on the data review checklist. The analyst may pass or fail individual samples or the entire batch and may update the status of any or all client samples to either REDO or REDX as part of the corrective action for a failed QC sample.

- The department supervisor (or qualified individual) performs a Secondary REVview of the data in LIMS utilizing ACZ's in-house computer program, SREV. SREV is performed with the aid of the same data review checklist filled out by the analyst who performed the AREV. It is the responsibility of the person performing SREV to confirm the analysis was conducted according to the established protocol and that quality control limits were met or that non-conformances were properly documented and appropriate corrective action was taken. The supervisor has the authority to pass or fail data that had been accepted or rejected by the analyst. Data which is deemed acceptable is passed and reported. The status of rejected data is updated to either REDO or REDX, unless there is insufficient sample volume for reanalysis. In this case the status is updated to INSX.

- The LIMS automatically performs several additional QC calculations on the approved data. These include cation/anion balance (CAB) checks and calculated TDS versus actual TDS ratios. The results of these calculations are included in the final report.

- The Reporting Department compares the requested analyses on the chain-of-custody records with ACZ's internal chain of custody. Once all analyses are completed and approved, the analytical report is generated and submitted for final review and validation by the Project Manager. If necessary, a case narrative is written describing the details of the project and any non-conformance issues. The PM electronically signs the report, and the Reporting Department sends the report to the client in an electronic format.

Once the entire review process is complete, a client report is generated. Refer to ACZ's *Reporting SOP* (SOPAD027) for more detail. The following information appears on an ACZ analytical report (Figure 13-1):

Client Name	Sample Matrix
Client Address	Parameter/Analyte
Client Contact	Method Reference
Lab Sample ID	Result
Client Sample ID	Units
Client Project ID	Qualifier/Flag
ACZ Report ID	MDL
Date/Time Sampled	PQL
Date/Time Received	Analyst Initials
Date/Time Analyzed	Extended Qualifiers (as separate page)

A complete electronic data package contains the analytical reports, the external chain of custody records, sample shipping documentation, and any other relevant project information. Department Reference Sheets explaining acronyms, qualifiers, and sources of methodology used are also included. All of these documents are an integral part of the final data package and must always be viewed as a whole. To prevent the separation of reports, all pages contain a unique ACZ Laboratory project number. Each page of this project has a unique, sequential page number. Each page of the data package details the total number of pages in the data package.

Figure 13-1. ACZ Laboratories, Inc. Analytical Report (Inorganic)

ACZ Laboratories, Inc.
2773 Downhill Drive Steamboat Springs, CO 80487(800) 334-5493

Inorganic Analytical Results

ACZ Laboratories, Inc.
Project ID: 10100
Sample ID: WP NUTRIENTS

ACZ ID: ***L34450-01***
Date Sampled: *10/15/01 00:00*
Date Received: *10/17/01*
Sample Matrix: *Surface Water*

Wet Chemistry

Parameter	EPA Method	Result	Qual	Units	MDL	PQL	Date	Analyst
Nitrate as N, dissolved	Calculation: NO3NO2 minus NO2	3.6		mg/L	0.1	0.5	10/22/01 7:45	calc
Nitrate/Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction	3.6	H	mg/L	0.1	0.5	10/18/01 16:01	jaf
Nitrite as N, dissolved	M353.2 - Automated Cadmium Reduction		UH	mg/L	0.05	0.3	10/18/01 16:01	jaf
Nitrogen, ammonia	M350.1 - Automated Phenate	4.90		mg/L	0.05	0.3	10/18/01 12:48	ksj
Nitrogen, total Kjeldahl	M351.2 - TKN by Block Digester	5.6		mg/L	0.2	1	10/21/01 18:14	ab
Phosphorus, total	M365.1 - Auto Ascorbic Acid (digest)	1.18		mg/L	0.03	0.2	10/21/01 14:50	jaf
Phosphorus, ortho dissolved	M365.1 - Automated Ascorbic Acid	0.981	H	mg/L	0.005	0.03	10/18/01 15:55	ksj

REPIN.01.11.00.01

14 DETECTION LEVELS

Several detection levels are utilized in the environmental laboratory business, such as Method Detection Limit (MDL), Reporting Limit (RL), Limit of Quantitation (LOQ), etc. Most scientists agree "the detection level is the smallest amount that can be detected above the noise in a procedure and within a stated confidence level."* ACZ utilizes three detection levels: Instrument Detection Level (IDL), Method Detection Limit (MDL) and Practical Quantitation Limit (PQL). The IDL is the concentration level that produces a signal greater than three standard deviations of the mean noise level. The MDL is similar to the IDL but rather than analyzing a clean matrix at the instrument level, the MDL is determined by processing a sample through the entire method procedure. The MDL is determined by spiking at least seven blank samples at approximately 3 to 10 times the estimated MDL, and submitting the sample to the method's prep and analytical procedures. The MDL is calculated by multiplying the standard deviation of at least seven replicates by the appropriate student t value.

ACZ performs MDL studies at least annually for each method unless otherwise specified. Some methods, special projects or certain clients may require MDL studies on a more frequent basis. Once the studies are completed, the MDLs are compared with different instruments performing the same method to make sure they are in agreement, as some variability is expected due to differences in analyst experience, instrument sensitivity, and even barometric pressure. Refer the ACZ's SOP *Demonstration of Capability & Method Detection Limit Studies* (SOPAD001) for additional information.

At the MDL level, data is not quantifiable. Uncertainty at the MDL level is ±100% (or ± MDL). However, at three to five times the MDL the data is quantifiable. This level, the Practical Quantification Limit (PQL), is the lowest level that ACZ can reliably achieve within method-specified limits during routine operations. Any data reported between the MDL and PQL is flagged as an estimated value. The MDL and PQL are adjusted accordingly for each parameter to reflect any sample dilution.

* Standard Methods, 19th Edition, pp.1-10, (1995)

15 SAMPLE DILUTIONS

Sample dilutions may be necessitated by several situations. First, whenever a sample concentration reads above the highest calibration standard, it must be re-analyzed on a dilution. The analyst uses his or her scientific judgment to determine the proper dilution factor necessary to place the concentration within the mid-to-upper part of the calibration range. A dilution may also be performed on a sample to reduce matrix interferences. For an accurate and precise ICP or ICP-MS analysis, samples with a TDS greater than 2000 mg/L must be diluted appropriately so the TDS is below 2000 mg/L. This is a requirement of the EPA procedures for these methods.

Samples analyzed by GFAA must be retested on a dilution if the background is greater than 1.0 absorbance units which is usually caused by high levels of dissolved solids. Dilutions are kept to a minimum, and only one dilution needs to be performed in addition to the initial analysis. If a background effect is still evident, the analyst makes a note on the data review checklist at AREV, and the sample is flagged. All dilution factors must be documented on the bench sheet along with a comment addressing the reason the analyst performed the necessary dilution. This comment should be noted on the final report and/or the case narrative for the benefit of data validation by the end user (client).

For samples that require dilution because of high concentrations of analytes, it is imperative to never dilute the sample so that it reads below or near the lowest standard of the calibration range. If a result is near the low end of the calibration, it is considered an estimated value rather than a precise value. Analysts are required to retest any sample on a smaller dilution if the data to be reported indicates the analyte concentration is between the MDL and PQL, unless the dilution is justified by the analyst and the justification is documented on the bench sheet. The optimal dilution is for a concentration of the sample to read above the mid-point of the calibration curve. ACZ's policy is that if a sample requires dilution due to an overcal, the diluted concentration must be no less than half of the mid-point concentration. If a diluted sample reads below half the concentration of the mid-point concentration, then it must be re-analyzed on a smaller dilution. Any client sample analyzed with QC must have the same dilution factor as the QC sample(s).

16 ERROR CORRECTION PROTOCOL

The proper way to correct an error in logbooks, bench sheets or any raw data sheet must be uniform throughout the entire laboratory. There is only one way to correct an error –by marking a **single line** through the erroneous data and then initial and date the cross out in the nearest margin or open space. Under no circumstances should White-Out® or any other substance be used to conceal data. Concealing or altering data is considered fraudulent and illegal. Anyone who is caught creating fraudulent data may be immediately terminated from ACZ. The following is an example of proper error correction:

fleece BWC 10-20-94

Mary had a little lamb, it's ~~feet~~ as white as snow. And everywhere that Mary went, the lamb was ~~shur~~ to go.

BWC 10-20-94 sure

Each employee's signature and initials are maintained by the QA/QC Officer. This is to identify individuals making error corrections on raw data within the lab. This policy applies to all errors in logbooks, data sheets and any other laboratory documents.

17 COMPUTER/AUTOMATED PROCESSES VERIFICATION (GALP)

ACZ Laboratories, Inc. employs a Laboratory Information Management System (LIMS) to acquire, record, process, store and archive our data. The ACZ LIMS encompasses the combination of hardware and software throughout the laboratory. ACZ implements the defined standards of Good Automated Laboratory Practices (GALP) to establish a uniform set of procedures to assure that all LIMS data used by our clients are reliable, credible, and legally defensible. The LIMS is continuously upgraded, using the latest hardware and software available to maintain a state-of-the-art facility.

17.1 Software

The software ACZ uses to achieve GALP goals is a combination of industry standard commercial software and internally developed applications. Commercial software is only purchased through professional and well developed companies such as Oracle, Microsoft and Lab Vantage Systems. With this type of software, ACZ is assured the vendor has completed sufficient testing and quality control to assure that the product functions properly.

ACZ's Information System Department develops necessary internal programs, such as ACZ's proprietary LIMS2000 application. LIMS2000 is the primary application for all employees; it is the interface for tasks such as client reports, analytical bench sheets, data approval and historical data review. All internal applications undergo extensive testing before being implemented and distributed throughout the laboratory.

Instrument data is automatically backed up anytime a file is saved through a client-server process running on most instrument PCs. This ability allows ACZ to see any version of a file created or modified during data processing. Backups are routinely made and all data generated is written to CD or DVD to maintain a complete historical record.

17.2 Hardware

ACZ deploys many application servers using industry standard architecture. All critical servers are redundant so that one hardware failure will not cause a system failure. All servers run standard enterprise operating systems such as Microsoft Windows 2000, SCO Unix and SuSE Linux on a total of ten servers for file and print services, intranet, web hosting, several databases and the phone system.

All servers are routinely backed up to tape to maintain a complete historical record of all data generated.

All instrument computers comply with - at a minimum – the recommendations of the instrument manufacturer. All instrument PCs are on the ACZ network allowing transparent backup and access to computers by system administrators. On most instrument computers, in the event of a hardware failure, a "bare metal" restore of the computer can be done for a minimum of down time.

17.3 Security

GALP security within the laboratory is controlled through a set of passwords. Anyone trying to log onto the network needs a log-in name and password. User network passwords must be at least five characters and are required to be changed every 90 days. Once logging onto the network, one can only access general software and their own documents. Each user has a given set of rights and is restricted to software only necessary to complete their functions.

A very secure firewall protects the ACZ network from the outside world, or, Internet. The only traffic permitted access to the internal network is e-mail and World Wide Web access. Incoming and outgoing E-mail is scanned for viruses, then scanned for inappropriate content and quarantined if necessary. All web traffic that is potentially harmful is blocked by a scanning application running on a proxy server.

17.4 Electronic Database Deliverables

Custom and standard Electronic database deliverables (EDDs) are generated by the Reporting Department. These deliverables, containing data in client specified format are sent by e-mail with the client report EDDs and analytical reports access data from the same Oracle tables, thus eliminating the possibility of inconsistent results

18 SUBCONTRACTS

ACZ Laboratories, Inc. utilizes subcontract labs to perform analyses for various reasons. ACZ selects between a few specialty laboratories that can perform the work in a timely manner and produce quality data. Each subcontract lab is evaluated prior to shipping any samples. Their QA manual is reviewed and a current copy is kept with ACZ's QA/QC Officer. All laboratories must, at a minimum, adhere to the same quality assurance standards implemented by ACZ and must be NELAP certified for the subcontracted analysis. When it becomes necessary to subcontract analytical work, ACZ exercises the following control procedures:

- Clients are notified prior to sample delivery if any analyses have been requested that cannot be performed by ACZ Laboratories, Inc. We inform the client of our intention to subcontract those analyses and discuss our preference of subcontractors.

- If equipment failure or scheduling problems dictate the need to subcontract samples, the client is notified prior to the shipment of samples to the subcontractor.

- We verify all chain-of-custody records and sample information noting any discrepancies. All samples are logged into our computerized LIMS in accordance with the log-in procedures mentioned previously in this section. All samples, whether analyzed by ACZ or the subcontractor are given a unique ACZ LIMS number.

- The Shipping/Receiving Clerk prepares samples for shipping, attaching a copy of ACZ's Chain-of-Custody record. ACZ LIMS number, not the Client ID, identifies samples on the COC.

- ACZ Laboratories, Inc. receives an analytical report from the subcontracting laboratory, that is scanned as an attachment to be included as part of ACZ's final report. A comment is added to ACZ's final report indicating which subcontracted laboratory performed the analyses.

Refer to ACZ's SOP *Subcontracting of Analytical Work* (SOPAD031) for more detail.

19 DATA CONFIDENTIALITY

ACZ Laboratories, Inc. has an obligation to our clients to maintain custody of their samples, data, and reports. In order to uphold this responsibility, ACZ must retain the custody of data at all times. If the data leaves the premises physically, verbally, or electronically, ACZ loses control of this custody.

Data or any other client information collected at ACZ is not allowed to leave the premises. This includes Chain of Custody's, raw data, workgroups, run logs, reports, QC summaries, data packages and disks containing data. Of course this data can be given to the client as directed on the Chain of Custody.

Besides maintaining the custody of data, ACZ has a responsibility to keep all data confidential. Client data can not be released to anyone besides the client or the client's desginated representative. Project data, including the client information, is not to be discussed with anyone other than ACZ employees and the client. If a client wants ACZ to discuss data or have data sent to another company or individual, including government regulators or a person who already has a report in their possession, ACZ requires written confirmation by the client before communication commences.

With the rapid advances of computer and information technology, it is possible for an employee to work at home and access any electronic data and documents they could access while at ACZ. This scenario leads to tough questions and decisions in regards to letting people perform work at home. Accessing data from outside of ACZ compromises security, confidential and custody issues. For now, ACZ's policy on external computer access is that an employee will be allowed to check on the status of reports, workgroups, and instruments. Employees may access ACZ's network for internal, non-client related work. This does not include access to data or client reports.

ACZ has implemented the latest available technology to protect our network from malicious attacks. The bridge/router that connects our internal network to the Internet is protected by the latest implementation of a Linux firewall. Only SMTP (e-mail) and HTTP traffic are allowed between the ACZ network and the Internet. All "dangerous" attachments, such as executables, macros and VB scripts are blocked by Exchange server.

20 CUSTOMER SERVICE/CLIENT COMPLAINT POLICY

Handling client complaints is a joint effort between the QA/QC, Project Management, and Client Service departments. If a client has a concern or complaint, either a Project Manager or Client Service Representative takes the call and initiates the complaint procedure. The ACZ employee documents the complaint in ACZ's ACT! Database. If the ACZ employee who took the call cannot easily resolve the problem or complaint, a Client Complaint must be issued using Issue Wizard (see section 2.5 for more detail). The complaint is routed from the initiator to other appropriate parties, including the QA/QC Officer. All client complaints are submitted to upper management as part of the monthly QA/QC Report to Management and are taken into consideration during the annual Management Review of the Quality System.

APPENDIX A. Requirements for Containers, Preservation, Sample Volumes, and Holding Times

Parameter	Container [a]	Preservation [b,c]	Minimum Vol/Wt	Maximum Holding Time
Alkalinity	P, G	4°C	50mL	14 days
Common anions	P, G	None required	50mL	28 days: Br^-, F^-, Cl^-, SO_4^{-2} 48 hours: NO_3^-, NO_2^-, PO_4^{-3}
Cyanide, total and amenable to chlorination	P, G, T	4°C; NaOH to pH > 12, 0.6 g ascorbic acid	500mL/ 4 oz	14 days (water and soil)
Filterable residue	P, G	4°C	100mL	7 days
Non-filterable residue	P, G	4°C	100mL	7 days
(pH) – Water & Soil	P, G	None required	N/A	Analyze immediately
Nitrogen, NO_2, NO_3	P, G	4°C, H_2SO_4 to pH < 2	500mL	28 days if preserved; 48 hrs if unpreserved
Conductance	P, G	None required	N/A	Analyze immediately
Temperature	P, G	None required	N/A	Analyze immediately
Dissolved oxygen	G	None required	500mL	Analyze immediately
Turbidity	P, G	4°C	N/A	48 hours
Total organic carbon	P, G, T	4°C, HCl or H_2SO_4 to pH < 2	500mL/ 4 oz	28 days (water and soil)
Chromium (VI)	P, G, T	4°C	500mL/ 8 oz	24 hours (water and soil)[d]
Mercury (Hg)	P, G, T	HNO_3 to pH < 2, 4°C	500mL/ 8 oz	28 days (water and soil)
Metals (except Cr^{6+} and Hg)	P, G, T	HNO_3 to pH < 2, 4°C	500mL/ 8 oz	180 days (water and soil)

a. Polyethylene (P); glass (G); brass sleeves in the sample barrel, aka California brass (T).
b. No pH adjustment for soil.
c. Preservation with 0.008 percent $Na_2S_2O_3$ is only required when residual chlorine is present.
d. The maximum recommended holding time for completion of extraction into water is 48 hours. The extract shall be analyzed within 24 hours of completion of extraction.

APPENDIX A Continued

Parameter	Container [a]	Preservation [b,c]	Minimum Vol/Wt	Maximum Holding Time
Total petroleum hydrocarbons (TPH)-volatile – Water & Soil	G, Teflon-lined septum, T	4°C, HCl to pH < 2	2 x 40mL/ 4 oz	14 days from sampling 7 days if unpreserved
Total petroleum hydrocarbons (TPH)-extractable –Water	G, amber, T	4°C	1 liter/8 oz	7 days until extraction 40 days after extraction
Total petroleum hydrocarbons (TPH)-extractable – Soil	G, amber, T	4°C	1 liter/8 oz	14 days until extraction 40 days after extraction
Volatile Aromatics – Water & Soil	G, Teflon-lined septum, T	4°C, HCl to pH < 2, 0.008% $Na_2S_2O_3$	2 x 40mL/ 4 oz	14 days if preserved 7 days if unpreserved
Halogenated Volatiles –Water & Soil	G, Teflon-lined septum, T	4°C, HCl to pH < 2, 0.008% $Na_2S_2O_3$	2 x 40mL/ 4 oz	14 days if preserved 7 days if unpreserved
Nitrosamines – Water	G, Teflon-lined cap, T	4°C	1 liter/ 8 oz	7 days until extraction 40 days after extraction
Nitrosamines – Soil	G, Teflon-lined cap, T	4°C	1 liter/ 8 oz	14 days until extraction 40 days after extraction
Chlorinated Herbicides – Water	G, Teflon-lined cap, T	4°C, pH 5–9	1 liter/ 8 oz	7 days until extraction 40 days after extraction
Chlorinated Herbicides –Soil	G, Teflon-lined cap, T	4°C, pH 5–9	1 liter/ 8 oz	14 days until extraction 40 days after extraction

APPENDIX A Continued

Parameter	Container [a]	Preservation [b,c]	Minimum Vol/Wt	Maximum Holding Time
Organochlorine pesticides and polychlorinated biphenyls (PCBs) – Water	G, Teflon-lined cap, T	4°C, pH 5–9	1 liter/8 oz	7 days until extraction 40 days after extraction
Organochlorine pesticides and polychlorinated biphenyls (PCBs) – Soil	G, Teflon-lined cap, T	4°C, pH 5–9	1 liter/8 oz	14 days until extraction 40 days after extraction
Organophosphorus pesticides/ compounds –Water	G, Teflon-lined cap, T	4°C, pH 5–9	1 liter/ 8 oz	7 days until extraction 40 days after extraction
Organophosphorus pesticides/ compounds –Soil	G, Teflon-lined cap, T	4°C, pH 5–9	1 liter/ 8 oz	14 days until extraction 40 days after extraction
Volatile Organics – Water & Soil	G, Teflon-lined septum, T	4°C, 0.008% $Na_2S_2O_3$ (HCl to pH < 2 for SW8260)[b]	2 x 40mL/ 4 oz	14 days w/ preservation 7 days if unpreserved
Polynuclear aromatic hydrocarbons (PAH's) –Water	G, Teflon-lined cap, T	4°C (dark), 0.008% $Na_2S_2O_3$	1 liter/ 8 oz	7 days until extraction 40 days after extraction
Polynuclear aromatic hydrocarbons (PAH's) –Soil	G, Teflon-lined cap, T	4°C (dark), 0.008% $Na_2S_2O_3$	1 liter/ 8 oz	14 days until extraction 40 days after extraction

APPENDIX A Concluded

Parameter	Container [a]	Preservation [b,c]	Minimum Vol/Wt	Maximum Holding Time
Semi-volatile Organics –Water	G, Teflon-lined cap, T	4°C 0.008% $Na_2S_2O_3$	1 liter/ 8 oz	7 days until extraction 40 days after extraction
Semi-volatile Organics –Soil	G, Teflon-lined cap, T	4°C 0.008% $Na_2S_2O_3$	1 liter/ 8 oz	14 days until extraction 40 days after extraction
Dioxins and Furans –Water & Soil	G, Teflon-lined cap, T	4°C (dark), 0.008% $Na_2S_2O_3$	1 liter/ 8 oz	30 days until extraction 45 days after extraction
Ethylene dibromide (EDB)	G, Teflon-lined cap, T	4°C 0.008% $Na_2S_2O_3$	2 x 40mL	28 days (water)
Explosive residues	P, G, T	Cool, 4°C	1 liter/ 8 oz	7 days to extraction; analyze-w/in 40 days after extraction
Explosive residues	P, G, T	Cool, 4°C	1 liter/ 8 oz	14 days to extraction; then analyze w/in 40 days
TCLP –Volatiles	G, Teflon-lined cap, T	Cool, 4°C	1 liter/ 8 oz	14 days to TCLP extraction 14 days after extraction
TCLP –Semi Volatiles	G, Teflon-lined cap, T	Cool, 4°C	1 liter/ 8 oz	14 days to TCLP extraction, 7 days to prep extraction 40 days after prep extraction
TCLP –Mercury	G, Teflon-lined cap, T	Cool, 4°C	1 liter/ 8 oz	28 days to TCLP extraction 28 days after extraction
TCLP –Metals	G, Teflon-lined cap, T	Cool, 4°C	1 liter/ 8 oz	180 days to TCLP extraction and 180 days after extraction
Volatile Organics	SUMMA® canister	None		

APPENDIX B CURRENT NELAP CERTIFICATE AND FIELDS OF TESTING (FOTS)

STATE OF CALIFORNIA
DEPARTMENT OF HEALTH SERVICES

NATIONAL ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

ACCREDITATION

Is hereby granted to

ACZ LABORATORIES, INC.

2773 DOWNHILL DRIVE

STEAMBOAT SPRINGS, CO 80487

Scope of accreditation is limited to the "NELAP Accredited Fields of Testing" which accompanies this Certificate.

Continued accredited status depends on successful ongoing participation in the program.

This Certificate is granted in accordance with provisions of Section 100825, et seq. of the Health and Safety Code.

Certificate No: 02111CA
Expiration Date: 04/30/2003
Effective Date: 04/01/2002

Berkeley, California
subject to forfeiture or revocation.

George C. Kulasingam, Ph.D.
Program Chief
Environmental Laboratory Accreditation Program

CALIFORNIA DEPARTMENT OF HEALTH SERVICES
ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM
NELAP Accredited Fields of Testing

ACZ LABORATORIES, INC.
2773 DOWNHILL DRIVE
STEAMBOAT SPRINGS, CO 80487

Lab Phone (970) 879-6590

Certificate No: 02111CA Renew Date: 04/30/2003

Field of Testing:	106 - Radiochemistry of Drinking Water		
106.010	001	EPA 900.0	Gross Alpha
106.010	002	EPA 900.0	Gross Beta
106.030	001	EPA 901.1	Radioactive Cesium
106.030	002	EPA 901.1	Radioactive Iodine
106.030	003	EPA 901.1	Gamma Emitters
106.050	001	EPA 903.0	Total Alpha Radium
106.050	002	EPA 903.0	Radium-226
106.051	001	EPA 903.1	Radium-226
106.060	001	EPA 904.0	Radium-228
106.600	001	EPA 913	Radon-222

Field of Testing:	108 - Inorganic Chemistry of Wastewater		
108.020	001	EPA 120.1	Conductivity
108.050	001	EPA 150.1	pH
108.060	001	EPA 160.1	Residue, Filterable
108.070	001	EPA 160.2	Residue, Non-filterable
108.080	001	EPA 160.3	Residue, Total
108.090	001	EPA 160.4	Residue, Volatile
108.100	001	EPA 160.5	Residue, Settleable
108.110	001	EPA 180.1	Turbidity
108.120	001	EPA 300.0	Bromide
108.120	002	EPA 300.0	Chloride
108.120	003	EPA 300.0	Fluoride
108.120	004	EPA 300.0	Nitrate
108.120	005	EPA 300.0	Nitrite
108.120	006	EPA 300.0	Nitrate-nitrite, Total
108.120	007	EPA 300.0	Phosphate, Ortho
108.120	008	EPA 300.0	Sulfate
108.130	001	EPA 305.1	Acidity
108.140	001	EPA 310.1	Alkalinity
108.161	001	EPA 325.2	Chloride
108.183	001	EPA 335.2	Cyanide, Total
108.191	001	EPA 340.2	Fluoride
108.200	001	EPA 350.1	Ammonia
108.211	001	EPA 351.2	Kjeldahl Nitrogen
108.231	001	EPA 353.2	Nitrate calc.
108.232	001	EPA 353.2	Nitrate-nitrite, Total
108.233	001	EPA 353.2	Nitrite
108.260	001	EPA 365.1	Phosphate, Ortho
108.261	001	EPA 365.1	Phosphorus, Total
108.281	001	EPA 375.3	Sulfate
108.282	001	EPA 375.4	Sulfate
108.291	001	EPA 376.2	Sulfide

As of 09/20/2002, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

Page 1 of 4

ACZ LABORATORIES, INC.

Certificate No: 02111CA
Renew Date: 04/30/2003

108.310	001	EPA 405.1	Biochemical Oxygen Demand
108.323	001	EPA 410.4	Chemical Oxygen Demand
108.340	001	EPA 415.1	Total Organic Carbon
108.361	001	EPA 420.2	Phenols, Total
108.380	001	EPA 1664	Oil and Grease
108.410	001	SM2320B	Alkalinity

Field of Testing: 109 - Toxic Chemical Elements of Wastewater

109.010	001	EPA 200.7	Aluminum
109.010	002	EPA 200.7	Antimony
109.010	003	EPA 200.7	Arsenic
109.010	004	EPA 200.7	Barium
109.010	005	EPA 200.7	Beryllium
109.010	006	EPA 200.7	Boron
109.010	007	EPA 200.7	Cadmium
109.010	008	EPA 200.7	Calcium
109.010	009	EPA 200.7	Chromium
109.010	010	EPA 200.7	Cobalt
109.010	011	EPA 200.7	Copper
109.010	012	EPA 200.7	Iron
109.010	013	EPA 200.7	Lead
109.010	014	EPA 200.7	Magnesium
109.010	015	EPA 200.7	Manganese
109.010	016	EPA 200.7	Molybdenum
109.010	017	EPA 200.7	Nickel
109.010	018	EPA 200.7	Potassium
109.010	019	EPA 200.7	Selenium
109.010	020	EPA 200.7	Silica
109.010	021	EPA 200.7	Silver
109.010	022	EPA 200.7	Sodium
109.010	023	EPA 200.7	Thallium
109.010	025	EPA 200.7	Titanium
109.010	026	EPA 200.7	Vanadium
109.010	027	EPA 200.7	Zinc
109.020	001	EPA 200.8	Aluminum
109.020	002	EPA 200.8	Antimony
109.020	003	EPA 200.8	Arsenic
109.020	004	EPA 200.8	Barium
109.020	005	EPA 200.8	Beryllium
109.020	006	EPA 200.8	Cadmium
109.020	007	EPA 200.8	Chromium
109.020	008	EPA 200.8	Cobalt
109.020	009	EPA 200.8	Copper
109.020	010	EPA 200.8	Lead
109.020	011	EPA 200.8	Manganese
109.020	012	EPA 200.8	Molybdenum
109.020	013	EPA 200.8	Nickel
109.020	014	EPA 200.8	Selenium
109.020	015	EPA 200.8	Silver
109.020	016	EPA 200.8	Thallium
109.020	017	EPA 200.8	Vanadium
109.020	018	EPA 200.8	Zinc

As of 09/20/2002, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

Page 2 of 4

ACZ LABORATORIES, INC.

Certificate No: 02111CA
Renew Date: 04/30/2003

109.041	001	EPA 204.2	Antimony
109.050	001	EPA 206.2	Arsenic
109.071	001	EPA 210.2	Beryllium
109.081	001	EPA 213.2	Cadmium
109.101	001	EPA 218.2	Chromium
109.121	001	EPA 220.2	Copper
109.161	001	EPA 239.2	Lead
109.190	001	EPA 245.1	Mercury
109.291	001	EPA 272.2	Silver
109.311	001	EPA 279.2	Thallium
109.420	002	SM3114B	Selenium
Field of Testing:	112 - Radiochemistry of Wastewater		
112.010	001	EPA 900.0	Gross Alpha
112.010	002	EPA 900.0	Gross Beta
112.020	001	EPA 903.0	Total Alpha Radium
112.021	001	EPA 903.1	Radium-226
112.030	001	SM7110B	Gross Alpha
112.030	002	SM7110B	Gross Beta
112.040	001	SM7500-Ra B	Total Alpha Radium
112.050	001	SM7500-Ra C	Radium-226
112.140	002	EPA 901.1	Gamma
112.160	001	EPA 904.0	Radium-228
112.210	001	EPA Ra-05	Radium-228
Field of Testing:	114 - Inorganic Chemistry of Hazardous Waste		
114.010	001	EPA 6010B	Antimony
114.010	002	EPA 6010B	Arsenic
114.010	003	EPA 6010B	Barium
114.010	004	EPA 6010B	Beryllium
114.010	005	EPA 6010B	Cadmium
114.010	006	EPA 6010B	Chromium
114.010	007	EPA 6010B	Cobalt
114.010	008	EPA 6010B	Copper
114.010	009	EPA 6010B	Lead
114.010	010	EPA 6010B	Molybdenum
114.010	011	EPA 6010B	Nickel
114.010	012	EPA 6010B	Selenium
114.010	013	EPA 6010B	Silver
114.010	014	EPA 6010B	Thallium
114.010	015	EPA 6010B	Vanadium
114.010	016	EPA 6010B	Zinc
114.020	001	EPA 6020	Antimony
114.020	002	EPA 6020	Arsenic
114.020	003	EPA 6020	Barium
114.020	004	EPA 6020	Beryllium
114.020	005	EPA 6020	Cadmium
114.020	006	EPA 6020	Chromium
114.020	007	EPA 6020	Cobalt
114.020	008	EPA 6020	Copper
114.020	009	EPA 6020	Lead
114.020	010	EPA 6020	Molybdenum
114.020	011	EPA 6020	Nickel

As of 09/20/2002, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

Page 3 of 4

ACZ LABORATORIES, INC.

Certificate No: 02111CA
Renew Date: 04/30/2003

114.020	012	EPA 6020	Selenium
114.020	013	EPA 6020	Silver
114.020	014	EPA 6020	Thallium
114.020	015	EPA 6020	Vanadium
114.020	016	EPA 6020	Zinc
114.031	001	EPA 7041	Antimony
114.041	001	EPA 7061A	Arsenic
114.071	001	EPA 7091	Beryllium
114.081	001	EPA 7131A	Cadmium
114.091	001	EPA 7191	Chromium
114.103	001	EPA 7196A	Chromium (VI)
114.111	001	EPA 7201	Cobalt
114.121	001	EPA 7211	Copper
114.131	001	EPA 7421	Lead
114.140	001	EPA 7470A	Mercury
114.141	001	EPA 7471A	Mercury
114.171	001	EPA 7741A	Selenium
114.181	001	EPA 7761	Silver
114.191	001	EPA 7841	Thallium
114.220	001	EPA 9010	Cyanide, Total
114.221	001	EPA 9012A	Cyanide, Total
114.240	001	EPA 9040	pH
114.241	001	EPA 9045	pH
114.291	001	EPA 340.2	Fluoride
Field of Testing:		115 - Extraction Test of Hazardous Waste	
115.020	001	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
115.030	001	CCR Chapter11, Article 5, Appendix II	Waste Extraction Test (WET)
Field of Testing:		118 - Radiochemistry of Hazardous Waste	
118.010	001	EPA 9310	Gross Alpha
118.010	002	EPA 9310	Gross Beta
118.020	001	EPA 9315	Radium, Total
118.030	001	EPA 9320	Radium-228
118.080	001	EPA 901.1	Gamma
118.150	001	EPA Ra-05	Radium-228
Field of Testing:		120 - Physical Properties of Hazardous Waste	
120.010	001	EPA 1010	Ignitability
120.040	001	Section 7.3 SW-846	Reactive Cyanide
120.050	001	Section 7.3 SW-846	Reactive Sulfide
120.080	001	EPA 9045C	Corrosivity - pH Determination

As of 09/20/2002, this list supersedes all previous lists for this certificate number.
Customers: Please verify the current accreditation standing with the State.

Page 4 of 4

APPENDIX C CURRENT AZ LICENSE

Arizona Department of Health Services

ENVIRONMENTAL LABORATORY LICENSE

Issued to:

Laboratory Director: Ralph V. Poulsen
Owner/Representative: Les Liman

ACZ LABORATORIES, INC.

AZ0102

is in compliance with Environmental Laboratory's applicable standards for the State of Arizona and maintains on file a List of Parameters for which the laboratory is certified to perform analysis.

PERIOD OF LICENSURE FROM: 06/03/2002 TO 06/02/2003

GREAT SEAL OF THE STATE OF ARIZONA 1912

Steven D. Baker, Chief
Office of Laboratory Licensure,
Certification & Training

03/19/03 10:43 ☎ 002

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
1740 West Adams, Rm. 203 N., Phoenix, AZ 85007
Wednesday, March 19 2003

Page: 1

AZ License: AZ0102
Lab Director: Mr. Ralph V. Poulsen

Lab Name: ACZ LABORATORIES, INC.
Phone: (970) 879-6590
Fax: (970) 879-2216

Program HW

Parameter	EPA Method	Billing Code	Entry Date
Alpha-Emitting Radium Isotopes	EPA 9315	RADIO	09/23/97
Aluminum	EPA 6010B	MTL3	06/03/98
Antimony	EPA 6010B	MTL3	05/09/02
Antimony	EPA 6020	MTL7	02/24/97
Antimony	EPA 7041	MTL2	05/01/92
Arsenic	EPA 6010B	MTL3	05/09/02
Arsenic	EPA 6020	MTL7	02/24/97
Arsenic	EPA 7060A	MTL2	09/23/97
Arsenic	EPA 7061A	MTL6	05/01/92
Barium	EPA 6010B	MTL3	06/03/98
Barium	EPA 6020	MTL7	02/24/97
Beryllium	EPA 6010B	MTL3	05/01/92
Beryllium	EPA 6020	MTL7	02/24/97
Beryllium	EPA 7091	MTL2	05/09/02
Cadmium	EPA 6010B	MTL3	06/03/98
Cadmium	EPA 6020	MTL7	02/24/97
Cadmium	EPA 7131A	MTL2	07/11/01
Calcium	EPA 6010B	MTL3	06/03/98
Chromium Total	EPA 6010B	MTL3	06/03/98
Chromium Total	EPA 6020	MTL7	02/24/97
Chromium Total	EPA 7191	MTL2	05/09/02
Cobalt	EPA 6010B	MTL3	06/03/98
Cobalt	EPA 6020	MTL7	02/24/97
Cobalt	EPA 7201	MTL2	05/09/02
Continuous Liquid-Liquid Extraction	EPA 3520C	*	05/09/02
Copper	EPA 6010B	MTL3	06/03/98
Copper	EPA 6020	MTL7	02/24/97
Copper	EPA 7211	MTL2	07/11/01
Corrosivity Ph Determination	EPA 9040B	NIA6	06/03/98
Dissolved In Water	EPA 3005A	*	05/09/02
Funnel Liquid-Liquid Extraction	EPA 3510C	*	05/09/02
Gross Alpha And Beta	EPA 9310	RADIO	09/23/97
Ignitability (Flash Point)	EPA 1010	HAZ2	05/25/94
Iron	EPA 6010B	MTL3	06/03/98
Lead	EPA 6010B	MTL3	06/03/98
Lead	EPA 6020	MTL7	02/24/97
Lead	EPA 7421	MTL2	07/11/01
Lithium	EPA 6010B	MTL3	06/26/02
Magnesium	EPA 6010B	MTL3	06/03/98

03/19/03 10:43 ☎ 003

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
1740 West Adams, Rm. 203 N., Phoenix, AZ 85007
Wednesday, March 19 2003

Page: 2

AZ License: AZ0102

Lab Name: ACZ LABORATORIES, INC.

Program HW

Parameter	EPA Method	Billing Code	Entry Date
Manganese	EPA 6010B	MTL3	06/03/98
Manganese	EPA 6020	MTL7	02/24/97
Mercury	EPA 7470A	MTL3	06/02/97
Mercury	EPA 7471A	MTL3	05/01/92
Microwave Assisted Digestions	EPA 3015	*	05/09/02
Microwave Assisted Digestions	EPA 3051	*	05/09/02
Molybdenum	EPA 6010B	MTL3	06/03/98
Nickel	EPA 6010B	MTL3	05/01/92
Nickel	EPA 6020	MTL7	02/24/97
Nickel	EPA 7521	MTL2	05/09/02
Nonhalogenated Volatile Organics	EPA 8015B	VOC3	05/09/02
Oil And Grease	EPA 9071A	MISC6	05/09/02
Organochlorine Pesticides	EPA 8081A	SOC9	06/03/98
Paint Filter Liquids Test	EPA 9095A	MISC24	05/09/02
Potassium	EPA 6010B	MTL3	06/03/98
Preparation And Extraction	EPA 3500B	*	05/09/02
Purge And Trap	EPA 5030B	*	05/09/02
Radium 228	EPA 9320	RADIO	06/26/02
Reactivity	REACTIVITY	HAZ3	05/25/94
Sediments, Sludges And Soils	EPA 3050B	*	05/09/02
Selenium	EPA 6010B	MTL3	05/09/02
Selenium	EPA 7740	MTL2	07/11/01
Selenium	EPA 7742	MTL6	09/23/97
Semivolatile Organics	EPA 8270C	SOC16	06/03/98
Silver	EPA 6010B	MTL3	06/03/98
Silver	EPA 6020	MTL7	02/24/97
Silver	EPA 7761	MTL2	07/11/01
Sodium	EPA 6010B	MTL3	06/03/98
Sonication Extraction	EPA 3550B	*	05/09/02
Soxhlet Extraction	EPA 3540C	*	05/09/02
Strontium	EPA 6010B	MTL3	05/09/02
Synthetic Precipitation Leaching Procedure (Splp)	EPA 1312	HAZ6	02/15/96
Thallium	EPA 6010B	MTL3	06/26/02
Thallium	EPA 6020	MTL7	02/24/97
Thallium	EPA 7841	MTL2	05/01/92
Tin	EPA 6010B	MTL3	06/03/98
Total Metals	EPA 3010A	*	05/09/02
Total Metals	EPA 3020A	*	05/09/02
Total Recoverable In Water	EPA 3005A	*	05/09/02
Toxicity Characteristics Leaching Procedure	EPA 1311	HAZ5	05/01/92
Vanadium	EPA 6010B	MTL3	06/03/98

03/19/03 10:44 ☎ 004

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
1740 West Adams, Rm. 203 N., Phoenix, AZ 85007
Wednesday, March 19 2003

Page: 3

AZ License: AZ0102

Lab Name: ACZ LABORATORIES, INC.

Program HW

Parameter	EPA Method	Billing Code	Entry Date
Volatile Organics	EPA 8021B	VOC1	01/15/03
Volatile Organics	EPA 8260B	VOC8	06/03/98
Zinc	EPA 6010B	MTL3	06/03/98
Zinc	EPA 6020	MTL7	02/24/97

Total Licensed Parameters in this Program: 84

Program SDW

Parameter	EPA Method	Billing Code	Entry Date
Cyanide	EPA 335.4	MISC7	06/26/02
Nitrite	EPA 353.2	NIIB4	06/26/02

Total Licensed Parameters in this Program: 2

Program WW

Parameter	EPA Method	Billing Code	Entry Date
Acidity	SM 2310B	NIIA1	06/26/02
Alkalinity, Total	SM 2320B	NIA1	06/26/02
Aluminum	EPA 200.7	MTL3	10/16/95
Ammonia	EPA 350.1	NIIB1	05/01/92
Antimony	EPA 200.7	MTL3	05/09/02
Antimony	EPA 200.8	MTL7	02/24/97
Antimony	EPA 204.2	MTL2	10/16/95
Arsenic	EPA 200.7	MTL3	05/09/02
Arsenic	EPA 200.8	MTL7	02/24/97
Arsenic	EPA 206.2	MTL2	10/16/95
Barium	EPA 200.7	MTL3	10/16/95
Barium	EPA 200.8	MTL7	02/24/97
Beryllium	EPA 200.7	MTL3	10/16/95
Beryllium	EPA 200.8	MTL7	02/24/97
Beryllium	EPA 210.2	MTL2	05/09/02
Biochemical Oxygen Demand	EPA 405.1	DEM1	05/25/94
Boron	EPA 200.7	MTL3	05/01/92
Bromide	EPA 300.0	NIIIA1	09/27/01
Cadmium	EPA 200.7	MTL3	10/16/95
Cadmium	EPA 200.8	MTL7	02/24/97
Cadmium	EPA 213.2	MTL2	07/11/01
Calcium	EPA 200.7	MTL3	05/25/94
Chemical Oxygen Demand	EPA 410.4	DEM2	05/01/92
Chloride	EPA 300.0	NIIIA1	05/25/94
Chloride	EPA 325.2	NIA2	09/18/96
Chromium Total	EPA 200.7	MTL3	10/16/95
Chromium Total	EPA 200.8	MTL7	02/24/97

03/19/03 10:44 ☎ 005

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
1740 West Adams, Rm. 203 N., Phoenix, AZ 85007
Wednesday, March 19 2003

Page: 4

AZ License: AZ0102

Lab Name: ACZ LABORATORIES, INC.

Program WW

Parameter	EPA Method	Billing Code	Entry Date
Chromium Total	EPA 218.2	MTL2	05/09/02
Chromium, Hexavalent	SM 3500-CR D	MTL4	05/09/02
Cobalt	EPA 200.7	MTL3	10/16/95
Cobalt	EPA 200.8	MTL7	02/24/97
Cobalt	EPA 219.2	MTL2	07/11/01
Color	EPA 110.1	NIA4	05/01/92
Copper	EPA 200.7	MTL3	10/16/95
Copper	EPA 200.8	MTL7	02/24/97
Copper	EPA 220.2	MTL2	07/11/01
Fluoride	EPA 300.0	NIIIA1	05/09/02
Fluoride	SM 4500-F B	NIB3	05/09/02
Fluoride	SM 4500-F C	NIB3	05/09/02
Hardness	SM 2340B	NIA5	05/09/02
Hydrogen Ion (Ph)	EPA 150.1	NIA6	05/01/92
Iron	EPA 200.7	MTL3	10/16/95
Kjeldahl Nitrogen	EPA 351.2	NIIB3	05/09/02
Lead	EPA 200.7	MTL3	10/16/95
Lead	EPA 200.8	MTL7	02/24/97
Lead	EPA 239.2	MTL2	10/16/95
Magnesium	EPA 200.7	MTL3	05/25/94
Manganese	EPA 200.7	MTL3	10/16/95
Manganese	EPA 200.8	MTL7	02/24/97
Mercury	EPA 245.1	MTL5	10/16/95
Molybdenum	EPA 200.7	MTL3	10/16/95
Molybdenum	EPA 200.8	MTL7	02/24/97
Nickel	EPA 200.7	MTL3	10/16/95
Nickel	EPA 200.8	MTL7	02/24/97
Nickel	EPA 249.2	MTL2	07/11/01
Nitrate	EPA 300.0	NIIIA1	05/09/02
Nitrate	EPA 353.2	NIB1	05/01/92
Nitrite	EPA 300.0	NIIIA1	05/09/02
Oil And Grease	EPA 1664A	MISC6	05/09/02
Organic Carbon, Total	EPA 415.1	MISC1	07/19/94
Ortho-Phosphate	EPA 300.0	NIIIA1	05/09/02
Ortho-Phosphate	EPA 365.1	NIIB5	05/01/92
Phenols	EPA 420.2	MISC8	05/09/02
Phosphorus Total	EPA 365.1	NIIB6	05/01/92
Potassium	EPA 200.7	MTL3	05/25/94
Radium 226	RADIUM 226	RADIO	06/05/97
Residue Filterable	EPA 160.1	NIIA5	05/01/92
Residue Nonfilterable	EPA 160.2	NIIA6	05/01/92

03/19/03 10:45 ☎ 006

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
1740 West Adams, Rm. 203 N., Phoenix, AZ 85007
Wednesday, March 19 2003

Page: 5

AZ License: AZ0102

Lab Name: ACZ LABORATORIES, INC.

Program WW

Parameter	EPA Method	Billing Code	Entry Date
Residue Volatile	EPA 160.4	NIIA7	05/01/92
Residue, Settleable Solids	EPA 160.5	NIIA6	05/01/92
Selenium	EPA 200.7	MTL3	05/09/02
Selenium	EPA 200.8	MTL7	02/24/97
Selenium	EPA 270.2	MTL2	07/11/01
Selenium	SM 3114B	MTL6	05/09/02
Silica, Dissolved	EPA 200.7	MTL3	05/01/92
Silver	EPA 200.7	MTL3	10/16/95
Silver	EPA 200.8	MTL7	02/24/97
Silver	EPA 272.2	MTL2	07/11/01
Sodium	EPA 200.7	MTL3	05/25/94
Specific Conductance	EPA 120.1	NIA7	05/01/92
Strontium	EPA 200.7	MTL3	05/09/02
Sulfate	EPA 300.0	NIIIA1	05/25/94
Sulfate	EPA 375.3	NIB2	09/23/97
Sulfate	EPA 375.4	NIB2	11/15/95
Sulfide	EPA 376.2	MISC11	05/09/02
Thallium	EPA 200.7	MTL3	05/09/02
Thallium	EPA 200.8	MTL7	02/24/97
Thallium	EPA 279.2	MTL2	10/16/95
Tin	EPA 200.7	MTL3	05/09/02
Turbidity	EPA 180.1	NIA9	05/01/92
Uranium	EPA 200.8	MTL7	02/24/97
Vanadium	EPA 200.7	MTL3	10/16/95
Vanadium	EPA 200.8	MTL7	02/24/97
Zinc	EPA 200.7	MTL3	10/16/95
Zinc	EPA 200.8	MTL7	02/24/97

Total Licensed Parameters in this Program: 95

Instruments	Quantity	Date
GAS CHROMATOGRAPH	4	05/25/94
ATOMIC ABSORPTION SPECTROPHOTOMETER	4	05/09/02
GAS CHROMATOGRAPH/MASS SPECTROMETER	3	05/09/02
ATOMIC ABSORPTION SPECTROPHOTOMETER	2	05/01/92
RADIATION COUNTING INSTRUMENT	2	07/11/01
INDUCTIVELY COUPLED PLASMA SPECTROMETER	2	05/09/02
ION CHROMATOGRAPH	1	05/25/94
INDUCTIVELY COUPLED PLASMA SPECTROMETER	1	05/01/92
MERCURY ANALYZER	1	05/09/02
INDUCTIVELY COUPLED PLASMA/MASS SPECTROMETER	1	07/11/01

03/19/03 10:45 ☎ 007

Arizona Department of Health Services
Office of Laboratory Licensure, Certification & Training
1740 West Adams, Rm. 203 N., Phoenix, AZ 85007
Wednesday, March 19 2003

Page: 6

AZ License: AZ0102

Lab Name: ACZ LABORATORIES, INC.

Softwares
ENVIRONQUANT - GC
ENVIRONQUANT - GCMS

APPENDIX D CURRENT DATA QUALIFIERS

METHOD	CODE	DESCR
Microbiology	A1	Too numerous to count.
Microbiology	A2	Sample incubation period exceeded method requirement.
Microbiology	A3	Sample incubation period was shorter than method requirement.
Microbiology	A4	Target organism detected in associated method blank.
Microbiology	A5	Incubator/water bath temperature was outside method requirements.
Microbiology	A6	Target organism not detected in associated positive control.
Microbiology	A7	Micro sample received without adequate headspace.
Method blank	B1	Target analyte detected in method blank at or above the method reporting limit.
Method blank	B2	Non-target analyte detected in method blank and sample, producing interference.
Method blank	B3	Target analyte detected in calibration blank at or above the method reporting limit.
Method blank	B4	Target analyte detected in blank at/above method acceptance criteria.
Method blank	B5	Target analyte detected in method blank at or above the method reporting limit, but below trigger level or MCL.
Method blank	B6	Target analyte detected in calibration blank at or above the method reporting limit, but below trigger level or MCL.
Method blank	B7	Target analyte detected in method blank at or above method reporting limit. Concentration found in the sample was 10 times above the concentration found in the method blank.
Method blank	BA	Target analyte detected in method blank at or above method reporting limit. Concentration found in the sample was 20 times above the concentration found in the method blank.
Method blank	BB	Target analyte detected in calibration blank at or above method reporting limit. Concentration found in the sample was 10 times above the concentration found in the calibration blank.
Method blank	BC	Target analyte detected in calibration blank at or above method reporting limit. Concentration found in the sample was 20 times above the concentration found in the calibration blank.
Confirmation	C1	Confirmatory analysis not performed as required by the method.
Confirmation	C2	Confirmatory analysis not performed. Confirmation of analyte presence established by site historical data.
Confirmation	C3	Qualitative confirmation performed. See case narrative.
Confirmation	C4	Confirmatory analysis was past holding time.
Confirmation	C5	Confirmatory analysis was past holding time. Original result not confirmed.
Dilution	D1	Sample required dilution due to matrix interference. See case narrative.
Dilution	D2	Sample required dilution due to high concentration of target analyte.
Dilution	D3	Sample dilution required due to insufficient sample.
Dilution	D4	Minimum reporting level (MRL) adjusted to reflect sample amount received and analyzed.
Dilution	DA	Sample required dilution because it was reactive.
Dilution	DB	Sample required dilution due to low bias result.
Estimated concentration	E1	Concentration estimated. Analyte exceeded calibration range. Reanalysis not possible due to insufficient sample.
Estimated concentration	E2	Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to sample matrix.
Estimated concentration	E3	Concentration estimated. Analyte exceeded calibration range. Reanalysis not performed due to holding time requirements.
Estimated concentration	E4	Concentration estimated. Analyte was detected below laboratory minimum reporting level (MRL).

Estimated concentration	E5	Concentration estimated. Analyte was detected below laboratory minimum reporting level (MRL), but not confirmed by alternate analysis.
Estimated concentration	E6	Concentration estimated. Internal standard recoveries did not meet method acceptance criteria.
Estimated concentration	E7	Concentration estimated. Internal standard recoveries did not meet laboratory acceptance criteria.
Estimated concentration	EA	Concentration estimated. Analytical result was greater than the negative MDL due to matrix interferences.
Hold time	H1	Sample analysis performed past holding time. See case narrative.
Hold time	H2	Initial analysis within holding time. Reanalysis for the required dilution was past holding time.
Hold time	H3	Sample was received and analyzed past holding time.
Hold time	H4	Sample was extracted past required extraction holding time, but analyzed within analysis holding time. See case narrative.
Hold time	HA	Sample was prepped within holding time and analyzed outside of holding time.
BOD	K1	The sample dilutions set-up for the BOD analysis did not meet the oxygen depletion criteria of at least 2 mg/L. Any reported result is an estimated value.
BOD	K2	The sample dilutions set up for the BOD analysis did not meet the criteria of a residual dissolved oxygen of at least 1 mg/L. Any reported result is an estimated value.
BOD	K3	The seed depletion was outside the method acceptance limits.
BOD	K4	The seed depletion was outside the method and laboratory acceptance limits. The reported result is an estimated value.
BOD	K5	The dilution water D.O. depletion was > 0.2 mg/L.
BOD	K6	Glucose/glutamic acid BOD was below method acceptance criteria.
BOD	K7	A discrepancy between the BOD and COD results has been verified by reanalysis of the sample for COD.
BOD	K8	Glucose/glutamic acid BOD was above method acceptance levels.
Laboratory fortified blank/blank spike	L1	The associated blank spike recovery was above laboratory acceptance limits. See case narrative.
Laboratory fortified blank/blank spike	L2	The associated blank spike recovery was below laboratory acceptance limits. See case narrative.
Laboratory fortified blank/blank spike	L3	The associated blank spike recovery was above method acceptance limits. See case narrative.
Laboratory fortified blank/blank spike	L4	The associated blank spike recovery was below method acceptance limits. See case narrative.
Matrix spike	M1	Matrix spike recovery was high, the method control sample recovery was acceptable.
Matrix spike	M2	Matrix spike recovery was low, the method control sample recovery was acceptable.
Matrix spike	M3	The accuracy of the spike recovery value is reduced since the analyte concentration in the sample is disproportionate to spike level. The method control sample recovery was acceptable.
Matrix spike	M4	The analysis of the spiked sample required a dilution such that the spike concentration was diluted below the reporting limit. The method control sample recovery was acceptable.
Matrix spike	M5	Analyte concentration was determined by the method of standard addition (MSA).
Matrix spike	M6	Matrix spike recovery was high. Data reported per ADEQ policy 0154.000.
Matrix spike	M7	Matrix spike recovery was low. Data reported per ADEQ policy 0154.000.
Matrix spike	MA	One spike recovery was outside of the method limits; the duplicate spike and the method control recoveries were within the method limits.
General	N1	See case narrative.
General	N2	See corrective action report.
General	NA	Unable to perform analysis. See case narrative.
General	NB	Unable to perform analysis due to insufficient sample. See case narrative.

Sample quality	Q1	Sample integrity was not maintained. See case narrative.
Sample quality	Q10	Sample received in inappropriate sample container.
Sample quality	Q11	Sample is heterogeneous. Sample homogeneity could not be readily achieved using routine laboratory practices.
Sample quality	Q2	Sample received with head space.
Sample quality	Q3	Sample received with improper chemical preservation.
Sample quality	Q4	Sample received and analyzed without chemical preservation.
Sample quality	Q5	Sample received with inadequate chemical preservation, but preserved by the laboratory.
Sample quality	Q6	Sample was received above recommended temperature.
Sample quality	Q7	Sample inadequately dechlorinated.
Sample quality	Q8	Insufficient sample received to meet method QC requirements. QC requirements satisfy ADEQ policies 0154 and 0155.
Sample quality	Q9	Insufficient sample received to meet method QC requirements.
Duplicates	R1	RPD exceeded the method control limit. See case narrative.
Duplicates	R2	RPD exceeded the laboratory control limit. See case narrative.
Duplicates	R3	Sample RPD between the primary and confirmatory analysis exceeded 40%. Per EPA Method 8000B, the higher value was reported.
Duplicates	R4	MS/MSD RPD exceeded the method control limit. Recovery met acceptance criteria.
Duplicates	R5	MS/MSD RPD exceeded the laboratory control limit. Recovery met acceptance criteria.
Duplicates	R6	LFB/LFBD RPD exceeded the method control limit. Recovery met acceptance criteria.
Duplicates	R7	LFB/LFBD RPD exceeded the laboratory control limit. Recovery met acceptance criteria.
Duplicates	R8	Sample RPD exceeded the method control limit.
Duplicates	R9	Sample RPD exceeded the laboratory control limit.
Duplicates	RA	Relative Percent Difference (RPD) exceeded limit; sample concentrations are less than 10x the MDL.
Surrogate	S1	Surrogate recovery was above laboratory acceptance limits, but within method acceptance limits.
Surrogate	S10	Surrogate recovery was above laboratory and method acceptance limits. See Case narrative.
Surrogate	S11	Surrogate recovery was high. Data reported per ADEQ policy 0154.000.
Surrogate	S12	Surrogate recovery was low. Data reported per ADEQ policy 0154.000.
Surrogate	S2	Surrogate recovery was above laboratory and method acceptance limits.
Surrogate	S3	Surrogate recovery was above laboratory acceptance limits, but within method acceptance limits. No target analytes were detected in the sample.
Surrogate	S4	Surrogate recovery was above laboratory and method acceptance limits. No target analytes were detected in the sample.
Surrogate	S5	Surrogate recovery was below laboratory acceptance limits, but within method acceptance limits.
Surrogate	S6	Surrogate recovery was below laboratory and method acceptance limits. Reextraction and/or reanalysis confirms low recovery caused by matrix effect.
Surrogate	S7	Surrogate recovery was below laboratory and method acceptance limits. Unable to confirm matrix effect.
Surrogate	S8	The analysis of the sample required a dilution such that the surrogate concentration was diluted below the method acceptance criteria. The method control sample recovery was acceptable.
Surrogate	S9	The analysis of the sample required a dilution such that the surrogate concentration was diluted below the laboratory acceptance criteria. The method control sample recovery was acceptable.
Method/analyte discrepancies	T1	Method promulgated by EPA, but not by ADHS at this time.
Method/analyte	T2	Cited ADHS licensed method does not contain this analyte as part of method compound list.

discrepancies		
Method/analyte discrepancies	T3	Method not promulgated either by EPA or ADHS.
Method/analyte discrepancies	T4	Tentatively identified compound. Concentration is estimated and based on the closest internal standard.
Calibration verification	V1	CCV recovery was above method acceptance limits. This target analyte was not detected in the sample.
Calibration verification	V2	CCV recovery was above method acceptance limits. This target analyte was detected in the sample. The sample could not be reanalyzed due to insufficient sample.
Calibration verification	V3	CCV recovery was above method acceptance limits. This target analyte was detected in the sample, but the sample was not reanalyzed. See case narrative.
Calibration verification	V4	CCV recovery was below method acceptance limits. The sample could not be reanalyzed due to insufficient sample.
Calibration verification	V5	CCV recovery after a group of samples was above acceptance limits. This target analyte was not detected in the sample. Acceptable per EPA Method 8000B.
Calibration verification	V6	Data reported from one-point calibration criteria per ADEQ policy 0155.000.
Calibration verification	V7	Calibration verification recovery was above the method control limit for this analyte, however the average % difference or % drift for all the analytes met method criteria.
Calibration verification	V8	Calibration verification recovery was below the method control limit for this analyte, however the average % difference or % drift for all the analytes met method criteria.
Calibration verification	VA	Sample matrix caused CCV to fail; analyzed on dilution for confirmation.
Calibration	W1	The % RSD for this compound was above 15%. The average % RSD for all compounds in the calibration met the 15% criteria as specified in EPA method 8000B.
ACZ	ZA	Poor recovery for Silver quality control is accepted because of solubility problems with Silver in samples, digestate, or extracts that do not contain HCI.
ACZ	ZB	Serial Dilution not evaluated because the sample concentration was less than 100 times the MDL.
ACZ	ZC	Low boiling point hydrocarbons present.
ACZ	ZD	Diesel range hydrocarbons present.
ACZ	ZE	High boiling point hydrocarbons present.

APPENDIX E REFERENCES UTILIZED BY ACZ

"NELAC Standards," National Environmental Laboratory Accreditation Conference. July 2000 (2001 standards effective July 2003).

"Standard Methods for the Examination of Water and Wastewater," APHA, 19th Edition, 1995.

"Methods for the Chemical Analysis of Water and Wastewater," USEPA, EPA-600/4-79-020, March 1979.

"Test Methods for Evaluating Solid Waste," USEPA, SW-846 Third Edition, Final Update III, December 1996.

"Guidelines in establishing test procedures for the analysis of wastewater pollutants," Code of Federal Regulations 40, Parts 136

"Quality Assurance of Chemical Measurements," Taylor, J., Lewis Publishers, Michigan. 1987

"Annual Book of Standards, Water Analysis," ASTM, 1989.

"Quality Assurance for Environmental Measurements," ASTM, Tech. Pub. 867, 1989.

"Methods of Soil Analysis," Black, C. A., American Society of Agronomy and American Society for Testing and Materials, Agronomy No. 9.

"Minimal Requirements for a Water Monitoring Quality Assurance Program," Colorado Dept. of Health, 1983.

"Quality Control in Analytical Chemistry," Kateman, G., Vol. 60, 1985.

"Principles of Environmental Analysis, Analytical Chemistry," Keith, L.H., et al., Vol. 55, 1983.

"Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," NRC, 10 CFR Part 50, Appendix B., 1986.

"Soil Testing Methods used at Colorado State University Soil Testing Laboratory for the Evaluation of Fertility, Salinity, Sodicity and Trace Element Toxicity," Soltanpour, P.N., Workman, S.M., 1981.

"Mine Spoil Potentials for Soil and Water Quality," Smith, R.M., EPA-600/2-78-054, 1974.

"Diagnosis and Improvement of Saline and Alkali Soils," USDA, Agri. Hdbk. No. 60., 1983.

"Recommended Methods for Water Data Acquisition," USDOI, 1984.

"Field and Laboratory Methods Applicable to Overburden and Mine Soils," USEPA, 1978.

"Handbook for Analytical Quality Control in Water and Wastewater Laboratories," USEPA, 1979.

"Manual for the Certification of Laboratories Analyzing Drinking Water," USEPA, 1982.

"Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater," USEPA, EPA-600/4-82-057, 1982.

"Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act," USEPA, Federal Register Vol. 49, No. 209, Oct. 26, 1984.

"Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," USGS, 1979.

"Methods for Determination of Organic Substances in Water and Fluvial Sediments," USGS, Open File Rep. 82-1004, 1983.

"Prescribed Procedures for Measurement of Radioactivity in Drinking Water," USEPA 600/4-80-032.

"Good Automated Laboratory Practices - Principles and Guidance to Regulations for Ensuring Data Integrity in Automated Laboratory Operations" USEPA, 2185, 1995.

ACZ Laboratories Inc.

Memo

To: MWH Analytical Task Manager, Mark Rettmann

From: Scott Habermehl

Date: April 22, 2004

Re: Sample Splitting – Field QA/QC

This memo defines the procedure that ACZ will use to create splits for QA/QC analyses of unhomogenized solid matrix file samples for the P_4 Production Site Investigations near Soda Springs, Idaho. Attachment A is a schematic diagram visually displaying the procedures discussed herein.

ACZ will receive, process and submit split solid matrix samples to the University of Idaho (UI) for QA/QC analyses. Samples to be split may include soil, sediment, plant tissue, benthic macro-invertebrates, and/or fish.

It is understood that the QA/QC sample specified on the chain of custody (COC) will be the sample ID for solids ending with (-QA). For example, "033104SEMST101-0" would be a regular sediment sample collected on 3/31/04 at station number 101, where as, "033104SEMST101-1-QA" would be the initial QA/QC sediment sample collected on the same date and at the same station, but will be prepared and split by ACZ for QA/QC analyses as detailed below.

When the soil, sediment, or plant tissue samples are received at the laboratory, ACZ will log in the original QA/QC sample and the two additional replicates (i.e., the three samples for ACZ analyses will be logged in), and place 4 laboratory identification numbers on the physical sample (i.e. L44500-01, -02, -03, -04). For benthic macro-invertebrate and salmonid (whole-body) samples, ACZ will log in the original QA/QC sample and place 2 laboratory identification numbers on the physical sample since only one replicate (split for the U of I) will be created. For forage fish and salmonid (fillet-with-skin) samples, ACZ will only log in the original sample and place the 1 laboratory identification number on the physical sample since they are not to be split for QA/QC analyses.

The client ID will be the original QA/QC sample ID with (-QA1), (-QA2), and/or (-QA3) assigned or modified by ACZ to identify them as replicates. If the client ID is too long for ACZ's Laboratory Information Management System (LIMS) ACZ will remove the sample date portion. Note that the split sample ID (-04) will not be logged into the ACZ LIMS; instead, the sample will be tracked by chain-of-custody within the lab up to the point that it is shipped to the University of Idaho, as described later in this procedure.

Once the samples are logged into the ACZ LIMS, the original, complete sample (before processing and splitting) will be transported to the appropriate section of the Lab until processing. Fish Tissue will be kept frozen until processing.

The following describes the number of QA/QC samples ACZ will receive for each matrix type, the number of QA/QC replicate/split samples ACZ will prepare for each matrix type, and the relevant sample preparation and splitting process for each matrix type:

1. **Soil and Sediment:** ACZ will receive one QA/QC sample per station for soil, and sediment. The QA/QC sample will be prepared and split into four even replicates, with one replicate being sent to UI.

   QA/QC samples will have the entire sample blended, an appropriate amount (of the as received blended sample) will be removed for percent moisture or percent solids analysis (which is dried at 105°C), and then the remaining blended sample will be oven dried at 35 degrees C. Sample size will then be reduced through a 2000 µm plastic sieve. Four even splits will then be created using a Gilson Company Versa Splitter (Model SP-2.5-3/4 inch openings). If a digestion is to be performed on the dried, sieved, and split samples, each of these split samples (except the UI split) will have an air dried solid performed (residual moisture from 35°C drying to percent-solid 105°C) to determine dilution factors on dried sieved sample material used for analysis and reported on dry weight basis. The sample that is analyzed is 35°C oven. The University of Idaho requires a sample size of at least 500 grams of soil or sediment if the sample is dry (<30% moisture) or 700 grams if the sample is wet.

2. **Plant Tissue:** ACZ will receive one QA/QC sample per station. The QA/QC sample will be prepared and split into four even replicates, with one replicate being sent to UI.

   QA/QC samples will have the entire plant weighed as received (beginning of plant percent moisture calculation) and the entire plant is dried at 35°C. The entire plant will then be pulverized in a decontaminated Wiley Mill (Thomas Scientific),

placed in a ziploc bag, and mixed. Four even splits will be created using a decontaminated Gilson Company Versa Splitter (Model SP-2.5-3/4 inch openings). A subsample of the pulverized material is weighed and dried at 105°C. These numbers combined allow us to get an entire wet weight of the sample and calculate to 105°C for percent solid. The pulverized sample from the 35°C oven is used for analysis. The University of Idaho requires a sample size of at least 10 grams of plant tissue if the sample is dry or 20 grams if the sample is wet or as received.

3. **Benthic Macro-Invertebrates:** ACZ will receive three samples per station, each having a unique identifier. One benthic macro-invertebrate sample per QA/QC station will be identified by MWH on the chain-of-custody to be split for QA/QC analyses, while the remaining two samples will be analyzed by ACZ as regular samples.

   The QA/QC sample will be prepared and split into two even replicates. If the amount of sample is not sufficient to create two even replicates, priority will be given to retain a sufficient amount for the ACZ subsample, with the remaining amount being used for the replicate subsample for UI.

   The benthic macro-invertebrate sample will be weighed and then homogenized with various tools such as, decontaminated stainless steel knives, blender, or Cuisinart™. Two even splits will then be created on a decontaminated glass cutting board with each individual weight recorded and then refrozen. The percent moisture or percent solids analysis and other analyses will be performed from these subsamples that have been refrozen (i.e., a frozen subsample will be weighed and dried for percent solids). The subsample will not be dried. The University of Idaho requires a sample size of at least 1 gram of benthic macroinvertebrate sample if the sample is dry or 5-10 grams if the sample is wet or as received.

4. **Forage Fish:** ACZ will receive three forage fish per station to be analyzed by ACZ as regular samples. Forage fish samples will not be split for QA/QC analyses.

   The whole-body fish will be homogenized with various tools such as, decontaminated stainless steel knives, blender, or Cuisinart™ and then refrozen. A frozen subsample is weighed and dried for percent solids. The sample will not be dried prior to analysis.

5. **Salmonid Fish (fillet-with-skin & whole-body):**ACZ will receive three salmonid samples per station, each having a unique sample identifier. One salmonid fish per QA/QC station will be identified by MWH on the chain-of-custody to be split for QA/QC

analyses, while the remaining two salmonids will be analyzed by ACZ as regular samples.

Salmonid fish will be prepared and analyzed as both fillet-with-skin and whole-body. The whole body will be weighed and recorded. A sufficient amount of fillet with skin will be removed to prepare one sample for ACZ analyses only. The amount of fillet-with-skin removed from the whole-body fish will be recorded. The fillet-with-skin sample will be homogenized with various tools such as, decontaminated stainless steel knives, blender, or Cuisinart™ and refrozen.

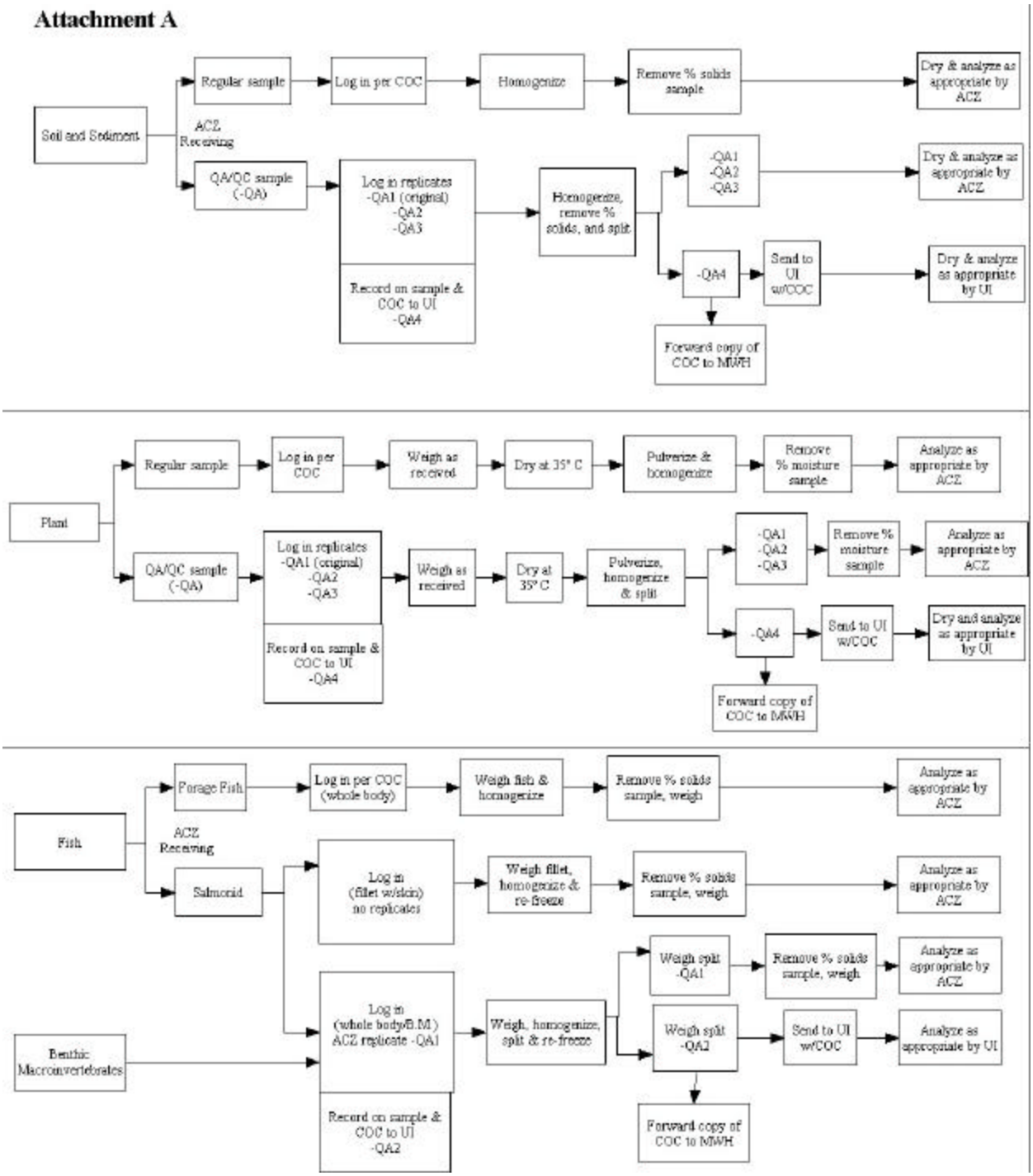
After the fillet-with-skin sample has been prepared, the remaining whole-body will be weighed and then homogenized with various tools such as, decontaminated stainless steel knives, blender, or Cuisinart™. Two even splits will then be created on a decontaminated glass cutting board with each individual weight recorded and then refrozen. Note, only the whole-body fish will be split and sent to the University of Idaho for QA/QC analyses.

The percent moisture or percent solids analysis and other analyses will be performed from these prepared fillet-with-skin and whole-body split samples that have been refrozen (i.e., a frozen subsample of the homogenized fillet and the homogenized whole-body will be weighed and dried for percent solids). The sample will not be dried. The University of Idaho requires a sample size of at least 10 grams of salmonid (whole-body) if the sample is dry or 20 grams if the sample is wet or as received.

Once sample splits/replicates are created they will be placed in their own appropriate containers and properly identified with the previously generated ACZ laboratory numbers. For example: sample L44500–01 (original), -02 (1st duplicate), -03 (2nd duplicate), -04 (UI sample split). Alternatively, the four prepared splits can be considered replicates of each other (i.e., replicate 1, replicate 2, replicate 3, replicate 4).

The sample splits (-04) or client ID (-QA4) will then be packaged appropriately, and shipped to the University of Idaho under an ACZ chain of custody in a 4°C cooler with wet and/or blue ice. All solid media, except forage fish (whole-body) and salmonid fish (fillet-with-skin), will be split and sent to the University of Idaho. ACZ will forward a copy of the COC and shipping papers to the MWH Analytical Task Manager via fax or an electronic .pdf file transmission when the spilt samples are shipped.

Attachment A



Appendix E
Laboratory Quality Assurance Plan
(U of I Analytical Sciences Laboratory)

Laboratory Quality Management Plan

University of Idaho
Analytical Sciences Laboratory
Holm Research Center
Moscow, Idaho 83844-2203
(208) 885-7081

Idaho Food Quality Assurance Laboratory
315 Falls Avenue
Twin Falls, Idaho 83301
(208) 732-5325

September 2003

University of Idaho

ANALYTICAL SCIENCES LABORATORY
IDAHO FOOD QUALITY ASSURANCE LABORATORY
SCIENCE IN THE PUBLIC SERVICE

Quality Management Plan for the Analytical Sciences Laboratory and Idaho Food Quality Assurance Laboratory

Approvals:

Jerry H. Exon, Ph.D., Administrative Director
University of Idaho Department of Food Science and Toxicology

Signature Jerry H. Exon Date: 9/15/03

Gregory M. Möller, Ph.D., Technical Director
University of Idaho Analytical Sciences Laboratory and
Idaho Food Quality Assurance Laboratory

Signature Date: 9-12-03

Steve McGeehan, Ph.D., Chief Chemist
Analytical Sciences Laboratory

Signature Date: 9-12-03

Michael Becerra, M.S., Laboratory Manager
Idaho Food Quality Assurance Laboratory

Signature Date: Sept 9, 2003

Janet C. Campbell, M.S., Quality Assurance Officer
University of Idaho Analytical Sciences Laboratory
and Idaho Food Quality Assurance Laboratory

Signature Janet C. Campbell Date: 9/16/03

Table of Contents

Mission Statement 1
Quality Assurance Policy Statement 2
Ethics Policy on Waste, Fraud, and Abuse 4
Quality Assurance Management 5
Administrative Organization 6
Personnel Qualifications 8
Facility Descriptions 16
Analytical Instruments 20
Capital Equipment and Lab Support System: Preventive and Routine Maintenance 20
Diagnostic and Corrective Actions for Quality Improvement 23
Laboratory Evaluation and Audits 30
Quality Assurance Reports to Management 34
Lab Documentation and Forms 35
Sub-Contracting of Services 41
Standard Operating Procedures 42
Laboratory Personnel Training Record 43
References 44

APPENDIXES
A. Ethics Statement A-1
B. University of Idaho Policy on Scientific Misconduct B-1
C. Policy on Protection of Public Employees Reporting Waste or Violations of Law C-1
D. Major Analytical Equipment D-1
E. QAU SOPs E-1
F. Standard Operating Procedures Table of Contents F-1

LIST OF FIGURES
1. ASL/IFQAL Organizational Chart 6
2. IFQAL - Idaho State Reporting Organizational Chart 7
3. Holm Research Center/ASL Floor Plan 17
4. IFQAL Floor Plan 18

LIST OF ACRONYMS

ASL	Analytical Sciences Laboratory
CFR	Code of Federal Regulations
DQO	Data Quality Objective
EPA	Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
GLP	Good Laboratory Practices
IFQAI	Idaho Food Quality Assurance Institute
IFQAL	Idaho Food Quality Assurance Laboratory
IR-4	Interregional Research Project No. 4
LIMS	Laboratory Information Management Systems
LQMP	Laboratory Quality Management Plan
PE	Performance Evaluation
QA	Quality Assurance
QAU	Quality Assurance Unit
QC	Quality Control
QMP	Quality Management Plan
SM	Standard Method
SMM	Standard Methods Manual
SOP	Standard Operating Procedures
TSCA	Toxic Substances Control Act
UI-ASL	University of Idaho Analytical Sciences Laboratory

University of Idaho Analytical Sciences Laboratory
Idaho Food Quality Assurance Laboratory
Mission Statement

The University of Idaho Analytical Sciences Laboratory and Idaho Food Quality Assurance Laboratory are committed to providing the highest quality analytical laboratory service and research support for:

- Food quality assurance support for consumers, producers, governmental agencies, agricultural groups, and processors.
- Enhancement of agricultural production and animal health management
- Environmental monitoring
- Recognition and dissemination of new knowledge

The Laboratories are a progressive and responsive service, teaching, and research organization with a staff that shares the following values:

- Commitment to client service: quality, efficiency, empathy, and confidentiality of client information.
- Current knowledge of the area agricultural industries, food quality and environmental concerns.
- Partnership with agricultural industry, animal health workers, and governmental agencies.
- Academic standards: commitment to the advancement of analytical procedures and state-of-the-art competency.
- Team work: unity, courtesy, open communications; commitment to the mission of the laboratory.
- Personal leadership: positive attitude, enthusiasm, flexibility, motivation, initiative, personal growth, acceptance of responsibility at every level.
- Trust, honesty, integrity and accountability.

University of Idaho Analytical Sciences Laboratory
Idaho Food Quality Assurance Laboratory
Quality Assurance Policy Statement

The University of Idaho Analytical Sciences Laboratory (ASL) and the Idaho Food Quality Assurance Laboratory (IFQAL) are committed to providing the highest quality analytical chemistry service and research support. The foundation for this lies in the ASL/IFQAL Quality Management Plan (QMP) and the standard operating procedures (SOPs) associated with it.

The primary objective of the quality system is to maintain the precision and accuracy of the laboratory's analytical data and to ensure that facilities, equipment, personnel, methods, practices, raw data, and quality controls are in compliance with the applicable Federal Good Laboratory Practice (GLP) regulations (40 CFR Part 160). It is ASL and IFQAL policy that GLP regulations will be strictly followed for regulated studies and to the fullest applicable and practical extent for other projects. Many non-regulated client-submitted samples do not specify required elements for GLP compliance. Hence, many components of regulated studies, such as Study Directorship, formal protocols, and final summary reports may not apply for these analyses. Further objectives include:

- The consistent use of current, management-approved standard methods and standard operating procedures;
- Supervisory and peer quality control (QC) review of each analytical batch and/or individual analysis which includes comparison of QC samples against traceable or statistically derived values;
- The establishment of and adherence to carefully designed protocols, project plans, and client-defined Data Quality Objectives (DQOs) for specific analytical processes;
- The consistent use of qualified, trained personnel, reliable and well-maintained equipment, and close supervision of all operations by laboratory management;
- Enlistment of a formal third party analysis at regular intervals and participation in the analysis of outside agency check sample and performance evaluation programs;
- Whenever the analysis type permits, to operate on the concept of traceability through the concurrent analysis of matrix-based certified reference materials and standards traceable to a national standards agency such as the National Institute of Standards and Technology.
- Periodic laboratory audits by the Quality Assurance Unit (QAU) to determine laboratory adherence to the QMP, client DQOs, GLPs, and project protocols, as applicable to the analysis.

It is essential that Laboratory personnel are aware of our commitment to quality assurance. This Quality Management Plan will be made available to individuals to enable them to take action to operate the quality system. Continuous improvement requires organization-wide commitment to QA. Responsibility for formulation of QA policy and for implementation resides with senior management. Responsibility for effective implementation is shared by each individual in the Laboratory. All staff are directly responsible for the quality of their own work and, in many cases, review of other's work.

The quality assurance system will be continually and systematically revised for effectiveness and compliance with defined requirements.

Ethics Policy on Waste, Fraud, and Abuse

Employees of the University of Idaho Analytical Science's Laboratory and Idaho Food Quality Assurance Laboratory sign an ethics statement (Appendix A) shortly after being hired. In addition all employees are subject to the University of Idaho policy (Appendix B) on scientific misconduct.

Employees reporting waste or violations of law are protected under University of Idaho Policy (Appendix C) as well as The Idaho Protection of Public Employees Act, Idaho Code 6-2101 through 6-2109.

Quality Assurance Management

QAU Authority

The QAU is authorized to conduct inspections/audits of all studies, analyses, or laboratory operations for the purposes specified in this QMP. Laboratory personnel provide QAU access to all laboratory areas, raw data, and personnel training records when such access is necessary for adequate study or process review.

QAU Separation

The QAU and its integral Quality Assurance Officers and files are entirely separate from and independent of the personnel engaged in the direction or conduct of a study. The unique situation associated with a laboratory in an academic setting facilitates independence of the QAU through the University hierarchical structure. A faculty member in the Department of Food Science and Toxicology (FST) serves as Testing Facility Management (Administrative Director). The QAU answers directly to this individual. The ASL/IFQAL Technical Director, ASL Chief Chemist, ASL Organic Group Leader, and IFQAL Laboratory Manager are involved in the direction and conduct of studies and routine laboratory analyses, from which the QAU is independent.

Administrative Organization

The Analytical Sciences Laboratory and Idaho Food Quality Assurance Laboratory administrative reporting/responsibilities are diagramed in figures 1 and 2 below.

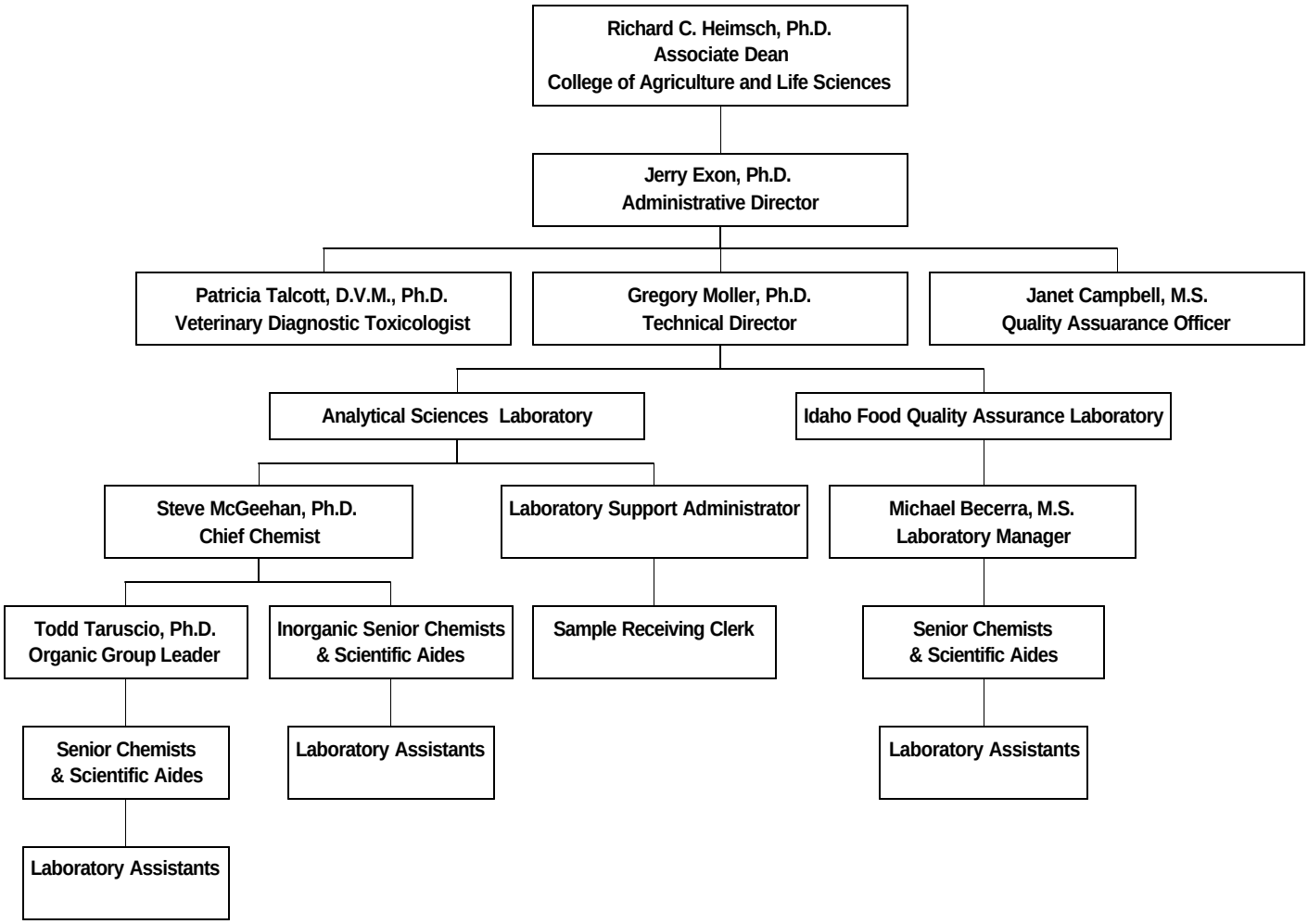


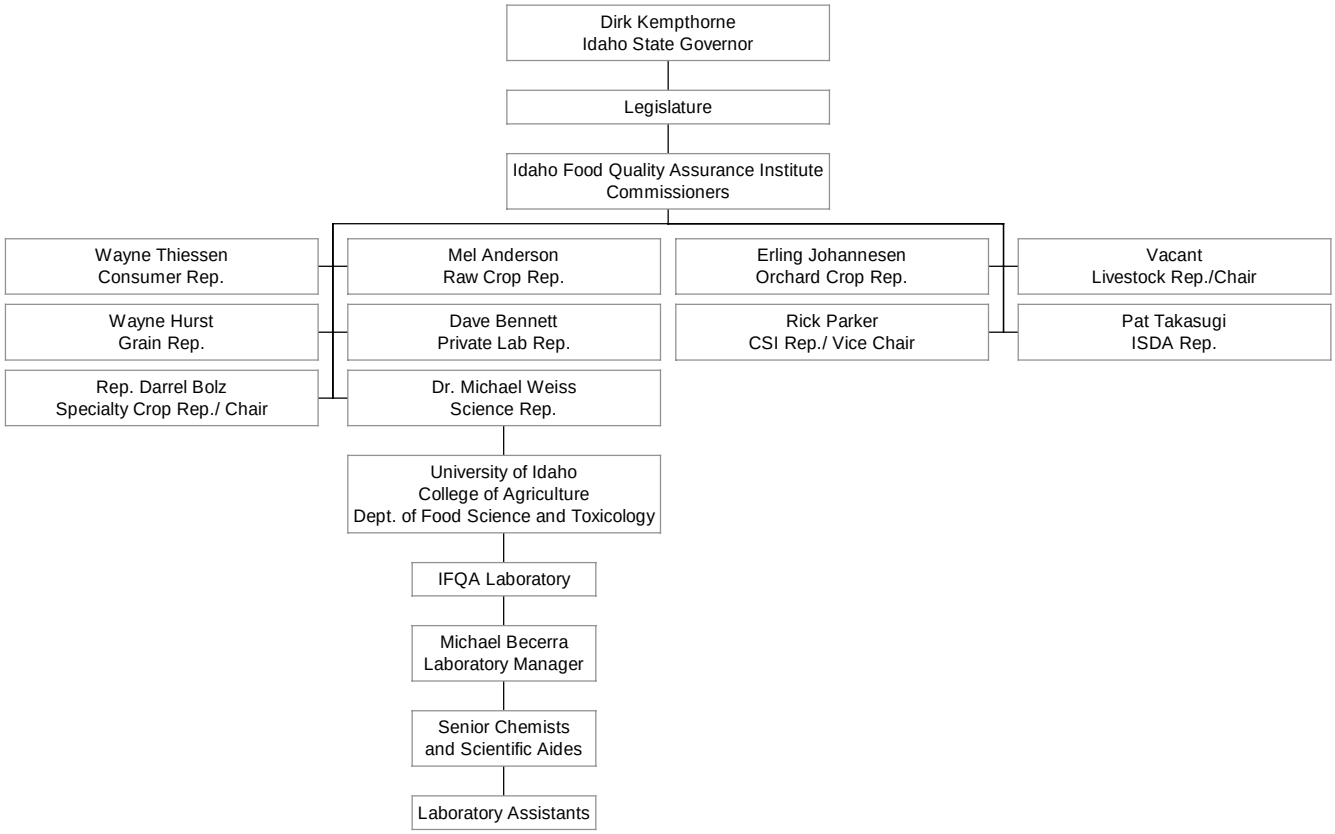
Figure 1. ASL/IFQAL Organizational Chart

The University of Idaho Analytical Sciences Laboratory (ASL) provides technical management of the Idaho Food Quality Assurance Laboratory (IFQAL) under contract with the Idaho Food Quality Assurance Institute (IFQAI).

Duties and Responsibilities of Key Section Heads

Please refer to pages 8 through 10 for the duties and responsibilities of the ASL/IFQAL Administrative Director, ASL/IFQAL Technical Director, ASL Chief Chemist, IFQAL Laboratory Manager and ASL Organic Group Leader.

Figure 2. IFQAL - Idaho State Reporting Organizational Chart



Analytical Sciences Laboratory
Idaho Food Quality Assurance Laboratory
Personnel and Qualifications: March 2003

Position descriptions of all personnel at the Analytical Sciences Laboratory (ASL) and Idaho Food Quality Assurance Laboratory (IFQAL) include using Good Laboratory Practices and Standard Operating Procedures in the performance of their duties. The duties listed below for ASL and IFQAL management reflects their duties only as applied to the laboratories. The Administrative Director, Technical Director, and Diagnostic Toxicologist all have University of Idaho responsibilities outside the laboratories.

ASL & IFQAL Management

Name:	Jerry Exon
Title:	Administrative Director of ASL & IFQAL
Degrees:	B.S., Zoology, Oregon State University, Corvallis, OR M.S., Toxicology, Oregon State University, Corvallis, OR Ph.D., Toxicology (Bacteriology), University of Idaho, Moscow, ID
Years of Experience:	13 years as Administrative Director of ASL/IFQAL; 24 years in the field of toxicology (currently Professor, Food Science and Toxicology at UI)
Duties:	Provides administrative oversight of budgets and personnel at ASL and IFQAL.

Name:	Gregory Möller
Title:	Technical Director of ASL & IFQAL
Degrees:	B.S., Honors Chemistry, Wichita State University, Wichita, KS Ph.D., Physical Chemistry, University of California, Davis, CA
Years of Experience:	13 years as Technical Director of ASL/IFQAL; 28 years in the field of chemistry (currently Associate Professor, Food Science and Toxicology at UI)
Duties:	Serves as Technical Director of the University of Idaho Analytical Sciences Laboratory in the Agricultural Experiment Station. These duties include employee training, method development, budget management, proposal writing, scheduling of projects, establishing a QA program and GLPs, ordering equipment and supplies and other duties related to the laboratory. Serves as IR-4 Satellite Laboratory Director conducting analytical method development and pesticide residue regulatory studies. Technical Director for the Idaho Food Quality Assurance Laboratory in Twin Falls, Idaho.

Name:	Steve McGeehan
Title:	Chief Chemist, ASL
Degrees:	B.S., Soil Science, Oregon State University, Corvallis, OR M.S., Soil Science, Oregon State University, Corvallis, OR Ph.D., Soil Chemistry, University of Idaho, Moscow, ID
Years of Experience:	17 years in the field of agricultural and environmental chemistry
Duties:	Serves as Chief Chemist of the University of Idaho Analytical Sciences Laboratory in the Idaho Agricultural Experiment Station. Supervises 15-20 chemists and laboratory technicians performing inorganic, soil chemistry, organic, and veterinary toxicology analyses. Schedules work flow, provides quality control oversight, performs method development, instrument maintenance and staff training as well as general group management tasks. Prepares reports, plans projects, establishes QA programs, and GLPs. Coordinates the work of the analytical laboratory including scheduling of analyses, equipment usage, and equipment maintenance. Develops modifications to procedures as improvements become necessary. Organizes and leads weekly group meetings to coordinate, plan and troubleshoot analyses. Reviews all work performed in the analytical laboratory for validity according to quality control defined guidelines. Writes grants as needed for Request for Proposals (RFPs) that are pertinent to the analytical laboratory's mission. Provides technical support for the Idaho Food Quality Assurance Laboratory as needed.

Name:	Patricia Talcott
Title:	ASL Veterinary Diagnostic Toxicologist
Degrees:	B.A., Biology, Bowdoin College, Brunswick, ME M.S., Veterinary Science, University of Idaho, Moscow, ID D.V.M., Veterinary Medicine, Washington State University, Pullman, WA Ph.D., Bacteriology/Toxicology/Pharmacology, University of Idaho, Moscow, ID Diplomate, American Board of Veterinary Toxicology
Years of Experience:	18 years
Duties:	Diagnostic Toxicologist for the Washington Animal Disease Diagnostic Laboratory (WADDL) and the UI College of Agriculture Food Quality Assurance Program. Evaluates, coordinates and interprets results of veterinary diagnostic toxicology samples submitted to the UIASL. Consults with veterinarians concerning veterinary toxicology cases and diagnoses. Maintains communications with WOI and WADDL personnel concerning veterinary toxicology services and cases. Conducts field investigations of animal poisonings when needed.

Name:	Michael Becerra
Title:	IFQAL Laboratory Manager
Degrees:	B.S., Chemistry and Biology, State University of New York, Fredonia, NY M.S., Analytical Chemistry and Water Resources, Oregon State University, Corvallis, OR
Years of Experience:	18 years in the field of chemistry
Duties:	Responsible for serving as Laboratory Manager and as a senior analytical scientist at the Idaho Food Quality Assurance Laboratory in Twin Falls, Idaho. Supervises, hires, and trains a group of approximately 6 to 12 chemists, laboratory technicians, and interns in their day to day work for the laboratory. Duties include ensuring that studies are in compliance with Good Laboratory Practice (GLP) standards by producing raw data, standard analytical methods, standard operating procedures, quality control data and reports under GLPs. Responsible for the daily analysis of samples for agrochemical residue studies including bench level sample preparation and instrumental analysis by GC, HPLC, GC-MSD, LC-MS and other techniques of analysis as needed. Develops methods for analysis related to food quality and agrochemical residue detection. Participates in oversight of studies in all phases including: planning, consultation with sponsors, initiation, sample tracking, implementation of GLPs, data management, and report production. Responsible for serving as laboratory purchasing agent. Responsible for laboratory coordination of the cooperative Laboratory Assistant Certification program with the College of Southern Idaho, Twin Falls, Idaho. Represents the laboratory at professional conferences and meetings.

Name:	Todd Taruscio
Title:	ASL Organic Group Leader
Degrees:	B.S., Biochemistry, Washington State University, Pullman, WA Ph.D, Zoophysiology, Washington State University, Pullman, WA
Years of Experience:	9 years in the field of chemistry
Duties:	Group Leader for organic analyses and regulated scientific studies at the University of Idaho Analytical Sciences Laboratory. Responsible for analysis and the general and direct supervision of a team of analytical scientists and laboratory technicians performing organic analytical chemistry. Organic analytical testing includes pesticides, herbicides and other agricultural, industrial and naturally occurring compounds and substances in agricultural, biological and environmental samples including plant and animal tissues, waters and soils using gas and liquid chromatography, mass spectrometry, and other methods as required. Responsible for residue analysis, workflow scheduling, quality control oversight, method development, instrument maintenance, report writing and training as well as general group management tasks. Responsible for Group adherence to GLPs and regulatory testing guidelines. Provides technical support for the Idaho Food Quality Assurance Laboratory as needed.

Quality Assurance Unit

Name:	Janet Campbell
Title:	Quality Assurance Officer
Degrees:	B.S., Biology, Appalachian State University, Boone, NC M.S., Plant Physiology, North Carolina State University, Raleigh, NC M.S., Wood and Paper Science, North Carolina State University, Raleigh, NC
Years of Experience:	4 years Quality Assurance Officer, 12 years in chemistry/biology
Duties:	Quality Assurance Officer for Analytical Sciences Laboratory and Idaho Food Quality Assurance Laboratory. Responsible for maintaining facility compliance with Federal Good Laboratory Practice Standards (GLPs), 40 CFR §160/792 for FIFRA and TSCA regulatory science studies. Conducts data audits, laboratory facility audits, critical phase audits, and report audits for management review and action. Responsible for training laboratory personnel in all applicable aspects of quality assurance practices and regulatory agency standards of performance.

ASL and IFQAL Staff Positions

ASL typically employs 15 to 20 staff members as Senior Chemists, Scientific Aides, and Laboratory Assistants. IFQAL typically employs 6 to 12 personnel in these positions.

ASL Staff

Name:	Tom Case
Title:	Soil Chemist
Degrees:	B.S., Soil Chemistry, University of Idaho, Moscow, ID
Years of Experience:	12 years
Duties:	Responsible for operation, public relations, and management of the soils testing facility. Instrumentation includes RFA, ICP, AA, CHN, and IC. Maintains QA/QC protocols on the soil tests conducted in the laboratory.

Name:	George Farwell
Title:	Scientific Aide
Degrees:	2 years undergraduate chemistry
Years of Experience:	13 years
Duties:	Prepares samples and analyzes substances of inorganic origin in water, plant, and veterinary toxicological samples. Prepares and analyzes standards and quality control samples. Performs method development and validation.

Name:	Ed Kuther
Title:	Scientific Aide
Degrees:	B.S., Chemistry, Lewis-Clark State College
Years of Experience:	12 years in the field of chemistry
Duties:	Extracts and analyzes plant, soil and water matrices for pesticides and herbicides using EPA methodology; conducts analyses of samples for veterinary toxicology. Performs instrument maintenance, data interpretation, data quality control checks, data entry, and generates reports. Uses GC, GC/MS, HPLC, TLC, and UV-VIS in the analysis of organic samples. Conducts method validations.

Name:	Lisa McEwen
Title:	Sample Receiving Clerk
Degrees:	A.A., Biology
Years of Experience:	4 years
Duties:	Initial point of contact for laboratory samples. Major responsibilities include sample check-in, gathering and entering client information into Laboratory Information Management System (LIMS), report generating, billing, assisting in preparation of veterinary toxicology samples, maintaining work lists detailing required analyses and data reporting, disposal or return of samples to client after adequate holding time.

Name:	Bridget Ricks
Title:	Scientific Aide
Degrees:	B.S., Chemistry, University of Idaho
Years of Experience:	6 years
Duties:	Performs inorganic analyses on water and plant samples using various methods including the use of AA and ICP instrumentation. Maintains instruments, prepares reagents and standards, and prepares client reports.

Name:	Bonnie Schafman
Title:	Senior Chemist
Degrees:	M.S., Chemistry, Washington State University, Pullman, WA
Years of Experience:	10 years
Duties:	Performs and assists in sample preparation and laboratory analyses including plant and animal tissues, waters and soils; sample preparation for organic analysis; maintenance of instruments; documentation of analytical results and quality control, general group and laboratory operations tasks; report writing. Uses GC, GC/MS, HPLC, TLC, and UV-VIS in the analysis of organic samples.

Name:	Margaret Sillers
Title:	Scientific Aide
Degrees:	B.S., Biology and Psychology, Washington State University
Years of Experience:	4 years
Duties:	Prepares samples for inorganic analyses and performs procedures using AA, FIA, ICP-AES, and ion chromatography. Prepares standard

solutions and reagents. Calibrates and maintains instruments. Assists in sample receiving and processes client reports.

Name:	Janet Snow
Title:	Laboratory Support Administrator
Degrees:	C.M.A., B.A., Business Administration
Years of Experience:	11 years
Duties:	Responsible for computer network maintenance including: hardware maintenance and purchasing; software review, purchasing and implementation, maintenance of user files; computer system backup; manages server space and trains employees on computer systems. Responsible for Laboratory Information Management System used for tracking samples and reporting results of analyses to clients. Responsible for client contact and coordination of sampling materials and data requirements. Responsible for various business functions of the laboratory including: determination of costs of analyses performed; tracking and handling of past due accounts; maintaining case files and archives of historical files; some ordering of supplies.

Name:	Bill Warner
Title:	Senior Inorganic Chemist
Degrees:	M.S., Physical Chemistry
Years of Experience:	21 years
Duties:	Develops and runs analytical procedures for inorganic analyses of samples submitted for toxicological, nutritional and environmental testing. Specifies and purchases equipment; troubleshoots and maintains all major laboratory equipment including: ICPs, AAs, CNS Analyzer, Flow Injection Analyzer, Gel Permeation Chromatograph, auto-evaporators, gas chromatograph equipment, and hardware of the laboratory LAN. Safety Officer for the laboratory. Stores and maintains chemical inventory.

IFQAL Staff

Name:	Ryan Yee
Title:	Senior Chemist
Degrees:	B.S., Biochemistry, University of California, Davis, CA M.S., Biochemistry, University of Southern California, Los Angeles, CA
Years of Experience:	19 years
Duties:	Performs analyses for pesticides by gas chromatography and high performance liquid chromatography. Operates, maintains, and trouble-shoots analytical instrumentation: GC, GC/MS, LC/MS, and HPLC. Performs QC and data interpretation. Trains student interns and staff in all aspects of laboratory work. Serves as Safety Officer for the lab.

Name:	Jennifer Holtzen
Title:	Scientific Aide
Degrees:	B.A., Biology with a minor in Chemistry, Carroll College, Helena, MT
Years of Experience:	3 years
Duties:	Performs and assists in sample and standard preparation and laboratory analyses. Performs extractions on samples to be analyzed by gas and liquid chromatography for pesticide residues. Operates, maintains, and troubleshoots analytical instrumentation: GC, GC/MS, and HPLC. Performs QC and data interpretation. Trains student interns in all aspects of laboratory work. Maintains SOP manuals and coordinates the processes of writing, revision and archiving with the QAU at ASL.

Name:	George Kinslow
Title:	Scientific Aide
Degrees:	Courses completed at: Cecil Co. Community College, MD; Harford Community College, MD; Barton Community College, KS; Kansas State University, KS; Cosumnes River College, CA.
Years of Experience:	11 years
Duties:	Performs and assists in sample and standard preparation and laboratory analyses. Performs extractions on samples to be analyzed by gas and liquid chromatography for pesticide residues. Operates, maintains, and troubleshoots analytical instrumentation: GC, GC/MS, and HPLC. Conducts QC and data interpretation.

Name:	Abbie Severa
Title:	Administrative Assistant
Degrees:	B.S., Agricultural Science and Technology, minor in Agri-business, University of Idaho
Years of Experience:	4 years
Duties:	Performs cost analyses on laboratory services, orders supplies, creates Certificates of Analysis and billings for services performed by the laboratory. Maintains lab service fee brochure. Conducts monthly safety equipment checks. Assists in sample preparation and analyses. Maintains employee, case, and archive files. Performs other basic office functions.

Name:	Gordon Sheppard
Title:	Laboratory Technician
Degrees:	A.A., Water Resource Management, minor in Chemistry, and Laboratory Assistant Certification, College of Southern Idaho, Twin Falls, ID
Years of Experience:	11
Duties:	Assists in the performance of laboratory analyses. Prepares samples for analysis using liquid-liquid, solid phase, and other methods of extraction following homogenization, grinding, or other methods of sample preparation. Prepares and analyzes quality control samples such as standards, controls, blanks, and fortifications. Responsible for target compound analysis, instrument maintenance, and documentation of analytical results and QC. Supervises and trains student interns.

Student Trainee Positions

ASL participates in hiring temporary part-time student interns at the laboratory. Their duties include performing extractions on samples, sample grinding and general laboratory duties.

IFQAL participates in a cooperative student intern program (Laboratory Assistant Certification Program) with the College of Southern Idaho in Twin Falls, Idaho. Their duties include performing extractions on samples to be analyzed by gas and liquid chromatography, preparation of standards, sample grinding and general laboratory duties as well as routine GC and HPLC operation.

Facility Descriptions

Analytical Sciences Laboratory
ASL is located in approximately 10,000 square feet of the Holm Research Center on the University of Idaho Moscow campus. There are separate organic and inorganic laboratories within the building. Wet chemistry operations are conducted in different areas from instrumental analysis. Glassware preparation is performed in a separate part of the building. Sample receiving and storage areas are separate and secure. A floor plan is presented on page 17. ASL is a secure, limited access facility, with external door access controlled by magnetic card readers.

Idaho Food Quality Assurance Laboratory
IFQAL is a state-of-the art facility located on the College of Southern Idaho campus in Twin Falls, Idaho. The laboratory facility is approximately 12,000 square feet and was built in 1992. Sample receiving and storage areas are separate and secure. Wet chemistry operations are separated from instrumental analysis areas. Glassware preparation is performed in a separate part of the building. A floor plan is presented on page 18, and a detailed listing of room assignments with functions is provided on page 19 of this document. IFQAL is a secure, limited access facility.

Analytical Sciences Laboratory

Figure 3: Holm Research Center/ASL Floor Plan

Analytical Sciences Laboratory

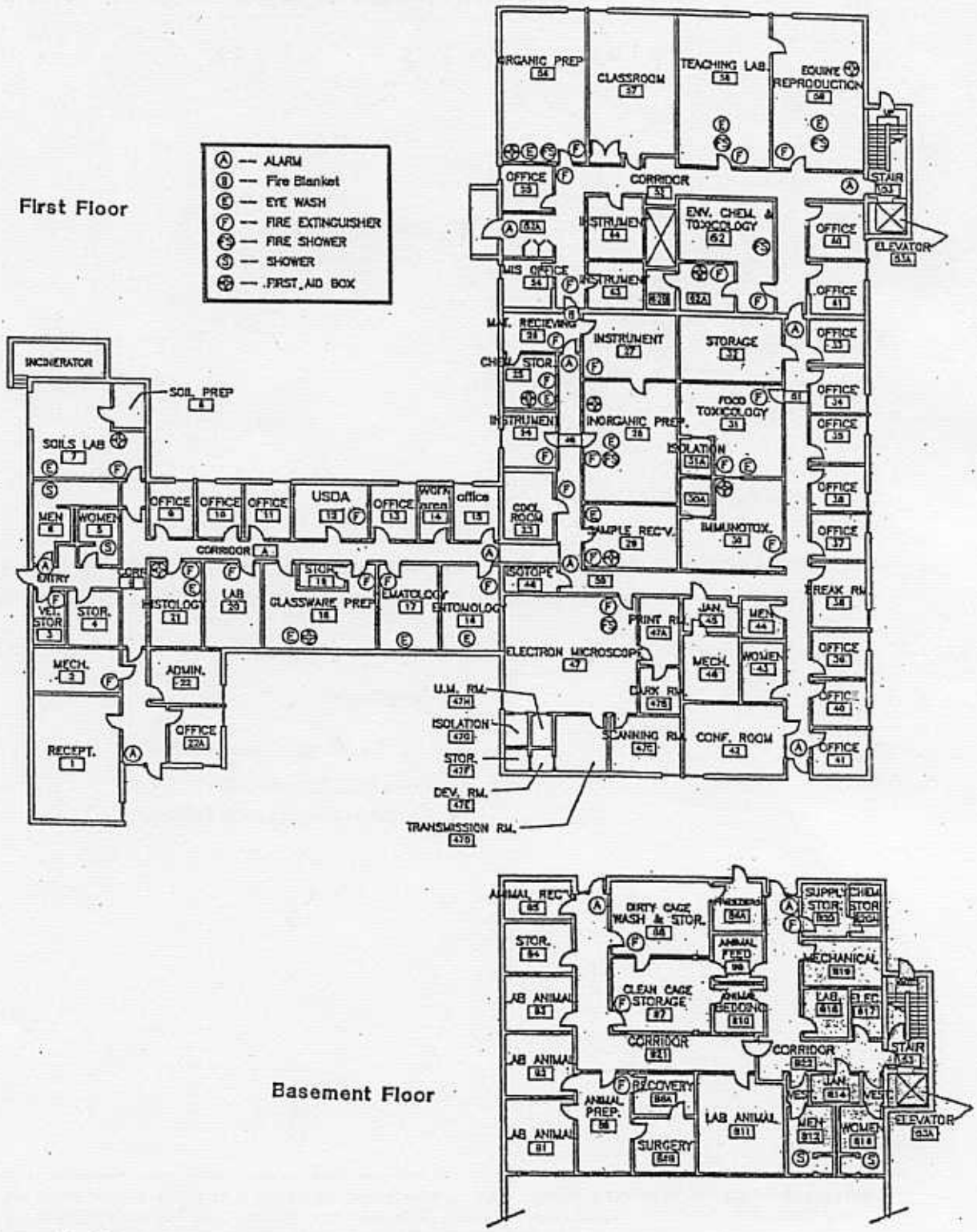


Figure 3: Holm Research Center/ASL Floor Plan

Idaho Food Quality Assurance Laboratory

Figure 4: IFQAL Floor Plan

Idaho Food Quality Assurance Laboratory

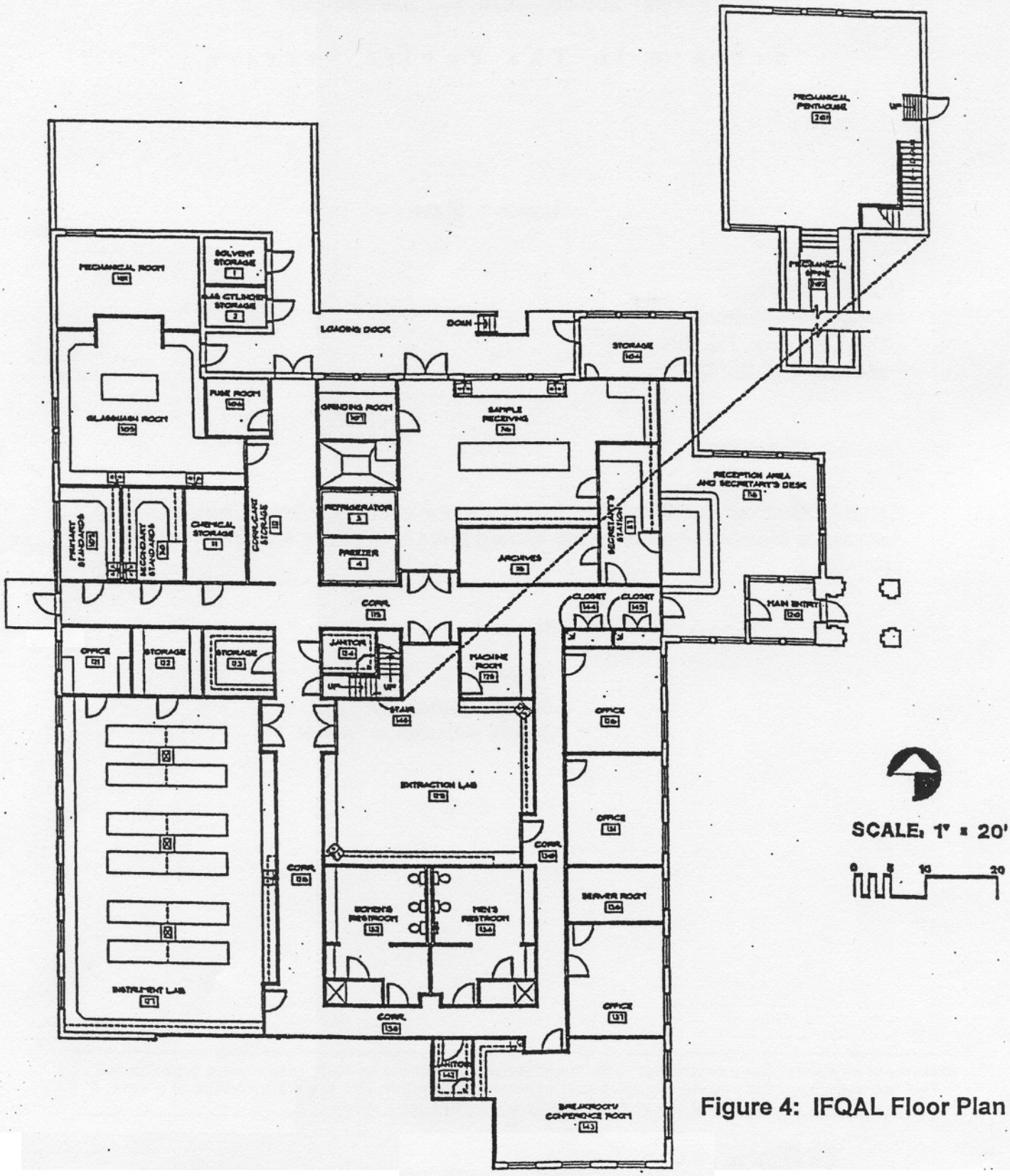


Figure 4: IFQAL Floor Plan

Idaho Food Quality Assurance Laboratory
Room Assignments

Room	Description	Room	Description
1	Solvent Storage		
2	Gas Cylinder Storage	123	GPC/ Sample extracts
3	Walk-in Refrigerator	124	Janitorial Closet
4	Walk-in Freezer	125	Machine Room
101	Mech. Room, deionized water supply system	126	Office
104	Storage	127	Instrument Lab
105	Glass wash Room	128	Corridor
106	Electrical/ Telephone Room	129	Extraction Lab
107	Grinding Room	130	Corridor
109	Primary Standards Room	131	Office
110	Secondary Standards Room	132	Women’s Restroom
111	Chemical Storage	134	Men’s Restroom
112	Corridor/Cart Storage	136	Office
115	Archives	137	Office
116	Sample Receiving	138	Corridor
117	Secretary’s Station	142	Janitorial Closet
118	Reception Area	143	Conference Room/Break Room
119	Corridor	144	Lab Coat Closet
120	Main Entry	145	Lab Coat Closet
121	Office	201	Mechanical Penthouse
122	Storage	202	Mechanical Spine

Analytical Sciences Laboratory
Idaho Food Quality Assurance Laboratory
Analytical Instruments

A current inventory of capital equipment is maintained by the Laboratory Support Administrator at ASL and by personnel at IFQAL. Major analytical equipment for the laboratories is listed in Appendix D.

Capital Equipment and Lab Support Systems
Preventive and Routine Maintenance

Laboratory support
ASL operates a PC-based computer network operating under Novell Netware 3.11. There are approximately 20 Windows-based workstations connected via the network with various point devices and scanners available. This network is connected to the University of Idaho local-area network providing access to the Internet. Sample tracking and reporting are handled by the EasyLIMS Laboratory Information Management System, a Windows–based database software.

Instrument Environment
ASL and IFQAL instrumentation represents some of the finest available for analytical laboratories. The state-of-the-art instrumentation and technology provides accurate and reliable testing services. Proper preventive maintenance begins with the environment in which the instrument is placed and used (Dux, 1990, p.87). ASL and IFQAL installed new heating, ventilation, and air-conditioning (HVAC) systems in 1998. These HVAC systems help to keep detrimental environmental conditions such as dust, fumes, and excessive heat to a minimum in each of the facilities.

Analytical Instruments and Quality Control
ASL and IFQAL are highly dependent on modern analytical instrumentation for efficient production. Maintenance procedures are instituted to reduce instrumental error and failure of these highly productive instruments. Every instrument used in the production of data has a standard operating procedure (SOP) detailing operation, general calibration, and routine maintenance schedules to ensure the quality of the instrument output. Method specific calibration information and instrument operating parameters are detailed in the standard method (SM) for that procedure.

Please refer to the equipment standard operating procedures listed in *Standard Operating Procedures Table of Contents* in appendix F.

Performance Checks
Daily performance checks are the first indicator of instrument failure. Indices of performance are established for all instruments. These indices do not need to cover every possible area of performance, but must be sufficient to diagnose all probable forms of deterioration or failure. Each instrument has a list of performance checks and their limits of acceptability defined within the equipment SOP. For example, a chromatograph can use the retention time, peak width and peak area of a test compound to monitor performance of the column, detector and oven. Calibration data may be a useful index of performance. The operators must be familiar with the performance required and take corrective action whenever the performance does not meet expectations.

Inspection
Observation and inspection of the equipment is the best defense against failure. Every operator develops the habit of watching the machine's behavior and noticing when unusual events occur. The instruments are inspected before each analysis. Liquid chromatographs are checked for leaks, autosamplers are checked for mechanical alignment, and peristaltic tubing is checked for wear, and so forth.

Analytical balances and dispensing pipettes are two of the most commonly used instruments found in the laboratory. Users read and are familiar with the instructions and SOPs for these devices. Both receive regular calibration for precision and accuracy. Operators check to ensure balances are level before each use. Calibration is documented in a balance logbook. Pipettes are checked by weighing multiple aliquots of water, as described in the pipette SOP; this is also documented. Both receive regular cleaning. Balances and hand pipettes are susceptible to corrosion and appropriate precautions are taken.

Instrument Service, Maintenance and Repairs
Instrument service falls into two categories: routine and non-routine maintenance. Each instrument has a log book in which these events are recorded. Most instruments have routine and non-routine maintenance forms which prompt the operator through steps of maintenance.

Routine (scheduled) maintenance is required for some instruments. The equipment SOP provides information for service intervals. The Chief Chemist or Laboratory Manager arranges for regular maintenance by an instrument operator, by the responsible person designated in the SOP, or by the factory service engineer. All routine maintenance performed on an instrument is recorded in the instrument’s routine maintenance form or log. Routine maintenance entries include in detail what was done, whether the maintenance was conducted in accordance with the SOP, date of maintenance and initials of the person recording the maintenance.

A non-routine maintenance is defined as an instrument failure that prevents the use of the instrument. A reasonable attempt to repair the machinery may be made by the staff, but major repairs are made by factory service engineers. A record of these

failures is essential to the diagnosis of the problem, especially when the failure is one that recurs. Logs include the date of the non-routine maintenance, how the problem was discovered, nature of the defect, actions taken and initials of the individual entering the information into the log. When repairs are made by factory service representatives, the representative's notes are attached to the log.

Diagnostic and Corrective Actions for Quality Improvement

Feedback

All employees are expected to pursue quality improvement in every aspect of their work. Detecting and preventing problems that affect quality is an important aspect of quality improvement. All employees are responsible for identifying conditions that are adverse to the quality of work performed in the laboratories and reporting to the responsible management for evaluation and action.

Effective communication and feedback from staff at all levels, laboratory clients, and suppliers is an important aspect of quality improvement.

Personnel are encouraged to keep abreast of, and evaluate, new ideas and current developments within their appropriate scientific discipline. An attitude of continuous improvement in data quality should incite a continuous effort to improve work practices and data quality. New ideas should be discussed with management. At the discretion of the appropriate supervisor, a new procedure may be tried and tested, validated, and become a SM or SOP.

Proficiency Testing

ASL participates in several performance evaluation (PE) programs. PE samples containing a comprehensive list of organic and inorganic analytes are tested as part of an annual certification as a Drinking Water Laboratory with the Idaho Department of Health and Welfare.

ASL's soil and plant analyses are evaluated in the North American Proficiency Testing Program through the testing of PE samples.

ASL participates in the National Blood Lead Proficiency Testing Program (Wisconsin State Laboratory of Hygiene) for which blood samples are analyzed approximately monthly. ASL analyzes quality control samples from the Veterinary Laboratory Association Quality Assurance Program approximately quarterly.

Calibration

Calibration is a procedure of comparing instrument output to a traceable standard. Instrument(s) used in a procedure are calibrated with standards traceable to certified materials. Standard solutions are prepared only by qualified, trained personnel.

Analytical instrument(s) are calibrated according to a specified procedure. The history of the calibration standards must be traceable to the original standard. If a check calibration is unacceptable for any reason, corrective action is taken until the calibration is acceptable. Corrective action may include instrument adjustment, instrument repair, and re-preparation of standards or reagents. Re-calibrations during the course of the analysis may be necessary depending on the nature of the instrument. For ICP and AA, re-calibrations are performed when check standards and/or reference materials are

out of acceptable ranges. Other instruments are calibrated according to the procedure in use. Whenever calibration yields instrument response factors (peak area, millivolts, characteristic mass, slope, etc.) these factors must be recorded in either a notebook, the quality control form, or on the instrument output.

Quality Control in the Analysis of Samples

Quality Control (QC) practices must be an integral part of every procedure used in the laboratory. QC serves first to give confidence and reliability to analytical results, and second to warn of defective results. QC serves third to determine the statistical significance and certainty of results. The tables at the end of this section specify the minimum QC requirements for lab analyses. ***Individual methods and client needs may require additional QC samples and criteria.*** The QC terms used, as well as others, are further defined in the section "Laboratory Quality Control Terms."

A ***reagent blank*** is prepared and analyzed with each batch of samples. Whenever available, a ***matrix blank*** is also analyzed to guard against false positive results.

Analysis of known samples (***control samples***) is the cornerstone of quality control and method validation. When ***reference materials*** (certified or in-house) are available with known values of analyte and suitably matched matrix, one or more is analyzed in each batch. This guards against false negative results and is an indication of the performance of the analysis. In addition, or when certified reference materials are not available, it may be possible to prepare ***matrix spikes***: a known amount of analyte(s) is added to either a matrix blank or a typical sample for use as a control. Spike samples must contain enough analyte to be reliably measured: more than the lower limit of quantification and less than the highest standard. If a spike must be made over a background level of analyte (laboratory fortified sample), the spike should be at least half the background, however twice the background is preferred (for EPA methods, spikes are two to three times the background level). The analysis of standards or blanks may be used as a measure of instrumental drift, but is not a substitute for the analysis of a sample having known values of analyte(s).

The analysis of control samples should precede the analysis of samples. If the analysis of the control is unacceptable the analysis will be stopped and corrective actions taken until an acceptable control value can be produced. Each method specifies the acceptance criteria for control values (for example, within twice the standard deviation or a given percentage range of the expected result). Client DQO's may also include specifications for control samples and acceptance criteria.

Replicate analysis is used to demonstrate repeatability (or reproducibility if not all factors are the same) of results and statistical measures of significance. At least one duplicate will be run per batch. Careful and correct laboratory sampling procedures are used in order that replication measures the repeatability of the method, more than the uniformity of the sample. Replicate analysis can also reveal contamination of glassware or sampling equipment. When poor repeatability is frequent, the analyst checks for contamination, inadequate cleaning, and insufficient rinsing of samplers.

Minimum QC Requirements for Inorganic Analyses

Quality Control	Frequency	Comments
Reagent/Extraction Blank	1 per batch	
Sample duplicates	1 pair per batch or every 15 samples	If insufficient sample for duplicates, spike matrix blank in duplicate.
Matrix Spike/ Matrix Spike Duplicates	As applicable in the method or as requested by the client.	
Reference Material	At least 1 per batch	See method requirements.
Calibration Blank	Beginning, end, and every 15 samples in a batch	
Check Standard	Beginning, end, and every 15 samples in a batch	

Minimum QC Requirements for ASL Organic Analyses
(*other than Vet-Tox. and Special Projects*)

Quality Control	Frequency	Comments
Reagent/Extraction Blank	1 per batch	
Matrix Spike Duplicates	1 pair per batch or every 15 samples	
Surrogates(s)	When applicable, added to every sample including QC	
Reference Material	When available	
Calibration Blank	Beginning, end, and every 15 samples in a batch	
Check Standard	1 per batch	

Minimum QC Requirements for ASL Organic Vet-Tox./ ASL Special Projects

Quality Control	Frequency	Comments
Reagent/Extraction Blank	1 per batch	
Control (in-house reference, e.g., serum, brain) *and/or* Over-spike of sample or control	At least 1 per batch; see method for possible further requirements.	Run duplicates if sufficient material (control, sample) or if > 1 sample in batch.

Minimum QC Requirements for IFQAL Organic Analyses

Quality Control	Frequency	Comments
Matrix Blank	1 per batch	
Matrix Spike Duplicates	1 pair per batch	
Matrix Extract Spike	1 per batch	Often referred to as "QC Blank" or "QC Check"
Surrogates(s)	When applicable, added to every sample *except* Matrix Blank	
Calibration standard sequence	At least 3 levels are run throughout the batch.	Generally, a standard is run every 5 samples (see individual method requirements).

Laboratory Quality Control Terms:

- ***Laboratory Reagent Blank:*** An aliquot of reagent water or other blank reagent that is treated exactly the same as a sample. This includes exposure to all glassware, equipment, solvents, reagents, internal standards, and surrogates that are used with other samples. The laboratory reagent blank is used to determine if method analytes or other interferences are present in the laboratory environment, the reagents, or the apparatus.
- ***Laboratory Fortified Reagent Blank:*** An aliquot of reagent water or other blank reagent to which known quantities of the method analytes are added in the laboratory. It is processed and analyzed exactly like a sample to determine if the methodology is in control, and whether the laboratory is capable of making accurate and precise measurements.
- ***Matrix Blank:*** A subsample of matrix that is the same or similar to the sample matrix is processed and analyzed exactly like a sample. The matrix blank is used to determine if interferences are present in the matrix, laboratory environment, the reagents, or the apparatus.
- ***Laboratory Fortified Sample Matrix*** *(also termed* ***Matrix Spike****):* A subsample of a sample matrix (e.g., plasma, soil, plant material) to which known quantities of the method analyte(s) are added in the laboratory. It is processed and analyzed exactly like a sample to determine whether the sample matrix affects recovery of the analyte(s) of interest and contributes bias to the analytical results.
- ***Matrix Spike Duplicates:*** Duplicates are made when two separate subsamples of the sample are spiked with the same concentration of target analyte(s). Matrix spike duplicates help determine the method bias and precision for the specific matrix.

- ***Laboratory Fortified Sample Matrix Extract*** *(also termed* ***Matrix Extract Spike,*** *and at IFQAL,* ***QC Check*** *or* ***QC Blank):*** A blank sample matrix is processed exactly like a sample; then known quantities of the method analyte(s) are added to the extract prior to analysis. Analysis helps determine interferences from extracted matrix components during the analytical step of the method.
- ***Sample Duplicates:*** Two subsamples of the same sample taken in the analytical laboratory and analyzed separately with identical procedures. Analyses indicate the precision associated with laboratory procedures, but not with sample collection, preservation, or storage procedures.
- ***Standard Reference Materials:*** Substances of known characterization (identity, purity, concentration, etc.) that are used in calibration or as a reference in evaluating the performance of an analysis. In general, these include:

  Certified Analytical Standards: Analytes used for preparing solutions for calibration standards, check standards, internal standards, surrogates, or spiking solutions (for laboratory fortified reagent blanks and matrix spikes). *See further explanations of these types of standards elsewhere in this listing*.

  Certified Reference Materials or In-house Reference Materials: Reference materials of a given matrix (e.g., blood, bovine liver, plant leaves, pine needles, rice flour, water) containing a known amount of an analyte that has been statistically demonstrated and documented by a reputable outside source or by the laboratory ("in-house").
- ***Primary Standard:*** Term used at ASL for a solid reference material (analyte) or a concentrated solution containing one or more method analytes; the primary standard is purchased from a reputable commercial source and is the initial source for preparing dilutions. At IFQAL, the term ***neat standard*** is used for the commercial solid reference material, and ***primary standard*** designates a solution prepared directly from it in the lab.
- ***Secondary, Tertiary, etc. Standards:*** A solution of one or more analytes prepared in the laboratory from stock standard solutions, and diluted as needed to prepare calibration solutions and other analyte solutions. (A secondary standard is prepared from a primary standard, tertiary from a secondary, etc.)
- ***Calibration Standard:*** A solution prepared from stock standard solutions (see primary, secondary, etc.). The calibration standard solutions are used to calibrate the instrument response with respect to analyte concentration.
- ***Internal Standard:*** A pure analyte added to a sample, extract, or standard solution in a known amount, and used to measure the relative responses (for example, GC column retention time) of other method analytes and surrogates that are components of the same sample or solution. The internal standard thereby provides correction for instrument drift. It must be an analyte that is not a sample component.
- ***Surrogate Analyte:*** A pure analyte, which is extremely unlikely to be found in any sample, that is added to a subsample in a known amount before extraction or other processing, and is measured with the same procedures

used to measure other sample components. The purpose of the surrogate analyte is to monitor method performance with each sample (for example, recovery of analyte).

- ***Check Standard:*** A solution of one or more method analytes, surrogates, internal standards, or other test substances used to evaluate the performance of the instrument system with respect to a defined set of criteria. This solution does not pass through extraction or other processing.

Types of Field Quality Control Samples Submitted by Clients:

- ***Trip Blanks***: Trip blanks are primarily used in VOC analysis. They determine whether contamination has occurred during transport.
- ***Field Duplicates***: Field duplicates aid in establishing the reproducibility of the results considering both sampling in the field and analysis processes.
- ***Equipment Rinsate Blanks***: Determine whether or not field sampling equipment was adequately decontaminated between sampling sites.
- ***Field Split Samples***: Split samples allow for inter-laboratory comparisons.

Quality Control: Review, Corrective Action, and Documentation

The review and documentation of sample and quality control analyses are the responsibility of the analyst and supervisor. Peer review also occurs during all phases of a procedure, from sample preparation to analysis, and finally, to the reporting of results. This peer review is required to guard against potential errors: typographical, transcription, calculation, technique, as well as errors in judgment.

Failure of a procedure to meet QC standards is inevitable, and can happen at any stage in the analysis. When this happens the analyst tries to determine the cause and may discuss the matter with any other personnel. Laboratory methods and equipment SOPs specify general corrective action steps for resolving problems. If the analyst cannot determine the cause of the failure he/she will discuss it with their supervisor. Corrective action is then planned and executed. If an instrument failure is the problem, the responsible person is notified, as designated in the SOP for that instrument. Examples of remedial action include: re-preparation of samples, QC samples, and/or reagents; re-analysis; re-calibration; or instrument adjustment. Any corrective actions are fully documented in the raw data package for the analysis and in the instrument logbook if applicable.

Each analytical batch (a batch may be as small as one sample and its associated QC) will generate a QC report. This report is produced by the analyst, read by the senior chemist (if applicable), and given to the Group Leader, Chief Chemist, or Laboratory Manager, as applicable, for final review. The report includes calibration information, instrument performance data, control sample results, computer data file names, bench sheet, notebook references, dates and names of analysts. This report accompanies a summary of the results in the batch. If there are original instrument tracings, or a printed log, these too become part of the report. The entire package is submitted to the Chief Chemist or Organic Group Leader at ASL or the Laboratory Manager at IFQAL for final disposition. This person judges the acceptability of results and includes this

assessment in the associated QC report by dated signature. If some results are rejected, the reasons are stated and the associated data are maintained in the data package. In multi-component analyses, any component may be excluded either from the entire run or from any particular matrix if adequate control cannot be established. If results are accepted despite a failure of the usual QC, the individual writes the justification on the QC report. Acceptable QC is also noted in the report. Results that are below method detection limit will be reported as BDL.

Identification and Correction of Deficiencies

Deficient conditions that are identified are documented and corrected via a formal procedure. A yearly facility inspection is performed by the ASL/IFQAL quality assurance officer. The quality assurance officer provides written reports to management documenting any deficient conditions that may have been identified. The Chief Chemist at ASL and the Laboratory Manager at IFQAL are responsible for overseeing the correction of these deficiencies and notifying the quality assurance officer of the corrective procedures. See the SOP, *General Facilities Inspection,* in Appendix E for details about the conduct of this inspection.

Following a formal process of assessments and inspections allows deficiencies to be tracked and followed through to corrections. Documentation of deficient conditions is an important tool in determining root causes of serious problems.

Deficient conditions identified by employees are brought to the immediate attention of their supervisors. Resolution is delegated by the Chief Chemist, Laboratory Manager, or group leader.

Laboratory Evaluation and Audits

QAU Authority and Responsibilities

The primary responsibility of the QAU is to monitor routine laboratory analyses and regulated studies to ensure management that facilities, equipment, personnel, methods, practices, records, raw data, and quality controls are compliant with applicable GLP Standards, project plans, project specific protocols and QA plans, SOPs, SMs, and/or the procedures outlined in this document, as appropriate to the study or analysis. A major goal is to maintain compliance with GLP requirements to the full extent of applicability for analyses. However, many non-regulated, client-submitted cases do not specify or provide required elements for GLP compliance. Hence, many components of GLP-regulated studies, such as study directorship, formal protocols, master schedule entries, and final summary reports do not exist for these analyses.

The following responsibilities and authorities of the QAU are designed to promote the production of quality data while assuring compliance with applicable regulations and laboratory standards. SOPs pertaining to QAU activities are provided in Appendix E.

Annual ASL and IFQAL Facility Audits

The QAU conducts annual, comprehensive inspections of facilities in accordance with the SOP titled *General Facility Inspection* (Appendix E) and submits a report to laboratory management. Laboratory operations are monitored in areas including, but not limited to, the following:

1. Documentation of employee training;
2. Adequacy of facilities;
3. Management responsibilities;
4. QAU function;
5. Proper receipt and storage of control and reference substances;
6. Calibration, maintenance, design and capacity of equipment;
7. Use and revision of SMs and SOPs;
8. Sample accountability;
9. Proper labeling of reagents, standards, and samples.

Standard Operating Procedure Review

The QAU is part of the peer review and approval process for SOPs and SMs. The primary review responsibility of the QAU relates to monitoring conformance of new or revised SOP and SM drafts to the SOP entitled *Use, Development, Revision, and Approval of Standard Operating Procedures*. The QAU also monitors conformance with established ASL and IFQAL norms. QAU review of proposed SMs purporting to be regulatory methodology also includes comparison to the regulatory method for completeness and accuracy. Modifications to regulatory methods are noted in the title of the SM, e.g. EPA 418.1 modified.

Current SOPs/SMs are continuously reviewed by personnel performing the procedures they describe. In addition, a formal review process is utilized to ensure that all SOPs/SMs accurately reflect current procedures. This review is performed

approximately every three years and is documented on review checklists provided by the QAU.

QAU SOPs
The SOPs reflecting the procedures followed by the QAU in fulfilling their responsibilities are contained in Appendix E of this document. The QAU SOPs are subject to the same review and approval process as all other SOPs.

QC Monitoring
Another prime goal of the QAU is to aid the laboratories in improving and maintaining the precision and accuracy of the laboratories' analytical results. This goal is achieved by monitoring the execution, documentation, and performance of quality control procedures as outlined in this Laboratory Quality Management Plan, Standard Methods, and Standard Operating Procedures. Management, administrative, statistical, investigative, preventive, and corrective techniques are employed by all personnel to maximize the reliability of the data produced by the laboratories.

Master Schedule
The QAU maintains a master schedule of all regulated studies conducted at the testing facilities. The master schedule sheet is indexed by test substance, and identifies the test system, nature of the study, date the study was initiated, current status of each study, the sponsor, and the study director. A second master schedule is maintained by the QAU that contains all applicable information pertaining to non-regulated studies conducted at the laboratories. The QAU follows the SOP titled *Quality Assurance Unit Master Schedule*, which details the procedures associated with maintenance of the master schedule.

Protocols
The QAU maintains copies of all protocols pertaining to all studies for which the QAU is responsible. The SOP entitled *Quality Assurance Files* details the procedure for maintenance and delineates the required contents of QAU study files.

Study Inspections/Audits
The QAU inspects each study for which it is responsible at intervals adequate to ensure the integrity of the study. This may include inspections/audits with primary focus on: facilities; protocol; in-life analytical phase; analytical raw data; in-life field phase; field raw data; or study file and final report. The QAU also maintains written and properly signed records of each periodic inspection showing:

- the date of the inspection;
- the study inspected;
- the phase or segment of the study inspected;
- the QAO performing the inspection;
- findings and problems;
- action recommended and taken to resolve existing problems;
- response;
- any scheduled date for re-inspection.

Any problems that are found during the course of an inspection that are likely to affect study integrity are brought to the attention of the study director (when applicable) and management immediately. Examples of critical items likely to affect the integrity of the study include, but are not limited to:

- lack of test system or test substance storage records;
- failing to meet test substance application interval(s) as specified in the protocol;
- expired reference standard(s) used for residue quantification;
- sample or reference standard integrity jeopardized by inappropriate storage temperatures;
- or failure to retain all raw data.

Deviations

During the course of periodic study and facility inspections, the QAU determines if deviations from approved protocols, SOPs, or SMs were made without proper authorization and documentation. Deviations are reported to testing facility management. In addition, deviations occurring during regulated studies (e.g., IR-4) are reported to the study director.

The QAU notifies management immediately of problems discovered during inspections that may affect the integrity of routine, client submitted sample analyses. Management initiates corrective action and responds to QAU concerns with a written report detailing the problem, the possible effects on data integrity, and actions taken to rectify the problem.

Final Report and Raw Data Review

The QAU reviews the raw data and the final study report, as a required inspection for all regulated studies. The final report is audited to assure it accurately describes the methods and procedures, and that the reported results accurately reflect the raw data of the study. The QAU also reviews the final study report of all non-regulated studies for which a final summary report is produced.

QAU Audit Statement

The QAU shall prepare and sign a statement to be included with the final report of a regulated study that shall specify study phases inspected, and the dates of inspections and report of findings to management and study director. The QAU also prepares a statement, at management request, for non-regulated studies requiring a comprehensive final report.

QAU Audit Log
The responsibilities and procedures applicable to the QAU, the records maintained by the QAU, and the method of indexing records are documented in writing. The QAU audit log includes the inspection dates, the study inspected, the phase or segment of the study inspected, and the name of the individual performing the inspection. The audit log will be made available for inspection to authorized employees or duly designated representatives.

Regulatory Agency Access
An authorized employee or duly designated representative of a regulating agency shall have access to the written procedures established for the inspection and may request testing facility management to certify that inspections are being implemented, performed, documented, and followed up in accordance with requirements.

Quality Assurance Reports to Management

Annual ASL and IFQAL Facility Audit
The QAO performs annual facility audits providing management with a written report from the results of the inspection. The QAU maintains written and properly signed records of each annual inspection showing:

- The date of the inspection;
- The QAO performing the inspection;
- Findings, problems, and recommended action;
- Responses from management and action taken to resolve existing problems.

Any problems that are found during the course of an inspection that are likely to affect study or data integrity are brought to the attention of ASL or IFQAL management immediately. Problems affecting regulated studies (e.g., IR-4) are reported to the study director as well.

Status Reports
The QAU periodically submits to ASL management written status reports on each regulated study, noting any problems and corrective actions taken by laboratory personnel in response to QAU findings. Reports generated regarding regulated studies are forwarded to the study director (generally off-site) after ASL management review and response.

Lab Documentation and Forms

Laboratory Documentation Practices

Every analyst must be familiar with and diligently use the laboratory documentation practices defined in this Quality Management Plan (QMP), the Standard Methods (SM) Manual, and the Standard Operating Procedures (SOP) Manual. These manuals contain detailed instructions for documenting all phases of laboratory work, including requirements for note keeping, error corrections, labeling, reagent and standard preparation, sampling, equipment maintenance, and laboratory analyses. Lab forms utilized at ASL and IFQAL guide the documentation trail necessary for reconstructable data and compliance with quality control procedures.

Bench Sheets

Each standard analysis performed at ASL and IFQAL has an associated bench sheet or method specific notebook that serves as a documentation repository for routine analyses. Analysts are responsible for ensuring the completeness of the documentation trail. All information necessary to reconstruct the analysis must be recorded. This may include:

1. Sample identification number and sample submitter information;
2. Sample weight;
3. QC sample information (matrix, fortification information such as source, purity, date prepared, expiration date, etc.);
4. Analytical extraction procedures (date with personnel initials per step);
5. Reagents and solutions (manufacturer, grade, lot number, and preparation information);
6. Date and initials of personnel performing specific analysis;
7. Instrumentation used (i.e. balance, pH meter, pipette, etc.) and record of calibration;
8. Date, time and initials of personnel removing and replacing samples from refrigerators/freezers (required for regulated studies);
9. Footnotes explaining any deviations from the method or SOPs, or any observations and additional information that will aid in

The file path for each bench sheet is defined in the SM document or a copy may be obtained from the MIS (Management Information Systems) office group files (for ASL). All spaces for information must be completed, dated and initialed. Spaces left blank are to have a line drawn through them with the current date and initials of the person completing the form. Documentation of error correction utilizes the accepted laboratory codes that explain the reason for the correction, along with the initials and date of the person entering the correction, as described in each lab's SOP, *Rules for Proper Correction of Raw Data.*

Bench sheets are used for most analyses, but are not applicable to a few specialized procedures. Method specific notebooks are maintained for these procedures and are shared by all personnel conducting the analysis. Analysts using a method specific

notebook should follow a defined procedure for entries to ensure the capture of all necessary information.

A notebook or bench sheet is created for each special project during method development. All the initial work on a project is recorded here, rather than in the routine notebooks or sheets. As the project progresses, methodology should be captured on standardized forms.

Personal Notebooks
Personal notebooks are issued to all permanent staff. These notebooks should be used for training notes, personal observations, work scheduling or organization, and any other purpose related to the analyst's duties. These notebooks are retained by the lab for potential future reference.

Quality Control Forms
An integral part of the raw data package for all analyses performed includes appropriate documentation of adherence to the QC procedures as required in the standard method and the QMP. Standard forms (often termed “Quality Control Summary Sheets” or “Quality Control Records”) have been designed to adequately capture pertinent information and facilitate adherence to this requirement. The file path for the QC form is defined in the SM for the procedure, or copies may be obtained from Management Information Systems (MIS) office group files for ASL analyses. Personnel monitor the QC forms to ensure applicability to current procedures and update when necessary. A QC form is also required as part of a method validation packet.

Analysts are required to create specific forms for specific analyses that will reflect the nature of each method. These custom forms include all the relevant information needed for complete quality control. The form states the title of the analysis, the names of the analysts involved, the date of the report, and the page(s) of the notebook if applicable. Spike and surrogate recoveries and QC check standard results are presented, as appropriate. Instrument calibration data sufficient to reconstruct the calibration curve may be recorded here, or are included in the data package, as are characteristic mass, response factors, etc., when applicable. Chromatography QC forms also include calibration curve correlation coefficients. Computer data files, when used, are referenced by name; data files can include autosampler sequence files, data storage files, analytical method files, calibration files, and so forth.

Custom QC report forms are typically maintained in computerized form. This allows easy modification and improvement. The files have been created with Microsoft Word for Windows or Excel and are designed to print on a LaserJet printer. Custom forms are not placed in private directories and are always left in the public domain of the laboratory computer network.

Labeling
All standards, solutions, and reagents in the laboratories are labeled according to the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), Good Laboratory Practice Standards. Laboratory personnel are to follow the detailed instructions in the following SOPs:

ASL: *General Requirements for Receipt, Storage, and Labeling of Analytical Standards and Reference Materials (SOP.35.050);* and *Labeling of Solutions and Reagents (SOP.40.030).*

IFQAL: *General Requirement for Receipt and Handling of Standards (SOP.35.500);* and *Solution, Reagent, and Analytical Standard Labeling (SOP.40.520).*

Any dilutions prepared from the source standard will include the source code [code produced from dilution of the source standard, i.e., primary (p), secondary (s), tertiary (t), quaternary (q), and the date the source standard was either prepared or received], use code (code, as above, which identifies the dilution of the standard being prepped and the date of preparation), initials of personnel preparing standard, expiration date, and storage conditions. Other preparation information (solvent, balance and pipette identification, etc.) is captured on standard forms in a UI ASL or IFQAL Analytical Standard Preparation Logbook or other standard record notebook.

Sample storage containers are labeled with the case number, sample number (referred to as the LIMS number at ASL), date and initials of person receiving, and when appropriate any other assigned identification number (see ASL's SOP *General Sample Receipt* and IFQAL's *Sample Receipt and Log In* for more information). The case number is a number assigned to a group of samples submitted by the same client on the same date and time. The sample number is the unique sample identification number assigned to each sample within a group. Other unique identification numbers may be assigned during subsampling. Special status labels such as HOLD, RABIES, SUSPECT, and URGENT will be used on sample containers as appropriate.

Labels of sample extracts and preparations include the sample number, preparation step, analyte, solvent, date, and initials of the analyst. An exception is made for sample preparation and extractions an analyst may be working on in the laboratory that are for immediate use and do not require storage. These samples are labeled with the sample identification number and may or may not include other labeling information. At a minimum these samples contain sufficient labeling to maintain sample identity.

Sample Accountability
Sample accountability ensures that the identity and integrity of a sample are preserved. Samples are received, stored, subsampled, analyzed and disposed of according to management protocol. Sample accountability extends into the analytical process to ensure that samples and results are properly identified.

Sample accountability begins with the Sample Receiving Custodian (or the designated Lab Technician at IFQAL) and is also the responsibility of every analyst who handles

the sample. All personnel take precautions to ensure that no loss, contamination, tampering, decomposition, theft, or fraud occurs.

Samples are labeled in such a way as to provide unmistakable identification of the sample (see *Labeling* above). The laboratories have a supply of forms, labels and seals for this use. Physical security for the sample commensurate with the importance and risk is maintained; at minimum, this involves storage in a lockable room and may require storage in a locked cupboard or freezer.

Sample Receipt
Several SOPs have been approved for sample receipt instructions. Please refer to:

ASL SOP	
SOP 25.010	General Sample Receipt
SOP 25.020	EasyLIMS Sample Log-In
SOP 25.030	Sample Inspection Upon Receipt
SOP 25.040	Sample Chain of Custody
SOP 25.050	Case Check-In for Veterinary Toxicology (VetTox)

IFQAL SOP	
SOP 25.500	Sample Receipt and Log In
SOP 25.510	Blank Receipt and Log In
SOP 25.520	Sample Inspection Upon Receipt
SOP 25.530	Sample Chain of Custody

In general, samples are delivered to the laboratory where they are unpacked and inspected. A case number and a unique sample number are assigned and entered in the sample receiving log (ASL: Laboratory Information Management System, LIMS; IFQAL: computer worksheets), where they are cross-referenced to the submitter's sample identification. Each sample is labeled with its lab sample number, case number, date, and the sample receiving personnel's initials. Samples for regulated studies require additional information on the labels (see ASL/IFQAL SOP.90.010).

The log also records the client (owner and veterinarian for Veterinary Toxicology), sample types, the sample condition (e.g., frozen, thawed; preservation used; condition of the container, seals, and labels), requested analyses, date received, storage location, and the submitter's case number, and initials of the person receiving the samples. Analysts are notified of any water samples requiring immediate attention for preservation. If there is any question concerning the condition of a sample upon receipt, especially as it may affect the validity of an analysis, a chemist or group leader is notified and the sample is held until further notice. All samples are placed in the appropriate storage unit following check-in, and analysts are notified when samples arrive that require immediate attention.

Computer generated work lists are printed out at least weekly at ASL for distribution to personnel for workload scheduling and sample tracking.

Chain of Custody
Please refer to the SOP entitled *Sample Chain of Custody* (ASL 25.040; IFQAL 25.530). Chain of custody is a legal concept for positive inventory control of samples. A chain of custody document is a form which is attached to a sample at the time and place of collection; the collector signs and dates the form, and is responsible for the

integrity of the sample until it is transferred to the custody of another. ASL and IFQ AL assume sample custody at sample receipt, and continue the documentation trail as each sample is stored, subsampled, prepared and analyzed, archived, and disposed of.

Sample Storage

Continuous monitoring of freezers and refrigerators is part of maintaining the integrity of samples. The condition of the sample will be noted during check in. If the condition of the sample is changed, especially during the course of sample preparation, this is noted on the chain of custody form and in the raw data. Each storage unit is given a unique identification. Knowing the current location of the sample is a time saving piece of information. Knowing the history of where a sample has been stored is a significant part of knowing the physical condition of the sample, as the temperature of each storage unit is recorded.

Each freezer or refrigerator where samples are kept will have a temperature-monitoring device inside and a log sheet attached to the door. Most refrigerators and freezers are equipped with a min-max thermometer. This facilitates monitoring by recording the minimum and maximum temperatures achieved. These storage units have a designated person responsible for recording the minimum and maximum temperature with the date and their initials on the temperature log. Some units have continuous monitoring by a thermograph. A designated person is responsible for replacing the recording paper. The dates and initials of the personnel removing and replacing the paper are recorded on each thermograph recording paper. Temperature loggers (HOBOs®) are utilized in certain storage units in addition to a thermometer or thermograph; the stored temperature data are off-loaded on a regular schedule to give a storage temperature record in graphical form covering an extended period. If a refrigerator or freezer fails, the supervisor is immediately notified and the samples are transferred to another location.

All samples are stored in a secure, limited access facility. Personnel closely monitor access to the lab, challenging all unauthorized persons. The doors accessing storage units are kept locked when no one is around. Limiting access to the sample helps guarantee that the sample is not altered or manipulated by unauthorized persons.

Samples are kept by the laboratory until sample specific holding time has passed. When a sample is removed for analysis, it is returned as soon as possible to the storage area so that other tests can be performed promptly and the integrity of the sample is not compromised. Some samples require subsampling to be done with liquid nitrogen to preserve sample integrity. This is designated in the standard method.

Sample Handling

Samples and subsamples may be withdrawn for tests. The (sub)sample is transferred into a labeled container for analysis. The label includes, at minimum, the sample number, along with any other relevant information (see *Labeling* above). Regulated studies have additional requirements. When a sample is milled or ground, any surplus

sample is stored and noted to that effect. Every time a sample (or extract) is transferred, the new container is labeled.

When a sample is weighed or pipetted, the case and sample numbers and the amount removed for analysis are all recorded in a logbook or benchsheet. For regulated studies at ASL and for all samples at IFQAL, sample inventory forms are filled out with the date, time, and initials of the persons removing and returning the sample from storage, the reason (grinding, sampling for analysis, etc.), and the storage location. This information helps in knowing who to ask questions about the state and location of the sample.

All autosampler containers are labeled distinctly making it possible to check the vials against the sequence description. All recorder tracings, printouts or data files have identification for each result that uniquely links it to a sample and analysis date. Redundant labeling is desirable because it facilitates error trapping.

Sample Disposal

All sample disposals are recorded. Samples are kept by the laboratory for a minimum of 30 days after the completion of analysis, or as specified in project protocols. The report informs the submitter of this policy. At the request of the submitter, the samples may be kept longer or returned. Samples that are known legal evidence may be kept for extended periods. As an analysis is completed, samples are transferred to long-term storage before final disposal. Samples classified as hazardous waste will be returned to the submitter, if possible.

Subcontracting of Services

In the event that ASL or IFQAL do not have the capability or capacity to perform required analyses, the Chief Chemist (ASL) or Laboratory Manager (IFQAL) will subcontract the work with client knowledge and approval. Potential subcontract laboratories must meet the quality assurance standards of ASL/IFQAL and the client's quality assurance expectations.

Standard Operating Procedures

In addition to this QMP, the laboratories maintain a Standard Methods (SM) Manual (detailing analytical methods) and a Standard Operating Procedures (SOP) Manual that details administrative, computer related, safety, general-repetitive, and instrument procedures. SOPs and SMs are the standard procedures that trained personnel follow to ensure the quality and integrity of their work. All repetitive tasks, procedures, and methodologies conducted at ASL and IFQAL are described in these written, management approved SOPs and/or SMs. These are maintained in a document control format in which each title is assigned a consecutive version number; the cover page displays the approval dates and signatures. The current versions are readily available to all personnel in manuals located throughout the laboratories, as well as on the laboratory computer network. Those versions that are no longer in use are signed by the QAU to indicate archival and are maintained in a historical file.

The responsibility for the drafting, revision, and review of SOPs and SMs rests with the laboratory personnel executing the procedures. Continuous SOP and SM review and revision ensures accurate reflection of the standard procedures of laboratory practices. In addition, a formal review process is utilized to ensure that all SOPs/SMs accurately reflect current procedures. This review is performed approximately every three years and is documented on review checklists provided by the QAU.

For a complete description on procedures for development, review, approval, use, document control, archival, and revision of standard operating procedures please refer to the procedures for SOPs in the ASL/IFQAL Standard Operating Procedures Manual. These SOPs are available in the SOP manuals provided in the laboratories and may also be obtained by request from the Analytical Sciences Laboratory Quality Assurance Unit.

A copy of the SOP manual table of contents and SM manual table of contents for ASL and IFQAL is in appendix F.

Laboratory Personnel Training Record

Every analyst must be familiar with and diligently use the laboratory practices defined in the Laboratory Quality Management Plan, Standard Methods (SM) Manual and the Standard Operating Procedures (SOP) Manual. These manuals contain detailed instructions for all phases of laboratory work. This includes requirements for note keeping, labeling, reagent preparation, sampling, and general laboratory technique. Most of the SMs will assume analyst knowledge of these practices, therefore the analysts must familiarize themselves with the QMP and applicable SOPs prior to initiating laboratory analysis.

Internal training seminars are conducted dealing with new approaches to analysis, QA/QC, or safety issues. Laboratory personnel are required to attend all training meetings, unless supervisor permission is granted. Supervisors are responsible for ensuring that personnel have education, experience and/or are trained to a level of familiarity with SOPs and SMs commensurate with the person's responsibility. Documentation of education, experience, and training shall be maintained in personnel training files.

The maintenance of the personnel training file is the responsibility of the individual employee. An individual's training file is audited annually for the required contents of: current CV or resume; job description; signed Ethics and Data Integrity Agreement; SOP/SM sign-off sheets; safety sign-off sheet; and certification of attendance at training meetings.

An analyst in training is directly supervised by an analyst who has completed training. The supervisor certifies the completion of the training by initialing and dating an employee's SOP/SM sign-off sheets.

Each employee reviews the SOPs/SMs that are applicable to his/her position approximately every two years. This review serves as reinforcement of training as well as an opportunity to update procedures. The employee then initials and dates the SOP/SM sign-off sheets to document review.

Please refer to the SOP for each laboratory entitled *Documentation of Personnel Education, Training, Experience, and SOP Review* for a more detailed description of personnel training and documentation. This SOP is in every SOP manual in the laboratories and may also be obtained by request from the Analytical Sciences Laboratory Quality Assurance Unit.

References

Dux, James P. *Handbook of Quality Assurance for the Analytical Chemistry Laboratory, Second Edition*, New York: Van Nostrand Reinhold, 1990.

EPA-910/9-92-032, Guidance on Preparation of Laboratory Quality Assurance Plans, October 9, 1992.

EPA QA/R-2, EPA Requirements for Quality Management Plans, Draft Interim Final, August 1994.

Good Laboratory Practice Standards (EPA, FIFRA), Title 40 Code of Federal Regulations Part 160, Final Rule, August 16, 1989.

Appendix F
Aquatic Habitat Assessment Protocol
Rapid Bioassessment Protocol Appendix A-1

APPENDIX A:

SAMPLE DATA FORMS FOR THE PROTOCOLS

APPENDIX A-1:

Habitat Assessment and Physicochemical Characterization Field Data Sheets

Form 1: Physical Characterization/Water Quality Field Data Sheet
Form 2: Habitat Assessment Field Data Sheet - High Gradient Streams
Form 3: Habitat Assessment Field Data Sheet - Low Gradient Streams

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

WEATHER CONDITIONS	**Now**	**Past 24 hours**	**Has there been a heavy rain in the last 7 days?** ❑ Yes ❑ No
	❑ storm (heavy rain)	❑	
	❑ rain (steady rain)	❑	**Air Temperature**_____ ^{0} C
	❑ showers (intermittent)	❑	
	____%❑ %cloud cover	❑____%	**Other**_____
	❑ clear/sunny	❑	
SITE LOCATION/MAP	**Draw a map of the site and indicate the areas sampled (or attach a photograph)**		
STREAM CHARACTERIZATION	**Stream Subsystem** ❑ Perennial ❑ Intermittent ❑ Tidal		**Stream Type** ❑ Coldwater ❑ Warmwater
	Stream Origin ❑ Glacial ❑ Spring-fed ❑ Non-glacial montane ❑ Mixture of origins ❑ Swamp and bog ❑ Other_____		**Catchment Area**_____km^2

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (BACK)

WATERSHED FEATURES	**Predominant Surrounding Landuse** ❑ Forest ❑ Commercial ❑ Field/Pasture ❑ Industrial ❑ Agricultural ❑ Other _____ ❑ Residential **Local Watershed NPS Pollution** ❑ No evidence ❑ Some potential sources ❑ Obvious sources **Local Watershed Erosion** ❑ None ❑ Moderate ❑ Heavy
RIPARIAN VEGETATION (18 meter buffer)	**Indicate the dominant type and record the dominant species present** ❑ Trees ❑ Shrubs ❑ Grasses ❑ Herbaceous **dominant species present** _____
INSTREAM FEATURES	**Estimated Reach Length** _____m **Estimated Stream Width** _____m **Sampling Reach Area** _____m^2 **Area in km^2 (m^2x1000)** _____km^2 **Estimated Stream Depth** _____m **Surface Velocity (at thalweg)** _____m/sec **Canopy Cover** ❑ Partly open ❑ Partly shaded ❑ Shaded **High Water Mark** _____m **Proportion of Reach Represented by Stream Morphology Types** ❑ Riffle_____% ❑ Run_____% ❑ Pool_____% **Channelized** ❑ Yes ❑ No **Dam Present** ❑ Yes ❑ No
LARGE WOODY DEBRIS	**LWD** _____m^2 **Density of LWD** _____m^2/km^2 **(LWD/ reach area)**
AQUATIC VEGETATION	**Indicate the dominant type and record the dominant species present** ❑ Rooted emergent ❑ Rooted submergent ❑ Rooted floating ❑ Free floating ❑ Floating Algae ❑ Attached Algae **dominant species present** _____ **Portion of the reach with aquatic vegetation** _____%
WATER QUALITY	**Temperature**_____^{0} C **Specific Conductance**_____ **Dissolved Oxygen** _____ **pH** _____ **Turbidity** _____ **WQ Instrument Used** _____ **Water Odors** ❑ Normal/None ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Fishy ❑ Other_____ **Water Surface Oils** ❑ Slick ❑ Sheen ❑ Globs ❑ Flecks ❑ None ❑ Other_____ **Turbidity (if not measured)** ❑ Clear ❑ Slightly turbid ❑ Turbid ❑ Opaque ❑ Stained ❑ Other_____
SEDIMENT/ SUBSTRATE	**Odors** ❑ Normal ❑ Sewage ❑ Petroleum ❑ Chemical ❑ Anaerobic ❑ None ❑ Other_____ **Oils** ❑ Absent ❑ Slight ❑ Moderate ❑ Profuse **Deposits** ❑ Sludge ❑ Sawdust ❑ Paper fiber ❑ Sand ❑ Relict shells ❑ Other_____ **Looking at stones which are not deeply embedded, are the undersides black in color?** ❑ Yes ❑ No

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)			**ORGANIC SUBSTRATE COMPONENTS (does not necessarily add up to 100%)**		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**	**Substrate Type**	**Characteristic**	**% Composition in Sampling Area**
Bedrock			Detritus	sticks, wood, coarse plant materials (CPOM)	
Boulder	> 256 mm (10")				
Cobble	64-256 mm (2.5"-10")		Muck-Mud	black, very fine organic (FPOM)	
Gravel	2-64 mm (0.1"-2.5")				
Sand	0.06-2mm (gritty)		Marl	grey, shell fragments	
Silt	0.004-0.06 mm				
Clay	< 0.004 mm (slick)				

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	1. Epifaunal Substrate/ Available Cover	Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Velocity/Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (Slow is < 0.3 m/s, deep is > 0.5 m.)	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—HIGH GRADIENT STREAMS (BACK)

Parameters to be evaluated broader than sampling reach	Habitat Parameter	Condition Category			
		Optimal	Suboptimal	Marginal	Poor
	6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	8. Bank Stability (score each bank) Note: determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
	9. Vegetative Protection (score each bank)	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
	10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
	SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
	SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score _____

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (FRONT)

STREAM NAME	LOCATION	
STATION #_____ RIVERMILE_____	STREAM CLASS	
LAT _____ LONG _____	RIVER BASIN	
STORET #	AGENCY	
INVESTIGATORS		
FORM COMPLETED BY	DATE _____ TIME _____ AM PM	REASON FOR SURVEY

Parameters to be evaluated in sampling reach	Habitat Parameter	Condition Category			
		Optimal	**Suboptimal**	**Marginal**	**Poor**
	1. Epifaunal Substrate/ Available Cover	Greater than 50% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	30-50% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	10-30% mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 10% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	2. Pool Substrate Characterization	Mixture of substrate materials, with gravel and firm sand prevalent; root mats and submerged vegetation common.	Mixture of soft sand, mud, or clay; mud may be dominant; some root mats and submerged vegetation present.	All mud or clay or sand bottom; little or no root mat; no submerged vegetation.	Hard-pan clay or bedrock; no root mat or vegetation.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	3. Pool Variability	Even mix of large-shallow, large-deep, small-shallow, small-deep pools present.	Majority of pools large-deep; very few shallow.	Shallow pools much more prevalent than deep pools.	Majority of pools small-shallow or pools absent.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	4. Sediment Deposition	Little or no enlargement of islands or point bars and less than <20% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 20-50% of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 50-80% of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 80% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
	5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
	SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET—LOW GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Sinuosity	The bends in the stream increase the stream length 3 to 4 times longer than if it was in a straight line. (Note - channel braiding is considered normal in coastal plains and other low-lying areas. This parameter is not easily rated in these areas.)	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	The bends in the stream increase the stream length 1 to 2 times longer than if it was in a straight line.	Channel straight; waterway has been channelized for a long distance.
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank)	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) Note: determine left or right side by facing downstream.	More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Parameters to be evaluated broader than sampling reach

Total Score _____

Appendix G
A Functional Upper Bound of Background

A Functional Upper Bound of Background

MWH Global Energy & Industry
Mining Group
Bellevue, WA, USA
September 3, 2003

Purpose

When investigating a contaminated site the background distribution of an analyte of interest must be characterized to determinate whether the analyte is a contaminant. If it is a site contaminant, knowledge of its background distribution may be used to help determine whether its release poses an unacceptable risk. If the contaminant does pose an unacceptable risk, knowledge of its background distribution may be used to help determine an appropriate cleanup goal. Thus, background data are critical, as is the protocol used to evaluate the data.

The average is often used, inappropriately, as a bright line to characterize background. If the background average is used, it should only be compared to the average for the contaminated site in question (e.g., with a t test); however, any average for the site as a whole may be misrepresentative. For example, if only a small portion of the site is contaminated, a large number of data from clean portions of the site may swamp a small number of contaminated data points and result in a comparison to background that fails to show contamination.

Use of the background average as a simple bright-line decision point to identify hot spots will, on the other hand, falsely identify far too many uncontaminated portions of a site as contaminated. In fact, if the background conditions were well described by a normal distribution (which is not usually the case), the use of the background average as a bright line would result in about half of background being misidentified as contaminated.

Given that an average, or any confidence bound on it (a confidence bound converges to the parameter in question given a large enough sample size), is an inappropriate bright line by which to characterize background, an alternative parameter is needed. The most appropriate is a high-end percentile of the background distribution.

Regulatory guidance most often identifies an appropriate high-end percentile to be the 95th percentile, or $p_{0.95}$. Because there is almost always substantial uncertainty in estimating $p_{0.95}$ (or any other parameter), a confidence bound is used. The resulting statistic can be denoted as $\hat{p}_{0.95;\,1-\alpha,n}$, where the hat indicates an estimate, α is the false-positive error rate, and n is the sample size. Convention sets α at 0.05, and the resulting $\hat{p}_{0.95;\,0.95,n}$ is frequently called the 95/95 upper tolerance bound, because it bounds 95% of the distribution with 95% confidence.

A problem with use of $\hat{p}_{0.95;\,0.95,n}$ is that, with small background sample sizes typically encountered in contaminated site investigations, it often generates unreasonably high values. It is not uncommon for $\hat{p}_{0.95;\,0.95,n}$ to exceed 1,000,000 ppm, a physical impossibility. The appropriate interpretation of such numbers is that there is a need for further background sampling. However, use of $\hat{p}_{0.95;\,0.95,n}$ is not always feasible given budget constraints typically placed on background investigations. To counter a perception of non-credibility of $\hat{p}_{0.95;\,0.95,n}$, some have used $\hat{p}_{0.90;\,0.90,n}$. However, this does not eliminate the problem of non-credible results when n is small and s, the sample standard deviation, is large. Furthermore, the use of $p_{0.90}$ as the parameter of interest is troubling to regulated parties as it implies that they are to be held accountable for approximately 10% of background, which can be an unacceptable amount at large sites. Finally, the use of an α of 0.10, twice the traditional value, smacks of statistic shopping (i.e., searching for a statistic that gives the desired results), thus causing a further erosion of credibility.

The purpose of this paper is to, within the context of an objective protocol, evaluate alternative high-end percentile statistics that avoid the problems inherent with $\hat{p}_{0.95;\,0.95,n}$, and recommend one for use as a bright line to characterize background.

Methods

Because lognormality is the best *a priori* assumption of distributional form for analytes in the environment, and, because environmental analyte concentration distributions have bounds, our null hypothesis of background distribution form is 4-parameter lognormal, $LN(\bar{x}_T, s_T, \hat{\lambda}, \hat{\upsilon})$, where:

- $\bar{x}_T$ is the sample mean of the 4-parameter ln-transforms, which are calculated—

$$x_{i,T} = \ln\left(\frac{x_i - \hat{\lambda}}{\hat{\upsilon} - x_i}\right), \qquad \text{Equation 1}$$

with the back-transformation being—

$$x = \frac{\hat{\upsilon}e^{x_T} + \hat{\lambda}}{1 + e^{x_T}}; \qquad \text{Equation 2}$$

- s_T is the sample standard deviation of the 4-parameter ln-transforms;
- $\hat{\lambda}$ is an estimate of the population lower bound; and,
- $\hat{\upsilon}$ is an estimate of the population upper bound.

The values of $\hat{\lambda}$ and $\hat{\upsilon}$ are generated by optimizing a 4-parameter lognormal fit plot of $x_{i,T}$ on z_i, the standard normal variate. The values of z_i are calculated using the Blom plotting position:

$$q_i = \frac{i - 0.375}{n + 0.25} \qquad \text{Equation 3}$$

where q_i is the quantile of the ith ordered background datum (with background observations ordered 1 through n). Each q_i is then transformed to z_i by means of a standard normal distribution inverse function (e.g., Excel's NORMSINV). The fit plots are tested using a probability plot correlation coefficient test of normality.

Optimizing of the fit plot occurs by maximizing the correlation coefficient, $r_{x_{i,T}:z_i}$, by iterative calculation. The initial assumption for $\hat{\lambda}$ is 0, unless the data contain negative observations. Negative observations are almost sure to arise in uncensored data, due to measurement error, for background characterizations of trace elements, naturally occurring radionuclides, or widespread anthropogenic contaminants that are present in trace amounts. In these cases, the initial assumption for $\hat{\lambda}$ is the negative value just below (to a two-significant-digit resolution) the lowest observation. Because of mathematical constraint, $\hat{\lambda}$ may not exceed the lowest observation.

The initial assumption for $\hat{\upsilon}$ is pure substance (e.g., 1,000,000 ppm). A refinement would be to use a level of saturation or some global maximum observation. By physical

constraint, $\hat{\upsilon}$ may not exceed the initial assumption, and may not be lower than the highest observation.

Another constraint we shall place upon the bounds, to be reasonable, is that they must, at a minimum, be an order of magnitude beyond their respective extreme observation. Mathematically:

$$\hat{\upsilon} \geq 10x_n \qquad \text{Equation 4}$$

and, if x_1 is positive:

$$\hat{\lambda} \leq \frac{x_1}{10} \qquad \text{Equation 5a}$$

or, if x_1 is negative:

$$\hat{\lambda} \leq 10x_1 . \qquad \text{Equation 5b}$$

These constraints avoid the arrogance of assuming that the extreme observations approach the bounds.

Once the optimized values of $\hat{\lambda}$ and $\hat{\upsilon}$ are generated, the observed range, $x_n - x_1$, is compared to the "range" defined by including each bound in turn, $\hat{\upsilon} - x_1$ and $x_n - \hat{\lambda}$, respectively. If the difference in a "range" for a given bound, relative to the observed range, is in excess of three orders of magnitude, then the bound associated with that "range" is deemed to be functionally equivalent to $-\infty$ or ∞, as appropriate, and is discarded. This results in one of four possible outcomes:

- If neither bound is discarded, the null hypothesis of 4-parameter lognormality is retained;

- If $\hat{\upsilon}$ is discarded and $\hat{\lambda}$ is retained, the null hypothesis is rejected in favor of an alternative hypothesis of 3-parameter lognormality;

- If $\hat{\lambda}$ is discarded and $\hat{\upsilon}$ is retained, the null hypothesis is rejected in favor of an alternative hypothesis of mirror-image 2-parameter lognormality (i.e., a lognormal distribution skewed to the left instead of the right); and,

- If both $\hat{\lambda}$ and $\hat{\upsilon}$ are discarded, the null hypothesis is rejected in favor of an alternative hypothesis of normality.

Goodness of fit is measured with the probability plot correlation coefficient test of normality ($\alpha = 0.05$) on the 4-parameter ln-transformed, 3-parameter ln-transformed, mirror-image 2-parameter ln-transformed, or untransformed concentration data, as appropriate. The equations for a 4-parameter ln-transformation and its back-transformation are provided in Equations 1 and 2 above.

The equation for a 3-parameter ln-transform is:

$$x_{i,T} = \ln\left(x_i - \hat{\lambda}\right). \qquad \text{Equation 6}$$

The back-transformation is:

$$x = e^{x_T} + \hat{\lambda}. \qquad \text{Equation 7}$$

The equation for a mirror-image 2-parameter ln-transformation and back-transformation are, respectively:

$$x_{i,T} = \ln\left(\hat{\upsilon} - x_i\right) \qquad \text{Equation 8}$$

and:

$$x = \upsilon - e^{x_T} \qquad \text{Equation 9}$$

If none of these distributions is found to fit, an alternative transformation is sought or the data are inspected to see if they include multiple distributions that need to be separated. The latter may, for example, be due to the presence of more than one distinct background stratum, or to a contaminated area being misclassified as background.

Results

Using the above protocol we selected four trace element background data sets, one fitting each of the four distributional forms, from a selenium release program being conducted in the phosphate mining district of Southeast Idaho (Monsanto, Spring 2002, n = 6):

- 4-parameter lognormally distributed V in sediment;
- 3-parameter lognormally distributed Se in surface water;
- mirror-image 2-parameter lognormally distributed Zn in sediment; and,
- normally distributed Cd in surface water.

After determining the distribution for each of the above, estimates were calculated of various high-end percentiles—the 90th, 95th, 99th, 99.9th, 99.99th, 99.999th, and 99.9999th—of each distribution for a wide array of confidence levels—from 0.0001% to 99.9999%. These results were plotted, along with the distribution itself, to allow for direct visual comparison of the traditional bright line, $\hat{p}_{0.95;\,0.95,n}$, against alternatives, various $\hat{p}_{p;1-\alpha,n}$. These cumulative plots are displayed in Figures 1 through 4 below. In each of the figures the left-most line, which is black, represents the best estimate of the background distribution, and the remaining lines represent various high-end percentiles.

Figure 1. Uncertainties in High-End Percentiles of 4-Parameter Lognormally Distributed Background $[V]_{sediment}$ LN(-2.23, 0.04, -180, 1,900) mg/kg dw, n = 6.

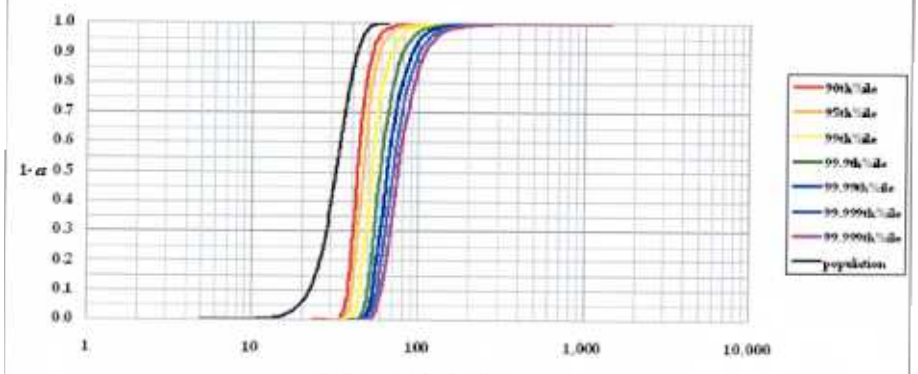
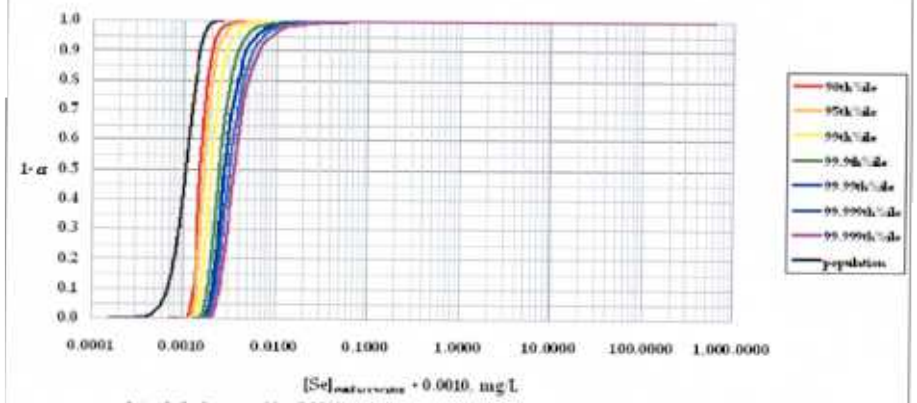


Figure 2. Uncertainties in High-End Percentiles of 3-Parameter Lognormally Distributed Background $[Se]_{surface\ water}$ LN(-6.19, 0.15, -0.0020) mg/L, n = 6.



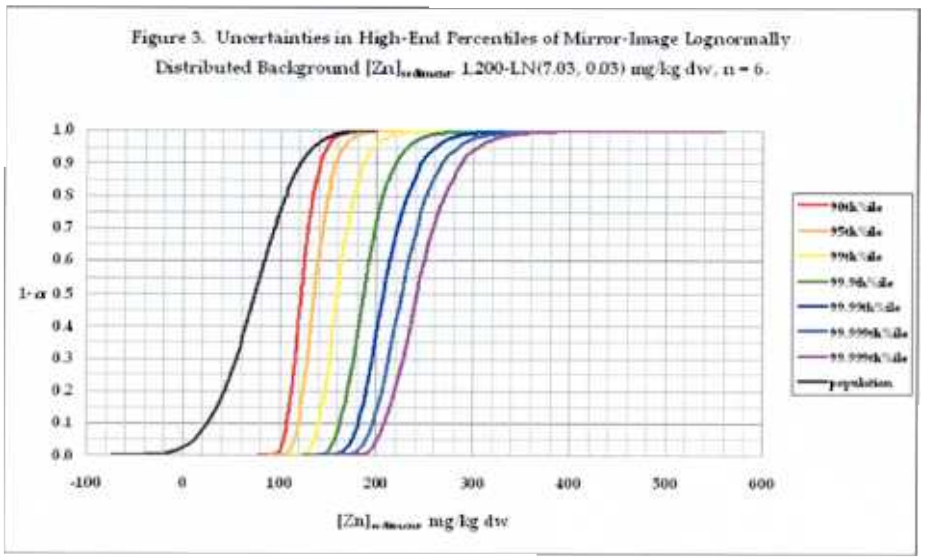


Figure 3. Uncertainties in High-End Percentiles of Mirror-Image Lognormally Distributed Background $[Zn]_{sediment}$ 1.200-LN(7.03, 0.03) mg/kg dw, n = 6.

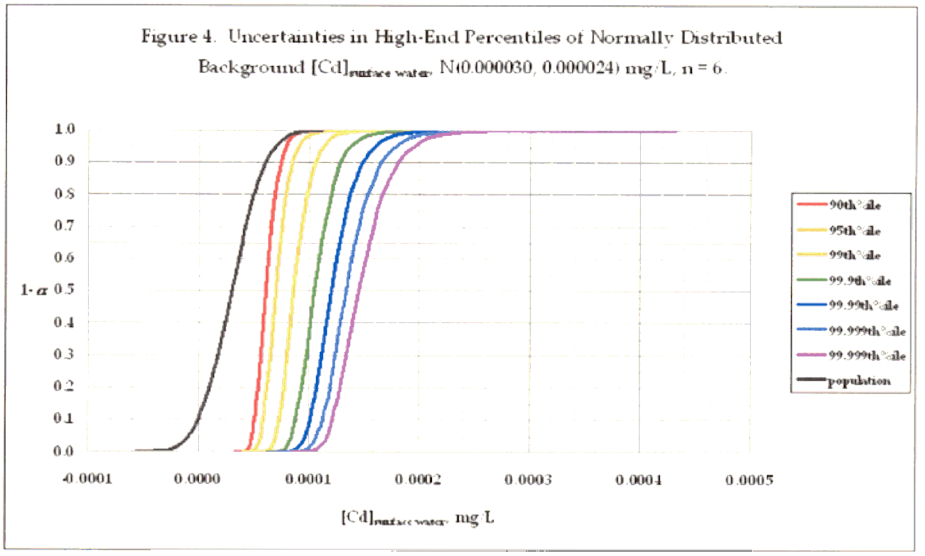


Figure 4. Uncertainties in High-End Percentiles of Normally Distributed Background $[Cd]_{surface\ water}$ N(0.000030, 0.000024) mg/L, n = 6.

Discussion

The initial use of an upper bound on the background distribution, through the null hypothesis of 4-parameter lognormality, virtually eliminates the $\hat{p}_{0.95;\,0.95,n}$'s problem of potential unrealism with small values of n. Simplifying the distributional form by eliminating bounds only when they are shown to be sufficiently distant from the observed data ensures that this problem won't arise (as long as outrageously extreme percentiles are of no interest). Thus, the protocol used for determining distribution form, while more complex than state of the practice, is logical and helps to produce a desired effect.

The figures above graphically demonstrate that estimates of high-end percentiles, just like any statistic, have uncertainty in both directions. Generally this uncertainty is much greater on the high end of the estimates of these percentiles, as is evidenced by decreased slopes of the plots at the higher confidence levels. One way, therefore, to reduce the degree of uncertainty would be to work with the lower end of these percentiles, in other words, to use a lower confidence bound on the percentile rather than an upper confidence bound.

For a lower confidence bound to be reasonable, the high-end percentile of interest must be more reasonable than the 95th percentile. It was mentioned earlier that a high-end percentile of 90% puts the regulated party in a position of having to assume responsibility for 10% of Mother Nature, but 5% is not much of a difference when the responsibility is as great as it is with contaminated sites.

We are proposing, after discussion with IDEQ, the use of the 99.9th percentile as the parameter of interest. Use of 99.9% as a target is far more palatable from all perspectives. One can argue that the assumption of responsibility for 0.1% of Mother Nature is a *de minimus* penalty to pay for all but the largest of sites.

As to the choice of which lower bound to use, application of tradition dictates use of an α of 0.05, i.e., a confidence level, $1-\alpha$, of 95%. However, since we're working on the low end of the statistic, the confidence level of interest in Figures 1 through 4 is 0.05. Thus, we are proposing that the functional upper bound of background be $\hat{p}_{0.999;\,0.05,n}$.

An examination of the figures shows that in all cases the $\hat{p}_{0.999;\,0.05,n}$ generates credible estimates of a functional upper bound, regardless of distribution form. Values of interest are presented in Table 1.

Table 1. Statistics of Interest.

Analyte	Distribution	n	$\hat{p}_{0.9;\,0.9,n}$	$\hat{p}_{0.95;\,0.95,n}$	$\hat{p}_{0.999;\,0.05,n}$	$\hat{p}_{0.999}$	$\frac{\hat{p}_{0.999}}{p_{0.999;0.05,n}}$
$[V]_{sed}$ mg/kg dw	4-parameter lognormal	6	42	53	38	49	1.3
$[Se]_{sw}$ mg/L	3-parameter lognormal	6	0.0010	0.0016	0.00077	0.0014	1.8
$[Zn]_{sed}$ mg/kg dw	mirror-image 2-parameter lognormal	6	160	200	140	190	1.4
$[Cd]_{sw}$ mg/L	normal	6	0.000089	0.00012	0.000076	0.00011	1.4

Table 1 shows that $\hat{p}_{0.999;\,0.05,n}$ is, in all four examples, lower than the traditionally used $\hat{p}_{0.95;\,0.95,n}$. The $\hat{p}_{0.999;\,0.05,n}$ is even lower than $\hat{p}_{0.9;\,0.9,n}$ in each case. Thus, it appears, even with examples using sample sizes that are a bit larger than what is often encountered, that the $\hat{p}_{0.999;\,0.05,n}$ performs well from a regulator's perspective.

From the perspective of a regulated party, the ratio $\hat{p}_{0.999}/\hat{p}_{0.999;\,0.05,n}$ (where $\hat{p}_{0.999}$ is the best estimate of the 99.9th percentile) gives a measure of the value of information additional background samples might provide—the higher this ratio, the more room for improvement. These numbers indicate that additional sampling of V or Zn in sediment or Cd in surface water would likely not be wise investments; however, additional sampling of Se in surface water may prove to be worth while.

Conclusion

In summary, $\hat{p}_{0.999;\,0.05,n}$ generates bright-line background values that are credible and that avoid the pitfalls associated with use of the traditional $\hat{p}_{0.95;\,0.95,n}$. The use of $p_{0.999}$ as a target parameter is more palatable to those who are regulated, yet reasonable to those who are regulating. The use of 95% confidence—to bound the uncertainty on the lower side—retains tradition and thus enhances credibility. Finally, use of a lower bound on $\hat{p}_{0.999}$ provides regulated parties with a potential business incentive to design better background investigations. The reduction of uncertainty that will result will prove to be a benefit to all.

Using a lower confidence bound requires a caution. Multiple comparisons, each performed at an α of 0.05, rapidly increase the experiment-wise type I error rate, α_{exp}. Thus, care should be taken—when multiple contaminants, media, monitoring periods, or other circumstances lead to multiple comparisons—to control α_{exp}.

References

Aitchison, J. and J.A.C. Brown, 1969. *The Lognormal Distribution.* Cambridge University Press, Cambridge.

Flynn, Michael R., 2003. *On the Moments of the 4-parameter Lognormal Distribution.* University of North Carolina, Chapel Hill, NC. 24 March 2004. Available: http://www.mathpreprints.com/math/Preprint/mflynn/20031108/1/CSDAFlynn.pdf

Gilbert, Richard O., 1987. *Statistical Methods for Environmental Pollution Monitoring.* Van Nostrand Reinhold, New York.

Helsel D.R. and R.M. Hirsch, 1992. *Statistical Methods in Water Resources.* Elsevier Science Publishers, New York.

Johnson, N.L. and S. Kotz, 1970b. *Continuous Univariate Distributions—2.* Houghton Mifflin, Boston.

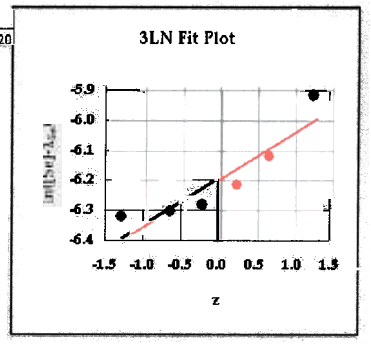
USEPA, 1992. *Statistical Analysis of Ground-Water Monitoring Data at RCRA Facilities: Addendum to Interim Final Guidance.* Office of Solid Waste, Permits and State Programs Division, Washington D.C. 24 March 2004. Available: http://www.epa.gov/correctiveaction/resource/guidance/sitechar/gwstats/gritsstat/download/addendum.pdf

USFS, 2000. *Parametric One-sided Tolerance Bounds for Normal Distributions.* Forest Products Laboratory. 24 March 2004. Available: http://www1.fpl.fs.fed.us/tolerance.html

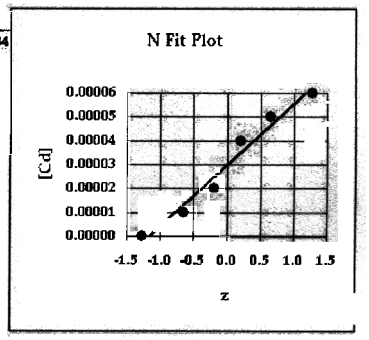
Attachment A
Raw Data and Fit Plots

Background Data				
Station ID	Surface Water, mg/L		Sediment, mg/kg dw	
	[Se]	[Cd]	[V]	[Zn]
MRV017	0.00020	0.000040	11	21
MST235	0	0.000010	18	37
MST049	-0.00017	0.000020	30	95
MST093	0.00070	0.000060	32	120
MST101	-0.00020	0	21	90
MST237	-0.00013	0.000050	21	80

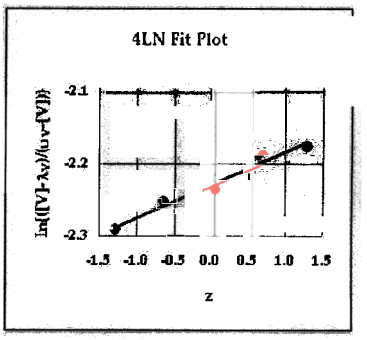
Concentrations	Ranks	Quantiles	Standard Normal Variates	Lower Bound	Upper Bound	4LN Transformations	Correlation Coefficient	Decision Criterion	Reasonableness of Bounds	Simplified Transformations	Correlation Coefficient
$[Se]_{ow}$	i	q	z	λ	υ	$\ln\{([Se]-\lambda_{Se})/(\upsilon_{Se}-[Se])\}$	r_{xz}	$\lvert r_{0.050,6}\rvert$	$\log[(x_n-\lambda_{Se})/(x_n-x_1)]$	$\ln([Se]-\lambda_{Se})$	$r_{3LN[Se]z}$
-0.00020	1	0.10	-1.28	-0.0020	1,000,000	-20.14	0.920	0.888	0.5	-6.32	0.920
-0.00017	2	0.26	-0.64			-20.12	Retain H_0: data are 4LN.		$\log[(\upsilon_{Se}-x_1)/(x_n-x_1)]$	-6.30	
-0.00013	3	0.42	-0.20			-20.10			9.0	-6.28	
0	4	0.58	0.20			-20.03			Simplify H_0 to: data	-6.21	
0.00020	5	0.74	0.64			-19.93			are 3LN.	-6.12	
0.00070	6	0.90	1.28			-19.73				-5.91	



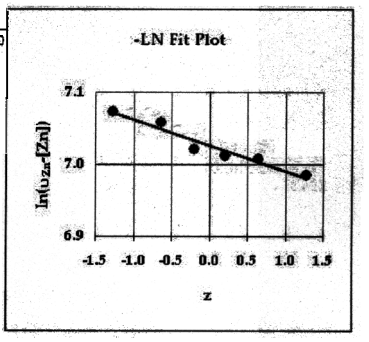
$[Cd]_{ow}$	i	q	z	λ	υ	$\ln\{([Cd]-\lambda_{Cd})/(\upsilon_{Cd}-[Cd])\}$	r_{xz}	$\lvert r_{0.050,6}\rvert$	$\log[(x_n-\lambda_{Cd})/(x_n-x_1)]$	[Cd]	$r_{[Cd]z}$
0	1	0.10	-1.28	-9.0	1,000,000	-11.62	0.984	0.888	5.2	0	0.984
0.000010	2	0.26	-0.64			-11.62	Retain H_0: data are 4LN.		$\log[(\upsilon_{Cd}-x_1)/(x_n-x_1)]$	0.000010	
0.000020	3	0.42	-0.20			-11.62			10.2	0.000020	
0.000040	4	0.58	0.20			-11.62			Simplify H_0 to: data	0.000040	
0.000050	5	0.74	0.64			-11.62			are N.	0.000050	
0.000060	6	0.90	1.28			-11.62				0.000060	



$[V]_{ow}$	i	q	z	λ	υ	$\ln\{([V]-\lambda_V)/(\upsilon_V-[V])\}$	r_{xz}	$\lvert r_{0.050,6}\rvert$	$\log[(x_n-\lambda_V)/(x_n-x_1)]$
11	1	0.10	-1.28	-100	1,900	-2.29	0.981	0.888	1.0
18	2	0.26	-0.64			-2.25	Retain H_0: data are 4LN.		$\log[(\upsilon_V-x_1)/(x_n-x_1)]$
21	3.5	0.50	0.00			-2.24			2.0
21	3.5	0.50	0.00			-2.24			Do not simplify H_0.
30	5	0.74	0.64			-2.19			
32	6	0.90	1.28			-2.18			



$[Zn]_{ow}$	i	q	z	λ	υ	$\ln\{([Zn]-\lambda_{Zn})/(\upsilon_{Zn}-[Zn])\}$	r_{xz}	$\lvert r_{0.050,6}\rvert$	$\log[(x_n-\lambda_{Zn})/(x_n-x_1)]$	$\ln(\upsilon_{Zn}-[Zn])$	$r_{-LN[Zn]z}$
21	1	0.10	-1.28	-1,000,000	1,200	6.74	0.970	0.888	4.0	7.07	-0.970
37	2	0.26	-0.64			6.76	Retain H_0: data are 4LN.		$\log[(\upsilon_{Zn}-x_1)/(x_n-x_1)]$	7.06	
80	3	0.42	-0.20			6.79			1.1	7.02	
90	4	0.58	0.20			6.80			Simplify H_0 to: data	7.01	
95	5	0.74	0.64			6.81			are -LN.	7.01	
120	6	0.90	1.28			6.83				6.98	



P_4 Production, LLC

A JOINT VENTURE OF

SOUTHEAST IDAHO MINE-SPECIFIC SELENIUM PROGRAM

Comprehensive Site Investigation

Program Health and Safety Plan—Final

April 2004

Prepared by

2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005

Program Health and Safety Plan
Approval Sheet

This Health and Safety Plan will be implemented as described herein.

Program Manager MWH	Date
Program Safety Officer MWH	Date
Program Manager P_4 Production	Date

Reviews and amendments to the Health and Safety Plan for the Southeast Idaho Phosphate Resource Area Selenium Project are summarized below. The On-Site Safety Officer is responsible for maintaining the operational copy of this plan.

RECORD OF REVIEW

Date	Reviewed By	Comments

RECORD OF AMENDMENTS

Date	Change Number	Summary of Amendment	Project Safety Officer Initials

TABLE OF CONTENTS

APPROVAL SHEET i

RECORD OF REVIEW AND AMENDMENTS ii

LIST OF ACRONYMS vi

1.0 INTRODUCTION 1-1
2.0 SITE SAFETY AND HEALTH ANALYSIS 2-2
2.1 POTENTIAL CHEMICALS HAZARDS 2-2
2.2 RADIOLOGICAL HAZARDS 2-3
2.3 PHYSICAL HAZARDS 2-3
2.4 BIOLOGICAL HAZARDS 2-6
3.0 ASSIGNMENT OF RESPONSIBILITIES 3-8
3.1 VICE PRESIDENT-IN-CHARGE 3-8
3.2 PROGRAM MANAGER 3-8
3.3 PROGRAM SAFETY OFFICER 3-9
3.4 ON-SITE SAFETY OFFICER 3-10
3.5 FIELD PERSONNEL 3-12
3.6 SITE VISITORS 3-12
4.0 PERSONNEL TRAINING 4-13
4.1 INITIAL SITE-SPECIFIC HEALTH AND SAFETY TRAINING 4-13
4.2 TAILGATE SAFETY MEETINGS 4-15
4.3 BLOODBORNE PATHOGENS AND FIRST AID/CPR 4-15
4.4 DOCUMENTATION OF TRAINING 4-16
5.0 MEDICAL SURVEILLANCE 5-17
6.0 PERSONAL PROTECTIVE EQUIPMENT 6-19
6.1 PERSONAL PROTECTIVE EQUIPMENT 6-19
6.2 LEVEL D PERSONAL PROTECTIVE EQUIPMENT 6-22
6.3 LEVEL C PERSONAL PROTECTIVE EQUIPMENT 6-23
6.4 LEVEL B PERSONAL PROTECTIVE EQUIPMENT 6-24
6.5 LEVEL A PERSONAL PROTECTIVE EQUIPMENT 6-25
6.6 PPE STORAGE 6-26
7.0 HAZARD ASSESSMENT 7-27
7.1 HEAT STRESS 7-27
7.2 COLD STRESS 7-28
7.2.1 Frostbite Monitoring 7-28
7.2.2 Hypothermia Monitoring 7-29
8.0 SITE CONTROL 8-31
8.1 MULTIPLE-EMPLOYER JOB SETTING 8-31
8.2 SITE SECURITY 8-31
8.3 COMMUNICATION SYSTEMS 8-32
9.0 DECONTAMINATION PROCEDURES 9-33
9.1 GENERAL DECONTAMINATION PROCEDURES 9-33

9.2 EMERGENCY DECONTAMINATION 9-33
9.3 CONTAMINATION CONTROL 9-34
9.4 DECONTAMINATION WASTE HANDLING AND DISPOSAL 9-34
10.0 EMERGENCY RESPONSE PLANNING 10-35
11.0 HEALTH AND SAFETY DOCUMENTATION 11-37
12.0 GENERAL SITE SAFETY 12-38
12.1 GENERAL HEALTH AND SAFETY PROGRAM ELEMENTS 12-38
12.1.1 Hazard Communication Program 12-38
12.1.2 Injury and Illness Prevention Program 12-39
12.1.3 Sanitation 12-40
12.1.4 Illumination 12-41
12.1.5 Excavation and Trenching 12-41
12.1.6 Confined Space Entry 12-41
12.1.7 Spill Containment Program 12-41
12.1.8 Standard Emergency Hand Signals 12-42
12.1.9 Fire Protection 12-42
12.1.10 Earthquake and Disaster Preparedness 12-45
12.1.11 Unanticipated Work Practices 12-46
12.2 COMMON PHYSICAL HAZARDS AND CONTROLS 12-46
12.2.1 Slip/Trip/Fall 12-46
12.2.2 Heavy Lifting 12-46
12.2.3 Electrical Hazards 12-47
12.2.4 Motor Vehicle Hazards 12-47
12.2.5 Hot Work Permits 12-48
12.2.6 Sharp Edges and Pinch Points 12-48
12.2.7 Noise 12-48
12.2.8 Heavy Equipment Use 12-48
12.3 SEVERE WEATHER 12-50
12.3.1 Lightning 12-50
12.3.2 Tornadoes 12-51
12.3.3 Winter Storms 12-51
12.4 ENGINEERED CONTROLS 12-52
12.5 ADMINISTRATIVE CONTROLS 12-52

LIST OF TABLES

Table 2-1 Occupational Exposure Limits and Toxicological Properties for Potential Chemical Exposure Hazards
Table 2-2 IDLH and PEL for Primary Target Elements, Se and Cd
Table 2-3 Ten Essentials for Wilderness Travel

LIST OF FIGURES

Figure 3-1 Project Organization Chart
Figure 6-1 Sample Protective Equipment Ensembles

LIST OF APPENDICES

Appendix A Activity Hazard Analysis
Appendix B Emergency Contacts
Appendix C Injury and Illness Prevention Program
Appendix D Personal Acknowledgement Form
Appendix E Tailgate Safety Meeting Form
Appendix F Occupational Injury/Illness/Incident Report Form
Appendix G OSHA Job Safety and Health Protection Poster

ACRONYMS AND ABBREVIATIONS

ACGIH	American Congress of Governmental Industrial Hygienists
AOC	Administrative Order on Consent
AIDS	Acquired Immune Deficiency Syndrome
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
CRZ	contamination reduction zone
HEPA	High Efficiency Particulate Air
HSP	Health and Safety Plan
IDEQ	Idaho Department of Environmental Quality
I/HW	Industrial/hazardous waste
IDLH	Immediately Dangerous to Life or Health
IIPP	Illness and Injury Prevention Program
IMASC	Idaho Mining Association Selenium Committee
MCL	maximum contaminant level
MSDS	Material Safety Data Sheet
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OSO	On-Site Safety Officer
PEL	Permissible Exposure Limit
PPE	Personal Protective Equipment
PSO	Project Safety Officer
REL	Recommended Exposure Limit
RI/FS	Remedial Investigation/Feasibility Study
SCBA	Self-contained Breathing Apparatus
SOP	Standard Operating Procedure
TLV	Threshold Limit Value
TWA	Time-weighted Average
USEPA	United States Environmental Protection Agency

1.0 INTRODUCTION

Toward the end of 1996, one of the five companies mining phosphate in southeastern Idaho informed a rancher with pasture on nearby land that his horses appeared to be ill. The rancher, with the help of a local veterinarian and professors from the University of Idaho and the University of Wyoming, subsequently determined that six of his horses were suffering from chronic selenosis. Four of the horses were immediately euthanized. Several months later, a fifth horse was euthanized, as well.

Monsanto Company has been involved in phosphate mining and phosphorus production in southeastern Idaho since the 1950s. P_4 Production is a joint venture between Monsanto and Solutia Inc. The joint venture was established in September 1997 when Solutia was formed from Monsanto. Solutia was the operating partner for P_4 Production until May 2001 when Monsanto became P_4 Production's operating partner.

This Health and Safety Plan has been prepared to establish the responsibilities, requirements, and procedures for protecting MWH personnel and subcontractors conducting an investigation of surface water, sediment, fish tissue, habitat, groundwater, surface soil, and vegetation quality during 2004–5. This HSP has been prepared to provide assigned field personnel with a safe working environment as the investigation proceeds. Specifically, the HSP has been developed to minimize the potential for job-related injuries and illnesses, and to prevent job-related injuries and illnesses from occurring.

A fundamental principle of industrial safety and loss prevention is that most accidents that cause injury, illness, or property damage are preventable. Investigations of the causes of industrial accidents and illnesses have demonstrated that most injuries or illnesses are the result of unsafe acts or conditions. Thus, minimizing industrial accidents and illnesses can be accomplished by recognizing, evaluating, and controlling unsafe acts and conditions.

In addition to the information contained in this HSP, MWH has developed Industrial/Hazardous Waste Operations Health and Safety Policies and Procedures that form the basis for safe employee work practices. A copy of the policies and procedures manual will be available in the field to project personnel. Employees are required by these policies and procedures to employ safe work practices and comply with applicable MWH requirements, as well as the applicable requirements of the agencies responsible for regulating industrial health and safety, including the OSHA and MSHA.

2.0 SITE SAFETY AND HEALTH ANALYSIS

This section of the HSP identifies activity-specific hazards that may be encountered at project sites during the course of planned field activities, as well as methods that will be employed to control exposure to these hazards. The field activities in 2004–5 will involve the collection of various environmental media. These potential sample locations are either on, or adjacent to, P_4 Production's phosphate mines.

Some of the selected sample sites are readily accessible; others, however, are remote, and may require travel on foot. Health and safety issues that are associated with these sites requiring extensive foot travel will be addressed herein.

Specific activities that may be involved in the investigation are listed in Appendix A, *Activity Hazard Analysis* together with the hazards that may be associated with these activities and recommended controls to minimize risk to MWH and subcontractor field personnel. Recognized specific chemical, physical, and biological hazards that may be encountered during field activities are also discussed in the following paragraphs.

Although phosphate ore bodies are known to have slightly elevated concentrations of Uranium-238 and associated decay daughters, ionizing radiation has not been identified as a hazard that is likely to be associated with this project, and monitoring for ionizing radiation will not be undertaken during the investigation. Additional safety practices more generally applicable to field activities are summarized in the subsequent sections of this plan.

2.1 POTENTIAL CHEMICALS HAZARDS

The hazards that may be associated with chemical contaminants can be assessed through comparison of measured or estimated personnel exposures to established occupational exposure limits. PELs are established by OSHA, while RELs are established by NIOSH. IDLH concentrations are also established by NIOSH. TLVs and TWAs are established by the ACGIH. PELs may be expressed as an 8-hour TWA or as a ceiling limit. Ceiling limits may not be exceeded at any time, and are enforceable by law. RELs are published guidelines that set employee exposure limits for airborne contaminants. RELs are expressed as a TWA or ceiling limit. The ACGIH TLV/TWA is the airborne concentration of a substance to which nearly any worker may be repeatedly exposed 8 hours per day, 40 hours per week, without experiencing adverse health effects. For some substances, the overall exposure to a substance is aggravated by contact with skin, mucous membranes, or the eyes. Other substances have a ceiling value that may not be exceeded during any part of the workday. An IDLH concentration is the maximum airborne concentration of a substance that one could escape within 30 minutes without impairing symptoms or irreversible health effects.

Extensive sampling has been undertaken in many areas of the Southeast Idaho Phosphate Resource Area to date by MWH and P_4 Production, the IMASC companies, and regulatory agencies. Based on area history, the events that prompted this investigation, and sampling to date, naturally-occurring selenium, cadmium, molybdenum, and other trace elements in the

phosphate ore body could potentially pose a hazard to sub-populations. Empirical evidence and evaluation of existing data indicate that there has been and is no reasonable possibility for health hazards to local residents. Such residents (who are assumed to consume exposed fish, game, and cattle) have high degrees of exposure—speaking relatively, rather than absolutely. Exposures to employees implementing the scope of work covered by this plan are substantially less and thus, there is no reasonable possibility for employee exposure to safety or health hazards associated with these substances. Table 2-1 presents occupational exposure limits and toxicological information for selenium and for other metals that could be present at the sampling sites. Table 2-2 presents information regarding exposure pathway and maximum exposures expected to be encountered in the project area.

As new contaminant data are generated, they will be evaluated with regard for reasonable possibility of employee exposure to safety or health hazards. If such a reevaluation determines that a reasonable possibility for such exposure exists, this plan will be revised to reflect the applicability of 29 CFR 1910.120.

2.2 RADIOLOGICAL HAZARDS

Phosphate ore in the southeast Idaho Phosphate Resource Area has slightly elevated levels of naturally occurring radionuclides, i.e., isotopes that produce ionizing radiation. Most notable is the isotope Uranium 238 (U-238). Natural background in soils varies significantly throughout the United States but generally ranges from 2 to 10 picocuries per gram (10^{-12} Curies - a Curie is a measure of the level of radiological activity, or disintegrations per second). Phosphate ore contains from 23 to 28 picocuries per gram of U-238. In addition, U-238 in the ore is in equilibrium with all of it's decay daughters, including radium, radon, and polonium (i.e., all of the decay daughters would be expected to range from 23 to 28 picocuries per gram in the ore as well). This level of radiological activity does not pose a threat to persons on a mine site. However, certain common sense precautions are worth noting. These precautions are similar to those used to prevent exposure to other trace elements in media being sampled, i.e., avoid inhalation and ingestion. The precautions include:

- Avoid breathing dusts;
- Avoid ingestion with food or drink;
- Use proper hygiene techniques such as washing your hands prior to eating;
- Change clothing daily if clothing becomes soiled with ore. Note that clothing can be washed normally to remove the ore; and,
- If using a respirator, ensure that you keep the respirator clean.

2.3 PHYSICAL HAZARDS

Physical hazards associated with active mine sites as well as those associated with persons working out-of-doors in a mountainous terrain probably pose the greatest threat to field personnel on this project. The physical hazards that may be encountered will vary according to the type of site being investigated. Active mines pose hazards that are specific to mine operations, including the operation of heavy equipment, blasting, and the possibility of mine wall collapse. Large mine haul trucks may travel at relatively high rates of speed and pose a unique traffic threat to anyone

traveling on mine haul roads. Railroad trains are also used at mines to haul ore to processing plants and pose railroad crossing hazards. Field personnel working on or around mine traffic areas should be especially mindful of mine-related traffic and mine-specific traffic rules. Before working at any active mine site, field personnel shall receive mine-specific hazard training from personnel representing the mine operator

Mine wall collapse could also occur at inactive mine sites. At some of the older mines, driving or walking near a high wall may pose a significant hazard, as well. Field personnel must be alert and aware of their surroundings. Therefore, prior to entering an inactive mine site, MWH personnel will be informed of any potential instability that could lead to rock slides, the collapse of high walls, and other physical hazards. MWH personnel will also be acquainted with the signs of instability that could lead to rock slides, the collapse of high walls, and similar hazards. Additionally, field personnel will need to exercise caution at former underground mine sites, and avoid abandoned underground mining portals.

At other sites, hazards associated with collecting samples are likely to be minimal. While traveling through or collecting samples in pasture land, possible hazards may be largely limited to slipping, tripping, and falling. Stream sampling can pose risks associated with loss of balance, including head and limb injuries, scrapes, hypothermia, and drowning. Personnel will need to use good judgment to determine whether it is safe to enter a body of water. In particular, while sampling from streams or rivers, field personnel should be aware of hazards that may be created by high or turbulent water, including being swept out by the current. Additionally, field personnel should be aware of hazards that may be created by stepping in deep, soft sediments, or floating debris.

Travel to remote areas engenders additional hazards specific to the method of travel. Hazards associated with foot travel include muscle strains and sprains. Travel by snowmobile primarily poses the risk of rollover, but risks also exist due to mechanical failure.

Travel in remote areas can also pose hazards that are best addressed by knowledge of wilderness safety, by safe operation of equipment, and through awareness of methods for handling contact with animals. Specific hazards associated with travel in remote areas are listed in Appendix A, *Activity Hazard Analysis*, together with recommended practices and procedures to minimize risks to MWH and subcontractor field personnel. Table 2-3, *Ten Essentials for Wilderness Travel* lists the ten essential items that field personnel should always have with them when working in remote areas.

TABLE 2-1
OCCUPATIONAL EXPOSURE LIMITS AND TOXICOLOGICAL PROPERTIES FOR POTENTIAL CHEMICAL EXPOSURE HAZARDS

Contaminant	OSHA PEL (mg/m^3)	NIOSH REL (mg/m^3)	ACGIH TLV (mg/m^3)	ACGIH/OSHA STEL	OSHA/NIOSH IDLH (mg/m^3)	IP (eV)	Route of Exposure	Symptoms of Exposure
Cadmium	0.005 (see 29 CFR 1910.1027)	Ca (lowest feasible)	0.01	NA	50	NA	INH, ING	Pulmonary edema, dyspnea, cough, chest tightness, pain, headache; chills, muscle aches; nausea, vomiting, diarrhea; emphysema, mild anemia
Fluoride	2.5	2.5	2.5	NA	500	NA	INH, ING, CON	Eye irritation, respiratory system, nausea, abdominal pain, diarrhea, excessive saliva, thirst, and sweat.
Molybdenum (soluble compounds as Mo)	5	NA	5	NA	NE	NA	INH, ING	In animals: irritant to eyes, nose and throat; anorexia; diarrhea; weight loss; listlessness; liver and kidney damage.
Nickel (soluble compounds as Ni)	1	0.015 (Ca)	0.1	NA	10 (Ca)	NA	INH, ING, CON	Headache, vertigo; nausea, vomiting, epigastric pain, substernal pain; cough, hyperpnea; cyanosis; weakness; leukocytosis, pneuitis; delirium, convulsion.
Selenium	0.2	0.2	0.2	NA	NA	NA	INH, ING, CON, ABS	Irritant to eye, nose and throat; visual disturbance; headache; chills, fever; dyspnea, bronchitis; metallic taste, garlic breath, gastro-intestinal disturbance; dermatitis; and skin, eye burns.
Vanadium (as Vanadium pentoxide)	0.5	0.05	0.05	NA	1	NA	INH, ING, CON	Irritant to eyes; green tongue, metallic taste, eczema; cough; fine rales, wheezing, bronchitis, dyspnea; irritant to the throat
Zinc (Zinc oxide fume)	5	5	5	NA	NA	NA	INH	Sweet, metallic taste; dry throat, cough; chills, fever; tight chest, dyspnea, rales, reduced pulmonary function; headache, blurred vision; muscle cramps, low back pain; nausea, vomiting; fatigue, lassitude and malaise

ACGIH-American Conference of Governmental Industrial Hygienists
Ca-NIOSH considered carcinogen
CFR-Code of Federal Regulations
CON-Skin or mucous membrane contact
eV-Electron volts
IDLH-Immediately dangerous to life or health
ING-Ingestion
INH-Inhalation
IP-Ionization potential
NA-Not applicable or available
NE-Not established
NIOSH-National Institute of Occupational Safety and Health
OSHA-Occupational Safety and Health Administration
PEL-Permissible exposure limit
REL-Recommended exposure limit
STEL-Short term exposure limit
TLV-Threshold limit values

Table 2-2 IDLH and PEL for Target Elements, Se and Cd							
	NIOSH Standard				Max Southeast Idaho Concentrations		
Exposure Pathway	Selenium		Cadmium		Selenium	Cadmium	Exceedance Yes/No?
	IDLH	PEL	IDLH	PEL			
Inhalation, Soil µg/m^3	1.0	0.2	9.0	0.005	0.000032	0.000014	Se—No Cd—No
Ingestion, Water[a] mg/L	28,000	2,800	NA	NA	4.3	0.030	Se—No Cd—No

[a]Water concentration is based upon a calculated equivalent benchmark, concentrations present are those which equate to an acute-sublethal LOAEL (~PEL) or acute-lethal LOAEL (~IDLH) if 25 ml of water were to be accidentally ingested.
NA-Not available

Table 2-3 Ten Essentials for Wilderness Travel		
To Find Your Way	**For Your Protection**	**For Emergencies**
Map of the area Compass Flashlight or headlamp	Sunglasses Extra food and water Extra clothing	Waterproof matches Candle, fuel tablets, or other long–burning fire starter Pocket knife First aid kit

2.4 BIOLOGICAL HAZARDS

Biological hazards that could potentially be encountered at hazardous waste sites may include snakes, spiders, ticks, fleas, poisonous plants such as poison oak and poison ivy, and micro–organisms such as the hantavirus.

Field personnel should be aware of their surroundings and avoid contact with snakes and insects. Snakes, spiders, and fleas typically occupy cool, dark, moist areas. The possibility of an encounter most frequently arises when reaching into dark, covered places. Suggestions for controlling the risks associated with snakes and insects include using a long stick to break apart webs or to remove soil cover from sheltered areas. A flashlight should also be used to inspect dark cavities before reaching into them.

Poisonous plants such as poison ivy and poison oak grow wild in dark, moist areas, and at the base of or around seedling and adult trees. Some individuals are prone to skin rashes on contact with the oil from certain plants. A visual site inspection and identification of possible poisonous plants should be completed prior to each shift so that assigned personnel are aware of the potential for exposures.

The Center for Disease Control in Atlanta, Georgia has established a hotline for inquiries regarding the hantavirus, at (800) 532-9929. Hantavirus has resulted in several deaths in the western part of the United States. While there may not have been any outbreaks or notices of the virus at a given project site, field personnel should be aware of the exposure route for the hantavirus and potential control methods. The hantavirus is transmitted through atmospheric dispersion of dried rodent excreta. The disease associated with the hantavirus begins with one or more symptoms that may include fever, muscle aches, headache, and cough. The disease progresses rapidly to a severe lung disease that often requires intensive care and treatment.

It is not expected that MWH field personnel will encounter biological hazards during the course of the investigation, except perhaps in the more remote areas covered by the survey. Possible biological hazards, as identified in the Activity Hazard Analysis in Appendix A, may include poisonous snakes, spiders, and plants such as poison oak, large predators, and microorganisms that could be present in water not provided by a public water supply.

As a matter of courtesy, field personnel should obtain permission from private landowners prior to entering private lands and immediately close any gates opened in order to access sampling stations and when leaving such stations to make sure that livestock do not inadvertently escape.

3.0 ASSIGNMENT OF RESPONSIBILITIES

Implementation of the Health and Safety Plan will be accomplished through an integrated effort of the following personnel:

MWH Vice President-in-Charge	Mr. Donald Caldwell
MWH Program Manager	Mr. William Wright
MWH Program Safety Officer (PSO)	Mr. Paul Stenhouse
MWH On-Site Safety Officer (OSO)	Mr. Paul Stenhouse
Subcontractor On-Site Safety Officer	To be determined by the subcontractor as appropriate.

Figure 3-1 presents the complete program organizational structure including responsibilities under the program health and safety program. The roles of these individuals from the preceding table are discussed further in the following paragraphs.

3.1 VICE PRESIDENT-IN-CHARGE

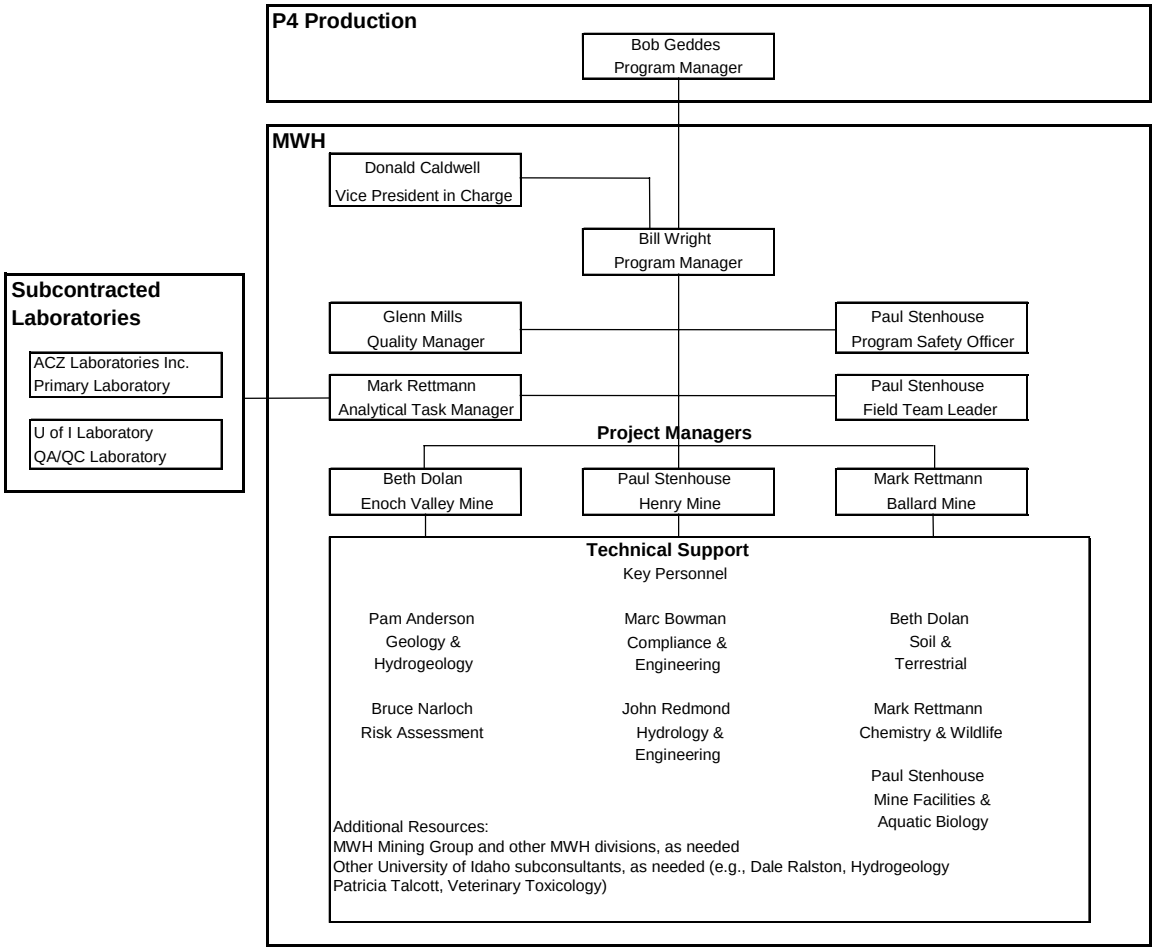
As the senior management representative for the program, the Vice President-in-Charge is responsible for defining program objectives, allocating resources, establishing the management organization, and evaluating program outcomes. The Vice President-in-Charge, working through the assigned Program Manager, is ultimately responsible for:

- Providing the facilities, equipment, and budget needed to perform work safely;
- Ensuring adequate personnel and schedule for safe operations;
- Ascertaining appropriate review and distribution of health and safety documents;
- Supporting the efforts of program and field personnel; and,
- Applying appropriate disciplinary action for unsafe acts or practices.

3.2 PROGRAM MANAGER

The Program Manager has overall responsibility for the safe performance of project activities. If a health and safety issue develops in the course of performing the contract that requires consultation with the client, the Program Manager is responsible for contacting the appropriate client representative and obtaining agreement on necessary actions, and for providing project personnel with suitable guidance.

Figure 1-1. Program Organization Chart



3.3 PROGRAM SAFETY OFFICER

The PSO shall:

- Work with the OSO to implement the requirements of the company Injury and Illness Prevention Program (IIPP), along with the requirements of this Health and Safety Plan.
- Be available for consultation with the Program Manager and the OSO during the course of field work covered by this Health and Safety Plan.
- If needed, conduct periodic inspections of field activities to evaluate the effectiveness of the health and safety program and compliance with the Health and Safety Plan.
- Be responsible for the preparation of and any subsequent amendment to the Health and Safety Plan.

- Consult with the Program Manager as necessary prior to approving changes to the Health and Safety Plan.

- Coordinate modifications to the Health and Safety Plan with the OSO.

- Prepare the materials to be used for project-specific health and safety training.

The PSO is also responsible for the following:

- Ensuring that health and safety documentation conforms to applicable federal, state, and local health and safety requirements.

- Ensuring that medical monitoring, incident reporting, and health and safety recordkeeping conform to applicable federal, state, and local requirements.

- Overseeing project-specific employee training and medical surveillance.

3.4 ON-SITE SAFETY OFFICER

The MWH OSO has the responsibility and authority to halt or modify any activity or to remove personnel from the site if he or she considers conditions to be unsafe. Additionally, the OSO shall:

- Be responsible for implementing the company IIPP, along with the requirements of this Health and Safety Plan.

- Maintain current certification in cardiopulmonary resuscitation (CPR) and first aid.

- Ensure that field personnel understand and comply with safety requirements, as outlined in the MWH Industrial/Hazardous Waste Operations Health and Safety Policies and Procedures, the company IIPP, and this Health and Safety Plan.

- Ensure that a copy of the Health and Safety Plan is located at each active work zone.

- Coordinate with the PSO and Program Manager to address any unanticipated conditions that develop during the course of field activities.

- Coordinate with any subcontractor-designated OSO to resolve unsafe behavior and unsafe conditions posed by subcontractor personnel.

- Be responsible for dismissing subcontractor personnel when resolution of unsafe acts and conditions cannot be reached.

- Obtain approval of amendments to the Health and Safety Plan from the PSO before implementing any deviations from stipulated health and safety procedures.

- Conduct and document daily tailgate safety meetings.

- Be responsible for controlling the entries to and exits from active work zones.
- Monitor on-site hazards and conditions.
- Monitor field personnel for signs of thermal stress and fatigue.
- Enforce the buddy system.
- Enforce procedures for personnel and equipment decontamination, as specified in this Health and Safety Plan.
- Know emergency procedures and evacuation routes, as well as the telephone numbers of the nearest ambulance service, local hospital, poison control center, fire department, and police department.
- Verify the route to emergency medical facilities, and ensure that route information is posted.
- Serve as the primary MWH contact during any on-site emergency.
- Direct responses to emergencies as outlined by emergency response plans (see Appendix B).
- Participate in accident/incident and near miss investigations.
- Ensure that personal protective equipment (PPE) specified for use in this Health and Safety Plan is available and is being used by project personnel.
- Conduct or arrange for air monitoring as needed to verify that workers are wearing the appropriate level of PPE.
- Ensure that equipment used for assessing health hazards is calibrated and maintained in good working order.
- Periodically inspect protective clothing, as well as equipment used for assessing health hazards, for defects and signs of wear.
- Inspect and maintain first-aid kits and other emergency supplies.
- Confirm with the PSO or the responsible subcontractor official the ability of each individual assigned to field activities to perform site work, and maintain a file of current training and medical surveillance certificates.
- Enforce written medical restrictions for field personnel, as necessary.

3.5 FIELD PERSONNEL

Field personnel are responsible for understanding and complying with the requirements of this Health and Safety Plan, and are required to sign an acknowledgment to that effect. Field personnel are also responsible for bringing perceived unsafe conditions to the attention of the OSO during each daily tailgate safety meeting, or sooner if conditions warrant. During the daily tailgate safety meetings, any subcontractor personnel who will be providing services shall inform the rest of the field team of any additional hazards posed by their procedures or the operation of their equipment.

3.6 SITE VISITORS

Visitors, including MWH and subcontractor management or staff, regulatory agency personnel, or client personnel, may be present at the project site during field activities. Visitors can most likely be accommodated by providing a general viewing area at a safe location in the support zone. The OSO can provide a brief overview of the field activities to any site visitors.

If unannounced visitors request access to a project site, the OSO shall inform the appropriate client representative to obtain permission or denial of access.

4.0 PERSONNEL TRAINING

Individuals assigned by MWH to complete field work in the Southeast Idaho Phosphate Resource Area will, as appropriate, be required to meet the general site worker standards of this Plan including the training requirements described below.

MWH supports an Injury and Illness Prevention Program. The purpose of this program is to prevent accidents and minimize risk to field personnel. The MWH IIPP is summarized in Section 12.1.2, and is provided in its entirety in Appendix C of this Health and Safety Plan.

4.1 INITIAL SITE-SPECIFIC HEALTH AND SAFETY TRAINING

Site-specific health and safety training will be provided to MWH employees charged with completing field assignments as part of the 2004–5 investigation. P_4 Production's three mine sites, as well as associated surface water features that drain these mine sites, form the study area for the project for which this health and safety plan covers. A specific map of the project area is located in the PgmFSP.

On the basis of available and extensive information, MWH has demonstrated that the work being conducted under this plan does not involve the reasonable possibility for employee exposure to safety or health hazards attributable to hazardous substances. Furthermore, the waste rock, which is the source of contamination of interest, does not meet the four-prong definition of a hazardous substance per 29 CFR 1910.120(a)(3). Therefore, the training requirements of 40 CFR §1910.120 are not applicable to field personnel involved in the 2004–5 sampling efforts.

It is the responsibility of the OSO to review each area subject to the 2004–5 sampling effort, prior to allowing a field team to enter the area, to ensure that none of the proposed sampling areas fall within the above-listed locations or activities. If a proposed sampling location or activity is determined by the OSO (or other informed person) to fall within one of the above-listed locations or activities, the OSO has the authority and responsibility to stop the proposed sampling activity until it is ascertained that the field personnel entering the area meet the requirements of 40 CFR §1910.120, including the appropriate level of HAZWOPER training.

Notwithstanding the above statements, MWH expects that all field personnel are familiar with, understand, and follow the health and safety requirements and guidance provided in this manual. Training will be conducted prior to job start-up, and as needed thereafter. The PSO, OSO, and/or the Program Manager will conduct the initial site-specific training to ensure that field personnel have a thorough understanding of the Health and Safety Plan, applicable standard operating procedures (SOPs), and the chemical, physical, and biological hazards that may be associated with the investigation. This training will be repeated for new field personnel tasked with field assignments connected with the investigation, as well, prior to their undertaking any field work.

Topics that will be addressed in the initial site-specific health and safety training will include the following:

- Names of employees and others responsible for project safety and health.
- Employee rights and responsibilities under OSHA.
- The Health and Safety Plan, including the medical surveillance program.
- The acute and chronic effects of exposure to hazardous substances that may be encountered during field activities; the potential routes of exposure and symptoms of exposure for these substances; the PELs and IDLH concentrations assigned to these substances; and the level of personal exposure that can be anticipated.
- Likely physical hazards such as slipping, tripping, or falling; noise; electrocution; being struck; or being caught in or between moving equipment.
- Site control measures, including procedures for chemical handling, spill containment, decontamination, fire prevention, and any SOPs prepared specifically for the project.
- Hazard communication (per the requirements of 40 CFR § 1910.1200).
- PPE, and the action levels for upgrading PPE and for evacuating work sites.
- Engineered controls, such as dust suppression techniques adopted for this project.
- Emergency procedures and equipment.
- Any procedures adopted for air monitoring, including the functions, limitations, use, and maintenance of monitoring equipment.
- Proper use of heavy equipment and machinery, as applicable.
- Personal cleanliness and restrictions on eating, drinking, and smoking at the job site.
- Heat and cold stress prevention, monitoring, and treatment.
- Contractor injury and illness prevention programs, if applicable.

Employees will also be instructed in the use of the buddy system. The buddy system will be used whenever employees are collecting samples from active or inactive mine sites, or from rivers or streams. The buddy system is a method of organizing work groups so that an individual is always available to provide his or her partner with assistance in an emergency; to monitor his or her partner for signs of chemical or physical exposure; to periodically check that his or her partner's PPE is functioning properly; and to notify emergency response personnel if an emergency occurs. The buddy system usually requires that two or more people maintain visual contact while working. However, the buddy system can employ radio contact if site conditions are such that a person could otherwise work alone. In order to deviate from the buddy system, the PSO will require an explanation of the specific task to be completed, along with a procedure for assuring that a single person work party is safe.

Prior to collecting samples from active mine sites, personnel will be provided with safety training furnished by the mine operator. It is assumed that the training furnished by the operator will fulfill MSHA requirements published under 30 CFR 48.31. Note that activities that will be conducted during the investigation do not require the 24-hour training specified under 30 CFR 48.21 through 48.30.

The OSO will maintain documentation that each site worker has successfully completed the initial site-specific training and any additional safety training furnished by a mine operator at an active mine site.

4.2 TAILGATE SAFETY MEETINGS

Tailgate safety meetings will be conducted by the OSO each day field activities take place. This meeting will cover site activities, changes in site conditions, and activity-specific health and safety issues, and include a review of pertinent topics detailed in the initial site-specific health and safety training. Employees will also be informed of the availability of emergency assistance, as well as the most probable route of evacuation from a site, should an evacuation become necessary. Issues addressed in the daily tailgate meeting shall be documented on a form that will be signed by the personnel who attend and will be retained by the OSO. A copy of a form that can be used to document the daily tailgate safety meetings is provided in Appendix E.

Should the use of respiratory protection become necessary, site-specific training will be provided for air-purifying respirators issued for protection against site contaminants, and for any supplied-air respirators issued for emergency response or egress. Note that use of respirators requires not only training, but proper fit-testing of respirators and medical surveillance.

4.3 BLOODBORNE PATHOGENS AND FIRST AID/CPR

Personnel assigned to conduct field work for this project do not conduct first aid or CPR as a primary job function. Rather, selected employees (e.g., the OSO) have been trained in first aid and CPR for application in an emergency only. Acting in the capacity of a designated emergency first aid provider is not mandatory, and anyone who is uncomfortable with the possibility of being so designated should notify the OSO.

An indoctrination to the bloodborne pathogens standard, 29 CFR 1910.103, will be provided to employees upon request either during their first aid training, or during the initial site-specific health and safety training. Hepatitis B and acquired immune deficiency syndrome (AIDS), among other pathogenic microorganisms, can be contracted while administering emergency first aid or CPR, through contact with blood. Universal precautions require one to assume that blood and bodily fluids contain pathogens, and additionally require the use of protective barriers to prevent exposure. Washing any body part or surface that has been contaminated with blood is an important part of the universal precautions. Latex gloves and CPR barriers will be available in the first aid supplies maintained by the OSO, and should be used prior to attending to a victim. The OSO should be notified of any potential contact with blood or bodily fluids resulting from first aid or CPR administered on the job.

A vaccine is available for hepatitis B. Should employees trained in first aid and CPR desire the vaccine, MWH will arrange to have the employee receive the series of inoculations. While less efficient, the hepatitis B vaccine also is effective when administered after exposure to blood containing the hepatitis B virus.

4.4 DOCUMENTATION OF TRAINING

Written documentation verifying compliance with the training requirements of this section must be submitted to the MWH PSO or OSO prior to the beginning of field work or site access. Documentation of each worker's current training credentials will be kept by the OSO for review by authorized agency personnel.

5.0 MEDICAL SURVEILLANCE

Personnel who will be completing field assignments in support of the investigation on locations or involved in activities in which the requirements of 29 CFR § 1910.120 govern (see discussion in Section 4.1 of this Plan), must be participating in a medical surveillance program consistent with the requirements of that regulation. In addition, field personnel required to don respirators, must be participating in a medical surveillance program consistent with the requirements of 29CFR § 1910.134, Respiratory Protection. These requirements mandate that field personnel receive medical examinations prior to participating in hazardous waste site activities; annually; upon termination; following occupational exposure or injury; and additionally as needed, on a case-by-case basis.

The medical surveillance program required of each company that allows personnel to conduct field work at hazardous waste sites must be overseen by a licensed physician who is certified in occupational medicine by the American Board of Preventive Medicine, or who by training and experience is Board-eligible. When applicable, the MWH PSO will maintain copies of the physician's written authorization statements that employees conducting hazardous waste site operations are fit for hazardous waste site duty and are able to wear respiratory protection. No one shall be permitted to participate in hazardous waste site operations subject to these requirements until a copy of their medical certification is received by the MWH PSO. Copies of the physician's authorization for field personnel will be available to the field personnel upon request. Medical and exposure records will be retained for the length of the employee's employment, plus 30 years.

Field personnel will receive additional medical monitoring upon notifying the OSO, PSO, Program Manager or other authorized MWH personnel of symptoms consistent with over-exposure to site contaminants, or if the employee is injured or exposed to contaminants at concentrations in excess of a PEL during emergency response operations. Further medical examinations may be required before an employee returns to work after a serious illness or injury. Such examinations may be necessary to assure the employee's continued ability to carry out assigned duties. The need for these examinations will be determined by the MWH PSO, in cooperation with the occupational health physician representing the company. An injury or illness incurred by one of the field personnel, whether on or off the job, shall be reported to the PSO or OSO immediately. Such injury or illness may also require work restrictions when/after the employee returns to work. If the injury or illness required seeing a physician, either the attending physician or the physician giving the employment physical will be involved in deciding when the employee can return to work, and if any work restrictions will apply.

There may be circumstances when personnel are exposed to pathogenic microorganisms, either from biologically contaminated waste or from the outdoor environment. Immunizations for tetanus and hepatitis B may be considered prior to the initiation of field work. The tetanus immunization is recommended to provide protection in the event that a worker sustains a cut and is exposed to biologically-contaminated wastes. The hepatitis B immunization is recommended in the event that a worker comes into contact with blood or other bodily fluids that could be contaminated with blood or blood products. These immunizations are not required by law or

OSHA regulation. In the case of hepatitis B, however, the employee needs to sign a declination form if he or she refuses the immunization.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 PERSONAL PROTECTIVE EQUIPMENT

The Environmental Protection Agency (EPA) designations of Levels D, C, B and A for PPE are used to describe the general PPE ensembles that may be employed during hazardous waste site operations. These ensembles are depicted in Figure 6-1. Based on site contaminant information and established exposure limits, Level D has been selected as the level of protection appropriate for field personnel completing this investigation. Field personnel will also adhere to the requirements of individual mine operators when collecting samples at active and inactive mine sites. These requirements may include the use of hardhats, eye protection, steel-toed boots, and respiratory protection. It is the responsibility of the OSO and the OSO representing any subcontract personnel to ascertain the appropriate/required level of PPE for each mine site, communicate such findings to the field personnel, and to ensure that the field personnel are provided with the PPE in a timely manner.

PPE that will be employed for project field tasks and procedures is identified in the Activity Hazard Analysis in Appendix A. For activities undertaken during this project, personnel will incorporate the following into the standard Level D ensemble:

Coveralls: Personnel will wear a work uniform, including longs pants, and short-sleeved t-shirts, as a minimum.

Gloves: Nitrile gloves are required when handling potentially media.

Hardhat: Personnel will wear a hardhat when entering active and inactive mine pits to protect against rock fall.

Once on site, the OSO and the OSO representing any subcontractor personnel will evaluate work conditions and adjust the level of PPE as necessary to properly protect field personnel and meet the local mine requirements. When specifying a PPE ensemble, the following will be evaluated:

- The local mine requirements;
- The anticipated site hazards that were used to select the initial PPE ensemble;
- The limitations of each piece of PPE;
- Work duration;
- The effect of temperature extremes on the PPE ensemble;
- PPE maintenance, storage, decontamination, and disposal requirements;
- Inspections of PPE completed prior to, during, and after use;
- Personnel training in PPE use and the need for fit-testing;
- Procedures for donning and doffing; and
- Evaluation of the effectiveness of the current PPE program.

Adjustments to the PPE ensemble will be communicated to field personnel via amendment of this Health and Safety Plan or during the tailgate safety meeting.

Equipment used for respiratory protection shall be NIOSH and MSHA approved. Currently, OSHA does not allow the use of contact lenses when respiratory protection is required. Contact lenses are therefore prohibited from use with respiratory protection. Note that the use of respiratory protection also triggers the requirement for respiratory protection training, respirator fit–testing, and medical surveillance.

Level A Protection
Totally encapsulating vapor-tight suit with full-facepiece SCBA or supplied-air respirator.

Level B Protection
Totally encapsulating suit does not have to be vapor tight. Same level of respiratory protection.

Level C Protection
Full-face canister air purifying respirator. Chemical protective suit with full body coverage.

Level D Protection
Basic work uniform, i.e. longsleeve coveralls, gloves, hardhat, boot, faceshield or goggles.

SAMPLE PROTECTIVE EQUIPMENT ENSEMBLES
FIGURE 6-1

6.2 LEVEL D PERSONAL PROTECTIVE EQUIPMENT

Level D protection may be used when the following conditions are met:

- Substances that pose inhalation hazards are not present above individual or combined PELs.
- Oxygen is present at a minimum concentration of 19.5 percent.
- Toxic organic compounds are not present in the air space at concentrations that exceed normal background concentrations or specified action levels requiring use of respiratory protection.
- Work functions preclude splashes, immersion in, unexpected inhalation of, or direct contact with hazardous concentrations of harmful chemicals.

Level D protective equipment shall consist of the following:

Dedicated work uniforms with long pants and short-sleeve shirt.

- Steel-toed and shank leather, PVC, or rubber safety shoes or boots meeting the specifications of American National Standards Institute (ANSI) Z41.
- Leather or impervious Gloves
- Safety glasses, goggles, face shield, or other approved eye protection.
- Hardhat, unless specifically stated otherwise.
- Escape breathing apparatus when potential site conditions warrant, as determined by the OSO.
- Hearing protection, as needed.

The dedicated work uniforms may include chemical-resistant coveralls or standard Tyvek coveralls, or standard cotton or cotton blend work uniforms. The work gloves may include heavy cotton or leather work gloves or impervious gloves. In general, it is recommended that an impervious glove be worn while performing actions that could result in direct contact with potentially contaminated soil, water, or other media. Approved eye protection must meet the specifications of ANSI Z87.1. The use of contact lenses is discouraged, but not prohibited, during Level D operations. However, safety glasses or goggles that fit over prescription lenses or prescription safety glasses or goggles are recommended. Approved hardhats must meet the specifications of ANSI Z89.1. Hearing protection must have a noise reduction rating consistent with reducing the ambient noise level to below 85 dBA.

6.3 LEVEL C PERSONAL PROTECTIVE EQUIPMENT

The OSO may upgrade to Level C protection when the concentration of known airborne contaminants or dust in the breathing zone is above action levels. However, the following conditions must be met:

- Oxygen is present at a minimum concentration of 19.5 percent.
- The types of air contaminants have been identified, their concentrations have been measured, and air-purifying respirators and protective clothing are available that can protect against the identified contaminants.
- The contaminants possess adequate warning properties, and the criteria for the use of an air-purifying respirator have been met.
- Exposed skin will not be adversely affected by airborne contamination, liquid splashes, or other direct contact.

Level C protective equipment shall consist of the following:

- Chemical-resistant coveralls made of polyethylene coated Tyvek, Saranex, or other approved fabric.
- Steel-toed and shank safety shoes with disposable boot covers or chemical-resistant, steel-toed boots meeting the specifications of ANSI Z41.
- Chemical-resistant gloves, such as disposable inner gloves of nitrile or latex; or disposable outer gloves of nitrile, Viton, silver shield, 4H, butyl or nitrile.
- Work gloves as necessary to prevent cuts, scrapes, and pinches.
- Half-face or full-face air-purifying respirator with appropriate cartridges.
- Safety glasses, goggles, or faceshield meeting the specifications of ANSI Z87.1 for use with a half-face air-purifying respirator.
- Hardhat meeting the specifications of ANSI Z89.1, unless specifically stated otherwise.
- Cuffs sealed to boots or gloves with duct tape or equivalent.
- Hearing protection, as necessary.

Hearing protection must have a noise reduction rating consistent with reducing the ambient noise level to below 85 dBA.

6.4 LEVEL B PERSONAL PROTECTIVE EQUIPMENT

The OSO may upgrade to Level B protection under the following conditions:

- Concentration of known airborne contaminants or dust in the breathing zone is above action levels.
- The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection. This condition may involve atmospheres with IDLH concentrations of specific substances that do not represent a severe skin hazard, or atmospheres that do not meet the criteria for use of air-purifying respirators.
- Presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high concentrations of chemicals harmful to skin or capable of being absorbed through intact skin.
- Confined-space entry is required.
- Oxygen is present at a concentration of less than 19.5 percent.

Level B protective equipment shall consist of the following:

- Chemical-resistant polylaminated, Barricade, or Saranex coverall.
- Steel-toed and shank safety shoes with disposable boot covers, or chemical-resistant, steel-toed boots meeting the specifications of ANSI Z41.
- Disposable, inner, surgical, or nitrile gloves.
- Disposable, outer, chemical-resistant gloves of Viton or the equivalent.
- Pressure-demand, self-contained breathing apparatus (SCBA) or airline system with five-minute egress bottle.
- Hardhat meeting the specifications of ANSI Z89.1, unless specifically stated otherwise.
- Ankles and wrists secured to boots and gloves with duct tape or equivalent.
- Hearing protection, as necessary.
- Two-way radio communications, or equivalent.

Use of Level B personal protective equipment requires that at least one person be available as a backup, ready to provide emergency assistance and to assist with the air supply. Hearing protection must have a noise reduction rating consistent with reducing the ambient noise level to below 85 dBA.

6.5 LEVEL A PERSONAL PROTECTIVE EQUIPMENT

Level A provides the highest protection available for respiratory, skin, and eye protection. Level A PPE is not expected to be required for use during any MWH field effort. However, in the event that site conditions change and the use of Level A becomes necessary, a specialty contractor will be retained to provide assistance with the Level A equipment and tasks.

The OSO will upgrade to Level A protection under the following conditions:

- The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either measured or potentially high concentrations of atmospheric vapors, gases, or particulates; or site operations and work functions create a high potential for splash or for exposure to unexpected vapors, gases, or particulates that are harmful to the skin or capable of being absorbed through the intact skin.

- Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible.

- Operations must be conducted in confined, poorly ventilated areas.

Level A protective equipment shall consist of the following:

- Fully encapsulating, chemical-resistant suit.

- Steel-toed and shank safety shoes with disposable boot covers, or chemical-resistant, steel-toed boots meeting the specifications of ANSI Z41.

- Disposable, inner gloves; disposable outer gloves may also be necessary.

- Pressure-demand, full facepiece SCBA, or pressure-demand, supplied-air respirator with escape SCBA.

- Hardhat meeting the specifications of ANSI Z89.1, unless specifically stated otherwise.

- Hearing protection, as necessary.

- Two-way radio communications or equivalent.

When heat stress is a concern, a cooling unit that can be worn inside of the fully encapsulating suit may be specified. Hearing protection must have a noise reduction rating consistent with reducing the ambient noise level to below 85 dBA.

6.6 PPE STORAGE

Clothing and respirators must be stored properly to prevent damage or malfunction due to exposure to dust, moisture, sunlight, damaging chemicals, extreme temperatures, and impact. Potentially contaminated PPE should be stored separately from new PPE and street clothing. Field personnel should always review the manufacturer's instructions for care and maintenance of PPE. Respirators must be cleaned after use with either a sanitizing wipe pad or sanitizing soap, and stored in a sealable container. When respirators are not in use, but have been worn, they must be stored in a sealable container other than the clean storage container. At no time is it permissible to store a doffed respirator outside of a storage container.

PPE storage will be provided in the field by the OSO. However, each individual is responsible for ensuring that his or her issued PPE is protected from extremes of temperature, and is stored in a manner that prevents the PPE from becoming damaged or disfigured.

Because of the relatively low exposures that are expected during the investigation, no vapor or dust monitoring will be undertaken. However, personnel monitoring for heat and cold stress will be performed. Heat and cold stress will be monitored qualitatively, as described in the following paragraphs.

7.1 HEAT STRESS

The stress of working in a hot environment can cause a variety of illnesses, including heat exhaustion or heat stroke; the latter can be fatal. The use of PPE can increase heat stress significantly, although heat stress can overcome people wearing regular, permeable work clothing, as well. To reduce or prevent heat stress, frequent rest periods and the intake of salts and liquids to conserve and replace body fluids may be necessary.

Personnel should recognize the symptoms of heat stress, and take appropriate action on recognition. Some of the symptoms that indicate heat exhaustion are:

- Clammy skin
- Lightheadedness
- Slurred speech
- Rapid pulse
- Weakness, fatigue
- Confusion
- Fainting
- Nausea (vomiting)

If these symptoms are noted, the following steps should be taken:

- Remove the victim to a cool and uncontaminated area;
- Remove protective clothing; and
- Give water to drink, if conscious.

Symptoms that indicate heat stroke include:

- Staggering gait
- Hot skin, temperature rise (yet may feel chilled)
- Incoherent, delirious
- Mental confusion
- Convulsions
- Unconsciousness

If these symptoms are noted, the following steps should be taken:

- Remove victim to a cool, uncontaminated area;
- Cool the victim, whole body, with water, compresses and/or rapid fanning;
- Give water to drink, if conscious; and
- Transport the victim to the designated medical facility for further cooling and monitoring of body functions.

HEAT STROKE IS A MEDICAL EMERGENCY!

7.2 COLD STRESS

On days of low temperature, high wind, and humidity, anyone can suffer from the cold. Severe exposure to cold can be life threatening. Several factors increase the harmful effects of cold: being very young or very old, wearing wet clothing, having wounds or fractures, smoking, drinking alcoholic beverages, fatigue, emotional stress, and certain diseases and medications.

Cold weather injuries may be local or systemic. Local cold weather injuries include chilblains (chronic injury of the skin and peripheral capillary circulation) and frostbite. Frostbite occurs in three progressive stages: frostnip, superficial frostbite, and deep frostbite. Systemic cold injuries associated with hypothermia affect the entire body system. Hypothermia is caused by exposure to cold and is aggravated by moisture, cold winds, fatigue, hunger, and inadequate clothing or shelter.

Precautionary measures that will be taken to prevent or mitigate cold stress will include:

- Providing field shelters or wind screens.
- Monitoring temperature and wind speed to determine appropriate safety measures.
- Adjusting work schedule based on weather conditions and temperature.
- Providing insulated clothing for field workers.
- Adhering strictly to the buddy system so that workers can monitor for symptoms of cold stress in their co-workers.

7.2.1 Frostbite Monitoring

Frostbite is a potentially crippling condition that can occur when inadequately protected skin or body parts are exposed to freezing weather. Team members should continually be alert for signs of frostbite in co-workers, and bring any occurrences to the attention of the OSO. A cold feeling, pain, and numbness precede the onset of frostbite. Frostbite usually appears as gray or white waxy spots on skin. Areas most susceptible to frostbite are the nose, ears, and cheeks.

The following steps should be taken to avoid frostbite:

- Dress warmly;
- Wear layers of clothes;
- Keep boots and gloves loose-fitting;
- Stay dry;
- Carry extra clothing;
- Avoid touching cold metal with bare hands; and
- Avoid spilling cold fuel, alcohol, or other liquids that freeze below 32°F on your body or clothing.

If a person is frostbitten, get them to a hospital as soon as possible. If transport to a hospital is not immediately available, get the person to a warm shelter and immediately perform the following:

- Cover exposed areas with additional clothing;
- Wrap the person in blankets or a sleeping bag;
- Give the person warm, non-alcoholic drinks;
- Undress the frozen part and submerge the frozen part in a tub of warm water (102° F to 105°F), or put the frostbitten person in a large tub of warm water, if available, and stir the water;
- Warm with skin to skin contact, such as placing warm hands on frozen nose or ears, (but do not rub); and
- Get the person to a hospital as soon as possible.

Do not rub the frozen part; do not give the person liquor; do not allow the person to walk on thawed feet; do not let the person smoke; do not break any blisters that may form; do not let the thawed part freeze again; and do not warm the frozen part in front of a source of dry heat, such as an open fire or oven.

7.2.2 Hypothermia Monitoring

Hypothermia is a lowering of the body's temperature due to exposure to cool or cold temperatures. Field personnel should be continually alert for signs of hypothermia in co-workers, and bring any signs of hypothermia to the attention of the OSO. Most cases of hypothermia occur at temperatures between 30°F and 50°F. Hypothermia is a medical emergency: if not properly treated, hypothermia can cause death. Safety equipment for hypothermia should include a synthetic sleeping bag and a hypothermia thermometer. Personnel suffering from hypothermia should be transported to a hospital as soon as possible, even if they appear to be recovering.

To prevent hypothermia:

- Eat well prior to exposure;
- Dress warmly; and
- Avoid becoming wet through sweating, rain or snow, or falling in water.

Early signs of hypothermia may include violent shivering, slurred speech, a loss of coordination, confusion and an inability to answer simple questions, unusually irritable or strange behavior, or a tendency to drop or lose clothing or equipment. As hypothermia progresses into more serious stages, the victim typically develops trouble seeing clearly, becomes sleepy and numb, and begins to move with difficulty. Eventually, the victim will lapse into unconsciousness if not properly cared for.

The following actions should be taken to treat a hypothermia victim:

- Get the victim to a warm, dry shelter as soon as possible;
- Remove any wet or cold garments and dry the person thoroughly; and
- Wrap the victim in blankets, sleeping bags, or dry clothing to prevent more heat loss.

If a warm area is not available, build a shelter and put the victim in the warmest, driest area available. Remove any wet or cold garments, and have one or more persons remove their clothing and lay next to the victim, providing skin to skin contact. Then, wrap the victim and rescuers in dry warm blankets, sleeping bags, or clothing. When the victim becomes conscious, place warm objects along the victim's sides to warm vital areas. When the victim is able to swallow easily, provide warm, sweetened drinks and food, preferably candy or sweets. Do not give the victim alcohol or allow the victim to smoke; do not rub the victim's skin; and keep checking the victim and providing additional assistance as needed.

8.0 SITE CONTROL

Site control is an important part of a field health and safety program. The purposes of site control are to minimize potential worker exposures, protect the public from site hazards, and prevent vandalism of site facilities. Site control procedures that will be implemented during the investigation of the southeast Idaho phosphate resource area, which are discussed in this section, consist of site security controls and communication systems. Decontamination procedures are discussed in Section 9.0, and emergency response planning is discussed in Section 10.0.

While undertaking site activities, personnel may forget or ignore provisions of the Health and Safety Plan. Personnel who observe deviations from accepted safe work practices will tactfully remind the responsible individuals of proper procedures. However, under no conditions are deviations from safe work practices to be tolerated by anyone on site. If the deviation continues, the MWH OSO will be informed of the circumstances. The MWH OSO will attempt to correct the unsafe behavior or unsafe condition. Should this attempt fail, the MWH OSO shall halt site activities and dismiss the non-cooperative personnel.

8.1 MULTIPLE-EMPLOYER JOB SETTING

Enforcing safe work practices at a multiple-employer job site presents many challenges. Under OSHA, each employer is required to provide a safe and healthful working environment for its employees. Most hazardous waste sites require several contractors to work simultaneously on different project tasks. In this situation, the activities of one company could create hazards for the employees of another company. It is not possible to anticipate every hazard associated with activities at a multiple-employer job site in a Health and Safety Plan. The OSO must discuss particular safety and health issues that may be associated with each day's activities at the daily tailgate safety meeting.

8.2 SITE SECURITY

Existing site controls that are likely to be encountered during the course of the investigation will vary from no controls to strict property perimeter controls. When possible, client personnel will be requested to investigate any suspicious activities at the field sites. In some cases, an independent security watch may be needed. Security at the sites will be the responsibility of the client during periods of inactivity, including weekends. To maintain security at the sites during working hours, the OSO will:

- Control site entrances and exits as necessary through the installation of appropriate safety barricades, signs, and/or signal lights.
- Establish a personnel identification system.
- Be responsible for enforcing entry and exit requirements.
- Utilize temporary fencing to control site access, where feasible.

- Post warning signs around the perimeter of the work area, should the use of temporary fencing not be feasible.

To maintain security during nonworking hours, the OSO will secure the site prior to leaving at the end of a working day. Equipment and supplies will be secured or stored in locked facilities, and any open holes or trenches will be covered with plywood or similar materials.

8.3 COMMUNICATION SYSTEMS

Two general types of communication systems should be available for workers assigned to field projects. One system will ensure adequate communication between field personnel, and the other will ensure the ability to contact personnel and emergency assistance off site. Internal communication will be used to:

- Alert team members to emergencies.
- Pass along safety information, such as weather conditions that could affect heat stress, cold stress or general safety.
- Maintain site control.
- Facilitate site work by being able to call the appropriate party for information without having to decontaminate the work party and equipment and secure the site.

Verbal communication can be impeded by background noise and limitations imposed by PPE. It is therefore vital that pre-arranged signals of communication be arranged prior to the initiation of site activities, particularly when heavy equipment may be operating in the vicinity. Common types of internal communication devices include:

- Radios;
- Noisemakers such as compressed air horns, megaphones, sirens, and whistles; or,
- Hand and arm signals.

External communication systems between on-site and off-field personnel are necessary to:

- Coordinate emergency response efforts,
- Report to upper management about site activities, and
- Maintain contact with essential off-field personnel.

The primary means of external communication are telephones, radios, facsimile machines, and computer networks.

9.0 DECONTAMINATION PROCEDURES

Decontamination procedures are implemented to prevent cross-contamination of samples, to control possible migration of site contaminants to clean areas, and to prevent personnel exposure to chemicals or pathogens that may contaminate clothing or protective gear. Personnel conducting field activities must decontaminate upon the completion of these activities**.** Additionally, before demobilization, equipment will be decontaminated before it is moved. Any material that is generated by decontamination procedures will be labeled and stored until final disposal arrangements are made.

9.1 GENERAL DECONTAMINATION PROCEDURES

Decontamination procedures shall be supervised by the OSO. The type of solution to be used for equipment decontamination is specified in the Field Sampling Plan. Personnel decontamination will be accomplished using ordinary soap and water. Personnel will be required to wash their hands, and optionally their faces, with soap before eating or drinking, unless specific procedures are in place to ensure that a drink can be taken without the possibility of contamination. Personnel may also be required to wash their hands, and optionally their faces, before leaving the work site. Decontamination solutions will be changed daily at a minimum.

The following decontamination procedures and guidelines shall be implemented:

- Respirators will be inspected and washed in soapy water, if necessary, at least at the end of each work shift. Respirators will be disinfected with sanitary wipes or sanitizer solution every day. Respirators will be stored in sealable plastic bags in a location that is free from chemical or biological hazards and temperature extremes.

- Disposable protective clothing will be used as necessary eliminate the need for decontaminating clothing.

- Decontamination procedures will be designed to prevent or minimize direct contact with waste materials.

- Disposable protective clothing and contaminated material will be collected in plastic sacks and disposed of appropriately.

9.2 EMERGENCY DECONTAMINATION

It is not anticipated that emergency decontamination of heavy equipment will be necessary. Emergency decontamination of field personnel may be necessary for medical reasons or in the event of personnel contamination. Emergency procedures will include:

- Assistance by field personnel with removal of contaminated protective clothing, when time permits. If the employee is injured and cannot be moved, attempts will be made to cut the clothing for removal.

- If the situation is life-threatening, decontamination or removal of protective clothing will be considered secondary to medical treatment. If needed to minimize the spread of contamination, personnel will be wrapped in blankets or plastic sheeting for transport to the emergency facility. Emergency personnel will be notified of the nature of the contaminated material and instructed about the importance of preventing skin contact.

- If the employee can walk or be moved without injury, affected skin areas should be washed thoroughly with soapy water and rinsed.

- Contaminated equipment will be decontaminated or disposed of in appropriate collection containers.

9.3 CONTAMINATION CONTROL

The decontamination procedures summarized above will be the primary methods of contaminant control. In addition to these procedures, measures will be taken to limit the movement of dust and vapors that may be generated within the work area.

Eating, drinking, smoking, chewing, and application of cosmetics shall be restricted to the support zone, except for drinking of replacement fluids. Replacement fluids shall be permitted in designated areas of the work area, under strict protocols designed to prevent ingestion of contaminated material. Personnel returning from the work area or decontamination zone shall cleanse their hands, faces, and other exposed areas thoroughly at the decontamination facility before smoking and eating.

Personnel who may be required to wear respiratory protective equipment, either on a routine or emergency basis, must be clean shaven (free from beards or other facial hair that would interfere with the proper fitting of respirators).

9.4 DECONTAMINATION WASTE HANDLING AND DISPOSAL

Wastes generated as a result of site activities will be handled in accordance with applicable environmental regulations. Investigation-derived wastes and contaminated site materials will be handled and disposed of in accordance with the provisions of the Field Sampling Plan or client specifications. Unless, specifically stated, personnel are to treat decontamination wastes as part of the investigation derived wastes.

10.0 EMERGENCY RESPONSE PLANNING

The objective of this Health and Safety Plan is to minimize exposure to chemical, biological, and physical hazards, and to prevent work-related illnesses and injuries. Emergency response planning is included as part of this plan to provide procedures for responding to emergencies that may occur. This section contains information on how to deal with emergencies. It is not the purpose of this Health and Safety Plan, however, to provide guidance for emergency response as part of field operations. Field personnel are instructed to assess emergencies and make the appropriate notification to emergency responders. **Under no circumstances are field personnel to take emergency response actions for which they are not properly trained.**

The MWH OSO will serve as the primary MWH contact during any on-site emergency. The OSO will be responsible for making the appropriate notifications, directing responses to emergencies until relieved by a qualified Incident Commander. As part of his or her duties, the OSO will be required to know emergency procedures and evacuation routes, as well as the telephone numbers of the nearest ambulance service, local hospital, poison control center, fire department, and police department. The OSO will also be responsible for verifying the route to emergency medical facilities, and ensuring that route information is posted and available to field personnel. Emergency telephone numbers and maps showing the locations of the hospitals and emergency clinics capable of providing emergency service for hazardous waste field personnel are provided in Appendix B. Telephone numbers for the Poison Control Center, local Police and Sheriff's Departments, local Fire Departments, including the emergency rescue squad, the Office of Emergency Services, MWH management, and client contacts also are included. Copies of the hospital route maps provided in Appendix B will be kept in site support vehicles; and field personnel will become familiar with the routes and the travel times involved.

The OSO shall immediately notify the Program Manager of the following:

- Any required site evacuation prompted by air monitoring data;
- Any fatality or injury to one or more field personnel that requires medical attention; and
- Any physical hazard creating the potential for death or permanent injury.

Vehicles that can be used to transport injured personnel from work sites will be available during working hours. A system will also be available on site for communicating with off-site personnel. On-site communication systems may include cellular phones, two-way radios, or other suitable devices. Additionally, first aid supplies and potable water will be available at every site for emergency use.

Cellular phones may not always be operable in remote areas. Consequently, when entering remote areas, field personnel will file their anticipated itinerary with each sampling team leader. The itinerary will include where the field team expects to be on what days, the travel route, and the expected date and time of return. The field team will notify each sampling team leader upon returning to their vehicle. If the sampling team leaders do not hear from a field team by an agreed-upon time, the field team leader will initiate search and rescue operations. In addition, the

field team leader will attempt to call the Program Manager daily to report on the daily activities, any health and safety issues encountered, and the expected itinerary for the next day.

Prior to the start of work, project personnel will be acquainted with established emergency response procedures and equipment. Furthermore the OSO will be certified to render first aid and CPR prior to commencement of field activities. The buddy system will be used when working in remote areas, near significant waterways, or in active or inactive mine pits. The buddy system will not be required while collecting samples in agricultural areas when cellular phone contact is available.

At each work site, evacuation routes will be clearly communicated to project workers who will enter a work area or CRZ. Evacuation routes from each work site will also be discussed during tailgate safety meetings prior to the start of work. A safe place of refuge where a headcount can be completed following an emergency evacuation will be identified at each work site. An unexpected vapor release, fire, or explosion will cause associated site work to cease and prompt an immediate evacuation.

Accidents, safety-related incidents, and safety-related near misses will be documented and reported to the MWH PSO, OSO and Program Manager on a daily basis at a minimum.

11.0 HEALTH AND SAFETY DOCUMENTATION

Documentation of personnel credentials, site activities, and environmental monitoring will be maintained by the OSO during field activities and by the PSO thereafter. Examples of some of the forms that may be employed for documenting compliance with the MWH health and safety program and this Health and Safety Plan are presented in the appendices. The MWH PSO or designated OSO will maintain and update these documents. Appropriate regulatory agency personnel shall be granted access to these records.

Unanticipated field conditions may occasionally require modification of this Health and Safety Plan. However, **except in case of emergency, no deviations from this plan may be implemented without the prior notification and approval of the designated MWH PSO.** Client notification and approval procedures will depend on field conditions. Any upgrade to PPE will be reported in the Tailgate Safety Meeting Forms. Minor changes to the Health and Safety Plan to accommodate on-site conditions can be implemented by the OSO upon review and approval of the PSO; such changes might include minor revisions to decontamination or site control procedures.

12.0 GENERAL SITE SAFETY

The health and safety program contained in this portion of each MWH Health and Safety Plan has been developed in accordance with relevant occupational safety and health regulations and requirements, and applies to field sites and workplaces. Because this section is intended to be applicable to a wide range of sites and conditions, there may be information in this section that applies to certain areas of the country only.

The following practices are expressly forbidden during site work:

- Smoking, eating, drinking, chewing tobacco, or applying cosmetics while in an exclusion zone, CRZ, or potentially contaminated area.
- Ignition of flammable materials in the work zone. Equipment will be bonded and grounded, spark proof and explosion resistant, as appropriate.
- Contact with potentially contaminated substances; walking through puddles or pools of liquid; kneeling on the ground; or leaning, sitting, or placing equipment on contaminated soil.
- Performance of tasks in an exclusion zone without a buddy: personnel will be required to use the buddy system unless specifically exempted elsewhere in the Health and Safety Plan.

Personnel must keep the following guidelines in mind when performing field activities:

- Hazard assessment is a continuous process. Personnel must be aware of their surroundings and the chemical and physical hazards that are present.
- The number of personnel in the exclusion zone will be the minimum number necessary to perform work tasks in a safe and efficient manner.
- Field personnel will be aware of the physical characteristics of each site, including site access, the location of overhead power lines and underground utilities, wind direction, and the location of communication devices and safety equipment.

12.1 GENERAL HEALTH AND SAFETY PROGRAM ELEMENTS

12.1.1 Hazard Communication Program

MWH has a written Hazard Communication Program. This program appears as MWH H & S Policies Procedure No. 1000. A copy of this will be available to field personnel. As necessary, the hazard communication program of subcontractors also will be solicited for use as a project

reference. MWH and subcontractor field personnel will be made aware of the MWH Hazard Communication Program and have access to MSDSs for chemicals brought to any field site.

12.1.2 Injury and Illness Prevention Program

The prevention of accidents and minimization of risks is the responsibility of every site worker. Injury and illness prevention protocols are described below. Appendix C presents the MWH IIPP in its entirety.

An IIPP is included in this Health and Safety Plan to assure a safe and healthful work environment for field personnel. The OSO will be responsible for implementation of company-specific IIPPs and for determining relative effectiveness. Field personnel will be accountable for reading, understanding, and following the guidelines contained in this Health and Safety Plan and the company-specific IIPPs affecting on-site work.

There are nine key components of an IIPP. Each component is summarized below:

- **Identification and Evaluation of Hazards**: It is the intent of this Health and Safety Plan to identify and evaluate the potential hazards associated with each site.

- **Inspections**: Inspections will be performed on a daily basis by the OSO or subcontractor's OSO, to assess the effectiveness of both the IIPP and this Health and Safety Plan. The PSO may be on site periodically to conduct audits of the health and safety program and Health and Safety Plan compliance.

- **Correction of Unsafe Conditions**: As a result of daily safety inspections and periodic site health and safety audits, unsafe conditions will be identified and a site-specific action plan developed to alleviate identified unsafe conditions. It is the responsibility of the OSO to coordinate the implementation of corrective site actions. Such corrective actions will be considered a top priority. When immediate health or safety hazards exist on the site, it will be the responsibility of the OSO to halt site activities until the immediate threat has been abated.

- **Accident Investigation**: Appendix F of this document contains recommended procedure for reporting and investigating site accidents, incidents, and near miss accidents or incidents. Field personnel will be held responsible for reporting accidents, incidents, and near misses. The OSO will begin the accident investigation procedure and determine if additional assistance is required. If necessary, the PSO and/or Program Manager will come to the site and participate in the accident investigation. Reports will be distributed to management, and corrective actions will be communicated to field personnel.

- **Communication**: Communication will take place on the site in accordance with the training provisions of Section 4.0 of this Health and Safety Plan. Emergency phone numbers will be posted for the fire department, ambulance service, and the nearest emergency medical clinic or hospital. As outlined in Section 4.0, tailgate safety meetings will be conducted to discuss pertinent site safety topics at the beginning of

each shift, whenever new personnel arrive at the job site, and as site conditions change. These meetings will be conducted by the OSO and, at the conclusion of each meeting, a completed tailgate safety meeting form will be posted at the job site. A sample Tailgate Safety Meeting Form is found in Appendix E.

- **Training**: Various training requirements apply to field activities. These requirements are addressed in Section 4.0 of this Health and Safety Plan.

- **Recordkeeping**: Various records documenting training, tailgate safety meetings, site inspections, accident reports, medical surveillance examinations and general site safety and health information are required for this project. The OSO will be responsible for maintaining records needed to demonstrate compliance with health and safety standards during field activities. The PSO will maintain these documents thereafter.

- **Responsibilities**: Clear assignment and definition of the various roles and responsibilities of this health and safety program are vital to its success. Section 3.0 of this Health and Safety Plan details the assigned roles and responsibilities for health and safety as they apply to this project. Section 3.0 also identifies by name the individuals tasked with the various roles and responsibilities.

- **Disciplinary Action**: Personnel assigned to the field are expected to conduct themselves in a manner that promotes personnel health and safety. Employees not able to conform to the safety and health protocols contained in this document will be subject to disciplinary action, up to and including termination. Personnel who knowingly disobey safe operating procedures will be disciplined. Depending on the nature of the infraction, the disciplinary action will progress from a verbal warning, to a written warning, to a suspension from site activities, to dismissal from the site.

12.1.3 Sanitation

Work breaks, eating, drinking, and paperwork tasks will be performed in the field vehicle or other suitable location outside of any exclusion zone or CRZ. Field personnel will wash their hands prior to eating or drinking.

The OSO is responsible for ensuring that an adequate supply of water is available at the site. During times of heavy labor and hot temperatures, it is recommended that approximately one liter of water per hour be ingested. Sport-type beverages also may be provided for field personnel. Non-potable water outlets must be clearly identified. When decontamination procedures interfere with the ability of field personnel to obtain sufficient drinking water, personnel may drink water without prior personnel decontamination under the following stipulations:

- Water is dispensed from a cooler with a pull-lever pouring spout. Push-button pouring spouts are unacceptable, as dirty fingers can easily contaminate the pouring spout.

- Minimum three-inch tall disposable drinking cups must be used and discarded after each use.

- Drinking cups must be dispensed out of a plastic or metal dispenser attached to the cooler, allowing the bottom of the cup to be grabbed without touching the top rim.

Support zone food handling must comply with local requirements governing the use of barbecues and vending. Food must be stored at above 140°F or below 40°F to kill or retard food-borne pathogenic microorganisms.

Sleeping quarters will be arranged by MWH management when personnel must travel away from their home to work on site. Longer-term sleeping quarters will be equipped with shower and changing facilities.

12.1.4 Illumination

All site work will be done during daylight hours, with the exception of driving to and from the work site. When performing work during non-daylight hours, personnel must be furnished with sufficient light. OSHA requires a minimum of five foot-candles of light for general work sites. However, five foot-candles is likely to be inadequate, and additional light may be required. Most equipment rental companies maintain light sources capable of providing enough light for site work. Ensure that electrical lines are properly grounded with a ground-fault circuit interrupter, and that explosion-proof lighting is used in flammable atmospheres.

12.1.5 Excavation and Trenching

Entry into excavations will be avoided. If an excavation or trench entry is necessary during the course of the project, specific details concerning the nature of the entry and safety precautions will be provided in Section 2.0. At a minimum, the excavation will be overseen by a Certified "Competent Person." Protective measures such as sloping, benching, or shoring will be implemented, depending on the nature of the entry and the soil classification. Trenching and excavation activities will conform to the requirements of 29 CFR 1926, Subpart P.

12.1.6 Confined Space Entry

Entry into a confined space shall not be permissible for any of the field personnel. Only trained and experienced personnel are permitted to conduct a confined space entry and then only under a confined space entry permit program. MWH does not maintain a confined space permit system or rescue team. Confined space entries will conform to the requirements of 29 CFR 1910.146.

12.1.7 Spill Containment Program

If a spill occurs on site, field personnel will assess the situation and notify the appropriate emergency responders. **Field personnel are not to take any emergency response actions for which they are not properly trained.** The OSO shall be immediately notified in any spill

event. The OSO will determine the appropriate notifications to make and the appropriate emergency response actions to be taken prior to the arrival of emergency response personnel.

Once appropriate notifications and efforts to mitigate the spill are underway, the MWH Program Manager and appropriate client representatives shall be notified. If any state or federal reportable quantities are exceeded, the client will report the spill to the appropriate federal, state, and local agencies.

12.1.8 Standard Emergency Hand Signals

Team members should be familiar with the following emergency hand signals:

- Hand gripping throat: "Respirator problems, can't breathe."
- Grip team member's wrist or place both hands around waist: "Leave site immediately; no debate!"
- Thumbs up: "OK, I'm all right; I understand."
- Thumbs down: "No, negative."
- Hands on face: "Put on respirator."

12.1.9 Fire Protection

Field activities associated with hazardous waste operations could potentially result in a fire at a site. Cigarette smoking is expressly forbidden in any exclusion zone. Air monitoring equipment used to monitor for flammable mixtures will be intrinsically safe, and measurements will be taken at a frequency that will allow a reliable assessment of fire hazards. Invasive field activities will be monitored with direct reading air monitoring equipment.

Electrical wiring will be free from frayed ends and sections, and hook-ups will be checked for loose fittings. Portable power tools will be connected to a ground fault circuit interrupter, and care will be taken to ensure that electrical connections do not exceed the maximum load capacity for any one circuit.

12.1.9.1 Wildfires

Wide open areas of natural brush present the danger of wildfires. Many project sites have structures that can provide enough of a fire break to prevent a wildfire from endangering field personnel, but such a structure does not provide absolute protection. The MWH OSO will therefore check regularly with the local fire department during the most common wildfire months of July through November. Should a wildfire threaten a work site, the MWH OSO will watch for changing conditions and evacuate and secure each active site, in accordance with local fire department instructions.

12.1.9.2 Fire or Explosion Response Action

The actions listed below are in a general chronological sequence. Conditions and common sense may dictate changes in the sequence of actions and the addition, elimination, or modification of specific steps.

Immediate Action. Upon detecting a fire/explosion, employees will notify the fire department and determine whether or not the fire is small enough to extinguish readily with immediately available portable extinguishers or water, or if other fire-fighting methods are necessary. Non-essential personnel will be directed away from the area of the fire. If it is judged that a fire is small enough to fight with available extinguishing media, employees will attempt to extinguish the fire provided that:

- They have been properly trained on the use of the specific fire extinguisher to be used.
- They are able to approach the fire from the upwind side, or opposite to the direction of the fire's progress.
- The correct extinguisher is readily available.
- No known complicating factors are present, such as likelihood of rapid spread, imminent risk of explosion, or gross contamination.

Personnel leaving a fire/explosion area will notify the fire department and will account for employees in that exclusion zone as soon as possible. The OSO or designee will perform a head count for that exclusion zone.

Notification. The MWH OSO will be notified as soon as possible of the location, size, and nature of the fire/explosion. A member of the MWH management team will notify appropriate agency personnel in the event of a fire or explosion resulting in a release of a hazardous material to the environment. As conditions dictate, the OSO will declare an emergency, initiate the remedial procedures, request assistance from the fire department, and make the necessary on-site and off-site notifications. If assistance from the fire department is required, an escort appointed by the OSO will direct responders' vehicles over clean roads to the extent possible to limit contamination. Note: National Fire Protection Association (NFPA) guidelines call for notifying the fire department, even for small fires to ensure proper extinguishment.

Rescue. If employee(s) are unable to evacuate themselves from a fire/explosion area for any reason, their rescue will be the first priority of responders. The field team leader and/or OSO will determine whether on-site resources are sufficient to proceed, or if rescue must be delayed until outside responders arrive. **Field personnel are not to take any actions which place themselves or other in danger and/or for which they have not been properly trained.**

Fire-Fighting Procedures. Planned fire-fighting procedures are described below. These apply to small fires that the project personnel are able to control.

Fire During Working Hours: In the event a support zone fire occurs during working hours, the following measures will be taken to put out the fire provided the person is properly trained to do

so. These measures are sequential, that is, if the first measure does not succeed in containing the fire, the next measure will be initiated.

- Use fire extinguishers
- Confirm that request for assistance from the fire department has been made
- Utilize earth moving equipment, foam unit, and water truck, as appropriate. Brush fires will be extinguished with water.

Fire During Non-Working Hours: In the event of a fire during non-working hours, existing alarms, site security (if applicable), or whomever from the project team is notified, will notify the MWH OSO or PSO. Additional actions will be consistent with procedures established for a fire during working hours.

Response Coordination. Upon arrival of outside responders from the fire department, the OSO will coordinate with the leader of the outside responders to direct fire-fighting activities; however, the control of the scene is now the responsibility of the leader of the outside responders.

Protection of Personnel. The primary methods of protecting personnel from fire conditions will be by distance and remaining upwind. Based on the conditions, the OSO will determine appropriate distances and the selection of personal protective equipment for field personnel.

Decontamination. At the conclusion of fire fighting activities, the OSO will:

- Determine to the extent practicable the nature of the contaminants encountered during the incident.
- Arrange for outside responders' fire response equipment, and on-site equipment as necessary, to be processed through the site decontamination zone, using methods appropriate for the contaminants involved.
- Equipment not easily decontaminated shall be labeled and isolated for further action, such as determining specific contaminants by wipe sampling or awaiting the delivery of specific decontamination media and supplies.

Fire Extinguisher Information. The four classes of fire, along with their constituents, are as follows:

Class A - Wood, cloth, paper, rubber, many plastics, ordinary combustible materials

Class B - Flammable liquids, gases, and greases

Class C - Energized electrical equipment

Class D - Combustible metals such as magnesium, titanium, sodium, and potassium.

Examples of proper extinguishing agents are as follows:

Class A - Water
Water with one percent AFFF Foam (wet water)
Water with five percent AFFF or Fluoroprotein Foam
ABC Dry Chemical
Halon 1211

Class B - ABC Dry Chemical
Purple K
Halon 1211
Carbon Dioxide
Water with six percent AFFF Foam

Class C - ABC Dry Chemical
Halon 1211
Carbon Dioxide

Class D - Metal-X Dry Chemical

No attempt should be made to extinguish a large fire. Large fires should be handled by the fire department. The complete area of the fire should be determined. If human life appears to be in danger, or the spread of the fire appears to be rapidly progressing, move personnel further upwind away from the fire. Do not attempt to extinguish even a small fire if you have not been properly trained to do so.

Use of Fire Extinguishers. Inspect the fire extinguisher on a monthly basis to ensure that the unit is adequately charged with extinguishing media. Do not store a fire extinguisher on its side. To use the extinguisher, follow the acronym PASS for instructions listed below:

1. **P**ull the pin on the top of the unit

2. **A**im at the base of the fire.

3. **S**queeze the handle on the top of the unit.

4. **S**weep the extinguishing media along the base of the fire until the fire is out. Ensure that the fire is fully cooled before assuming it is completely extinguished.

12.1.10 Earthquake and Disaster Preparedness

If an earthquake or natural disaster occurs during working hours and the magnitude is such that field personnel may be in danger, the MWH OSO will initiate the site evacuation procedure. This action is to be taken only if in the judgment of project personnel and/or OSO the earthquake is large enough to have potentially caused damage to any of the structures or equipment being used on the site. If the earthquake or disaster occurs during non-working hours the OSO will

determine whether safe entry into the exclusions zones can be made, or if an inspection is needed first. If at any time the inspection team feels that they need the assistance of the fire department, the inspection shall cease until the fire department is able to assist. The inspection will be conducted using the buddy system. The team will look at structures, equipment, and any chemical storage areas for signs of cracks or deterioration. When assessing areas known to contain chemicals, appropriate air monitoring equipment will be used to ensure that leaks are detected quickly and without injury to the inspection team. When inspecting areas where chemical releases could have occurred as a result of a breach of containment, Level B PPE is recommended.

In the event of a catastrophic earthquake or disaster, up to 72 hours could elapse before emergency assistance arrives. Therefore, it is advisable for the project team to maintain enough supplies (food, water, emergency supplies such as first aid kits, personal medication, and any other applicable supplies) for each person scheduled to work on a full-time basis. These supplies should be stored in a place that is not likely to be impacted by an earthquake or other natural disaster.

12.1.11 Unanticipated Work Practices

MWH typically does not conduct investigations of sites with unknown drums, explosives, or chemical warfare agents. When such work is required, detailed procedures for health and safety will be provided in Section 2.0.

12.2 COMMON PHYSICAL HAZARDS AND CONTROLS

This section provides information concerning common physical hazards associated with hazardous waste operations and recommended controls to minimize risk to field personnel. Section 2.0 and Appendix A list the physical hazards specific to this project.

12.2.1 Slip/Trip/Fall

Field personnel are to be vigilant in providing clear footing, clearly identifying obstructions, holes, or other tripping hazards and maintaining an awareness of uneven terrain and slippery surfaces. If necessary shoes providing more elaborate tread will be worn to minimize slip, trip and fall hazards. Working at heights above six feet is not anticipated to be necessary during the course of most projects. If work at such heights is necessary for this project, Section 2.0 of this plan will include a fall protection program.

12.2.2 Heavy Lifting

During manual lifting tasks, personnel will remember to lift with the force of the load suspended on their legs and not their backs. They are to maintain a straight back and hold the object close to the body. Mechanical lifting devices or the help of a fellow field team member should be sought when the object is too heavy for one person to lift.

12.2.3 Electrical Hazards

The presence of underground and overhead utilities must be assessed before any field work involving heavy equipment with booms or extensions or invasive work is permitted. An underground utility service in conjunction with a review of as-built construction drawings will identify and locate utilities prior to invasive activities. Invasive activities must be at least five feet away from marked underground utilities. In every case, personnel will be vigilant about the presence of overhead lines before raising the mast of a drill rig, backhoe bucket, or crane arm. Generally, clearances of 20 feet or more are recommended. Minimum distances from mast to overhead electrical lines, based on voltage, are as follows:

Nominal Power Line System (kV)	Minimum Required Clearance (feet)
0–50	10
51–100	12
101–200	15
201–300	20
301–500	25
501–750	35
751–1,000	45

Source: United States Army Corps of Engineers

Other electrical hazards include temporary office power supply, generators, and lightning. Field personnel are responsible for ensuring that equipment brought to the work site is grounded before use. Additionally, the use of ground-fault circuit interrupters are required for portable electrical tools and fixed electrical equipment to be used at the site.

12.2.4 Motor Vehicle Hazards

Motor vehicle accidents can occur any time people drive. Field personnel are required to employ defensive driving techniques, and obey site speed limits and vehicle safety requirements. Accidents are to be reported to the MWH OSO. Working in an active mine area poses unique hazards to personnel whether in a vehicle or as a pedestrian. Mine equipment, especially haul trucks, are often large, may operate at relatively high rates of speed, often have limited visibility, and cannot stop or maneuver like over-the-road vehicles. Unique mine driving rules often apply within a local mine that are different from public road rules. Haul trucks within a mine area often have the right-of-way in every instance. Therefore, it is extremely important that while walking or driving within an active mine area, to be exceptionally alert to all traffic around you. When in doubt, yield the right-of-way. **Field personnel are required to wear seatbelts at all times when in a moving vehicle.**

12.2.5 Hot Work Permits

Any welding, torch cutting or other hot work will be performed in accordance with any client-specific hot work permit procedures. Otherwise, hot work must be done with the complete knowledge of the MWH OSO and a fire watch nearby with a suitable fire extinguisher.

12.2.6 Sharp Edges and Pinch Points

During the course of the field work, it is feasible that personnel will encounter sharp edges and pinch points. Sharp objects may include site debris, field tools, equipment, or other objects. Pinch points are places where the hands may be caught between objects or moving parts. When danger of cuts to the hands or other body parts is probable, employees will either arrange paths where personnel may walk free of sharp edges, or ensure during the tailgate safety meeting that areas with known sharp edges are brought to the attention of the entire field crew. Heavy work gloves shall be used in conjunction with any chemical resistant gloves when handling sharp objects is required.

12.2.7 Noise

Noise levels will vary during the course of field activities at any site. Noise monitoring will be required during the initial stages of site work or when it is anticipated that noise levels will need to be characterized. The sound level meter or noise dosimeter will meet the OSHA requirements [ANSI S1.4-1971 (R1976), Specifications for Sound Level Meters, Type 2] for measuring noise levels in decibels (dBA) with an A-weighted scale, in the slow response mode. Time-weighted average exposures greater than 85 dBA will necessitate implementing the hearing conservation requirements stated in 29 CFR 1910.95, Occupational Noise Exposure. These include continued area noise monitoring, additional personnel training regarding noise hazards and protective measures, and the mandatory use of protective hearing devices (such as ear plugs with a noise reduction rating greater than or equal to 25).

12.2.8 Heavy Equipment Use

12.2.8.1 Drilling Operations

Potential hazards associated with drilling operations include exposure to site contaminants; electrical hazards such as overhead power lines and underground utilities; rolling, spreading, or sliding tools and supplies; and rotating machinery. A utility locating service will be used and no drilling will be allowed within 5 feet of marked underground utilities or within 20 feet of overhead high-voltage electrical hazards. The following safety provisions will be adhered to by the MWH field team and the drilling contractor:

- Before drilling, the boring location must be adequately monitored for hydrocarbon vapors. Each site will be monitored for organic vapors and gases, as stated in Section 2.0 of this Health and Safety Plan. Chemical resistant gloves will be used when handling contaminated soil and water. Protective clothing requirements for the field activities also are discussed in Section 2.0 of this Health and Safety Plan.

- Before raising the mast, drill rig personnel (with the exception of the operator) and field personnel will be cleared from the area immediately to the rear and the sides of the mast. Drill rig personnel and other field personnel must be informed that the mast is being raised prior to raising it.

- Before raising the drill rig mast in the vicinity of electrical power lines, the operator shall walk completely around the drill rig to determine the distance of the rig to the nearest power line when the mast is raised. Any questions regarding the appropriateness of a drilling location will be brought to the attention of the MWH OSO or the MWH PSO.

- Before the mast of a drill rig is raised and drilling is initiated, the drill rig must be leveled and stabilized with leveling jacks or solid cribbing. The drill rig should be re-leveled if it settles after initial set-up. The mast will be lowered only when the leveling jacks are down and the leveling jack pads will not be raised until the mast is lowered completely.

- Prior to drilling, a hand auger will be used to clear the boring location to a depth of approximately five feet if there is any question of the location of underground utilities.

- Suitable storage for tools, materials, and supplies will be provided. Pipe, casings, augers, and similar drilling tools will be arranged to prevent rolling, spreading, or sliding by using blocks.

- Work areas and drilling platforms will be kept free of materials, obstructions, and substances that could cause a surface to become slick or otherwise hazardous.

- Augers will be used in accordance with the manufacturers recommended methods for securing the auger to the power coupling. Additionally, the operator and tool handler will be responsible for establishing safe procedures for drilling, auger connection and disconnection, and auger insertion and removal.

- Augers will be cleaned only when the drill rig is in neutral and the auger has ceased to rotate.

- Unattended boreholes must be properly covered or otherwise protected.

12.2.8.2 Backhoe Operations for Trenching and Excavations

Potential hazards associated with trenching/excavation include exposure to organic vapors, metal dust, explosive decomposition gases, and dermal contact with site contaminants. The following safety precautions will be utilized when operating a backhoe conducting trenching or excavation activities:

- Air monitoring for oxygen content and combustible gases will be performed. When possible, environmental samples will be collected from a backhoe bucket, obviating the need to enter a trench.

- No one will be permitted in the trench without contacting the PSO and adhering to requirements provided in Section 2.0 for safe entrance procedures for trenches.

- The buddy system will be employed.

- No trench will be left unattended or open without adequate barricades, caution tape, and safety signs.

- Personnel and equipment will maintain a minimum two-foot clearance from the edge of the excavation.

- Suitable storage for tools, materials, supplies will be provided by the contractor or subcontractor.

- Work areas will be kept free of materials, obstructions, and substances that could cause a surface to become slick or otherwise hazardous.

- Tools and equipment will be used in accordance with the manufacturers recommended methods. The operators shall be responsible for establishing safe equipment use procedures.

- Unattended excavation must be properly covered or otherwise secured when work is not active.

- Soil shall be backfilled as soon as possible.

12.3 SEVERE WEATHER

While each project site will be subject to varying types of weather conditions, this section provides general information and controls on several types of severe weather.

12.3.1 Lightning

If a lightning storm is suspected or observed, site activities must be stopped, and site equipment must be evaluated for its potential for acting as a lightning rod. Drill rig masts provide conduits for lightning to strike and injure workers. Personnel should wait indoors for the storm or lightning event to end. If the strike of lightning occurs and personnel are out in the field, the response should be to disband from one another and lay low to the ground by dropping to your knees and bending forward with your hands wrapped around your knees, away from any poles or trees.

Persons struck by lightning receive a severe electrical shock and may be burned, but they carry no electrical charge and can be handled safely. Someone who appears to have been killed by lightning often can be revived by prompt action. Those unconscious but breathing probably will recover spontaneously. First aid and CPR should be administered as appropriate until medical assistance arrives. Realize that victims who appear to be only stunned or otherwise unhurt also need attention. Check for burns, especially at fingers and toes and next to metal buckles, jewelry, or personal items that the victim is wearing. Remember to treat for shock.

12.3.2 Tornadoes

Tornadoes usually develop from thunderstorms and normally occur at the trailing edge of the storm. Most tornadoes occur in the months of April, May, June, and July in the late afternoon and early evening hours.

When storms are predicted for the project areas, monitor weather conditions on a radio. A tornado watch is issued when favorable conditions exist for the development of a tornado. A tornado warning is issued by the local weather service office whenever a tornado has actually been sighted or is strongly indicated by radar.

If a tornado warning is issued, seek shelter immediately. If there are permanent buildings located on site, go there immediately, moving toward interior hallways or small rooms on the lowest floor.

If a tornado warning is issued and you are in a vehicle or a site trailer, leave and go to the nearest building. If there are no buildings nearby, go in the nearest ditch, ravine, or culvert, with your hands shielding your head.

If a tornado is sighted or a warning issued while you are in open country, lie flat in a ditch or depression. Hold onto something on the ground, such as a bush or wooden fence post, if possible.

Once a tornado has passed the site, field personnel are to assemble at the designated assembly area to determine if anyone is missing or injured. Administer first aid and seek medical attention as needed.

12.3.3 Winter Storms

When snow or ice storms are predicted for the project area, field personnel should monitor radio reported weather conditions. A winter storm watch is issued when a storm has formed and is approaching the area. A winter storm warning is issued when a storm is imminent and immediate action is to be taken.

When a storm watch is issued, monitor weather conditions and prepare to halt site activities. Notify the Program Manager or field team leader of the situation. Seek shelter at site buildings or leave the site and seek warm shelter.

If you are caught in a severe winter storm while traveling, seek warm shelter if road conditions prevent safe travel. If you are stranded in a vehicle during a winter storm:

- Stay in the vehicle. Disorientation comes quickly in blowing and drifting snow.
- Wait for help.
- Keep a window open an inch or so to avoid carbon monoxide poisoning.
- Run the engine and heater sparingly.
- Keep watch—don't let everyone sleep at the same time.
- Exercise occasionally.

12.4 ENGINEERED CONTROLS

Where economically and practically feasible, engineered controls will be selected to reduce exposure of field personnel to health or safety hazards. Engineered controls that may be feasible include use of pressurized cabs or control booths on equipment, use of remotely operated material handling equipment, dust suppression techniques (such as wetting down a surface with a water spray), noise insulation barriers, and use of shoring devices for trench or excavation entry.

12.5 ADMINISTRATIVE CONTROLS

When engineered controls are not feasible, administrative controls in the form of work practices will be implemented to minimize risk to personnel from site hazards. Work practices that may be instituted include removing non-essential personnel from the exclusion zone and locating employees upwind of the hot zone. Work rotation will be used to control exposures to extreme thermal stresses; however, work rotation for the purpose of limiting exposure to field personnel from airborne chemical hazards is unacceptable.

Appendix A
Activity Hazard Analysis

Tasks	Hazards	Controls	Air Monitoring Requirements	PPE Required
Sampling at Operating Mine Sites (including sites undergoing reclamation)	• Cuts and scrapes	• Follow procedures of mine operator. Report injuries to buddy or to person designated by mine operator for first aid. • Come to work alert and ready—make sure that general awareness of surroundings is part of job planning and execution. • Wear heavy work gloves when handling sharp objects, and point sharp objects toward the ground.	None required.	Minimum: hard-hat, safety glasses, boots, long pants, and cotton shirt; heavy work gloves for handling sharp objects. Additional PPE as specified by the mine operator.
	• Heat or cold stress	• Monitor for heat and cold stress as outlined in the Health and Safety Plan (see Section 7.0).		
	• Slips/trips/falls	• Maintain general awareness of surroundings.		
	• Being struck by heavy equipment or caught between equipment and a stationary object	• Receive site-specific hazard training. • Be alert to the direction of traffic flow. • Maintain eye contact with heavy equipment operators and give them the right-of-way. • Never stand between operating vehicles and nearby stationary objects. • Ask the mine operator where the blind spots for each piece of equipment are located—DO NOT STAND IN BLIND SPOTS.		

Tasks	Hazards	Controls	Air Monitoring Requirements	PPE Required
Sampling at Operating Mine Sites (continued)	• High wall collapse	• Receive site-specific hazard training. • Perform work under escort of mine employee. • Do not stand between high wall and heavy equipment—make sure you have an escape route. • Know the mine emergency signals and evacuation procedures.		
Sampling at Inactive Mine Sites	• Cuts and scrapes	• Report injuries to buddy for first aid. • Come to work alert and ready—make sure that general awareness of site surroundings is part of job planning and execution. • Wear heavy work gloves when handling sharp objects, and point sharp objects toward the ground.	Not required.	Minimum: hard-hat, boots, long pants, and cotton shirt; heavy work gloves for handling sharp objects.
	• Slips/trips/falls	• Do not walk at the edge of sharp drop-offs. Maintain special care on scree slopes or while working in other areas with unstable footing. Maintain general awareness of surroundings. • Be aware of the possibility of abandoned underground mine portals.		
	• Dislodged rocks	• Avoid areas below people who may dislodge rocks while working or walking on slopes. Cry “ROCK” after dislodging a rock when other people are below.		

Tasks	Hazards	Controls	Air Monitoring Requirements	PPE Required
Sampling at Inactive Mine Sites (continued)	• Deteriorated roads	• Receive site-specific hazard training. • Exercise care while traveling by vehicle.		
	• High wall collapse or rock-fall	• Receive site-specific hazard training. • Know signs of instability. Carefully examine the surroundings to determine if entry is safe. • Be aware of the most efficient evacuation route. • Do not walk on top of high walls. • Avoid working downslope of rock slides.		
	• Falling into standing water in mine pits	• Sample from a safe, stable location at water level. Personnel will not be belayed without prior discussions with the Project Safety Officer regarding proper procedures for using harnesses. • If it is necessary to enter standing water, first measure the pH. Personnel will not enter the water if the pH is less than 4 or is greater than 10. • If the pH is greater than 2 but less than 4, or is greater than 10 but less than 12, sampling may be conducted from a raft or similar device. Samples will be collected only from the land if the pH is less than 2 or greater than 12.		Life vest if sampling from a raft in water over five feet deep

Tasks	Hazards	Controls	Air Monitoring Requirements	PPE Required
Sampling at Inactive Mine Sites (continued)	• Heat or cold stress	• Monitor for heat and cold stress as outlined in the Health and Safety Plan (see Section 7.0).		
	• Drinking water from mine pits	• Water in mine pits is of unknown quality, and WILL NOT be used for drinking water. Water purification with iodine, filters, or boiling will not remove potentially toxic metals.		
Sampling Rivers and Streams	• High water	• Inspect the river to ensure that it is safe to enter. Fast-moving water should not be entered if more than knee-high. • If the stream bottom is not visible, probe with a stick to check the water depth. • Be watchful for logs and other debris coming from upstream. • If you should fall into a river or stream, float downstream feet first to avoid head injury.	Not required.	Minimum: hip boots. Additional: chest waders, life vest (depending on water depth).
	• Hypothermia	• Wear specified PPE. • If you should fall into a river, change into dry clothes as soon as practicable. • If exhibiting signs of hypothermia, drink hot liquids and move to a warm place, such as the inside of a vehicle. A person continuing to exhibit signs of hypothermia should be taken to the hospital (also, see Section 7.0).		

Tasks	Hazards	Controls	Air Monitoring Requirements	PPE Required
Travel in Remote Areas	• General	• Always carry ten essentials for wilderness travel (see Table 2-3).	Not required.	Heavy work gloves for handling sharp objects.
	• Slips/trips/falls	• Maintain general awareness of surroundings.		
	• Cuts and scrapes	• Report injuries to buddy for first aid. Come to work alert and ready—make sure that general awareness of site surroundings is part of job planning and execution. • Wear heavy work gloves when handling sharp objects, and point sharp objects toward the ground.		
	• Safe drinking water	• Contact National Forest officials in advance regarding any water quality advisories. • Bring sufficient water. Assume that you will need one gallon of drinking water per person per day.		

Tasks	Hazards	Controls	Air Monitoring Requirements	PPE Required
Travel in Remote Areas (continued)	• Severe weather	• Bring proper rain gear and warm clothes. • Listen to weather forecasts before entering remote areas. If severe weather is likely, postpone sampling. • In case of lightning, avoid high ground and open areas. • In the event of rain, monitor for hypothermia. • In the event of snow, monitor for frostbite and hypothermia. In the event of a blizzard that reduces visibility, stay put in an emergency shelter. Do not risk disorientation.		
	• Getting lost	• Provide the Program Manager or designee with itineraries, including travel routes and the expected date and time of return. Check in once per day, if possible, when in remote areas. Always check in with the Program Manager or designee before and after sampling. The Program Manager or designee will contact search and rescue if field personnel do not return or call in by the specified time. • Bring emergency shelter. • If lost, stay put. You are easier to find this way.		

Tasks	Hazards	Controls	Air Monitoring Requirements	PPE Required
Travel in Remote Areas (continued)	• Heat or cold stress	• Monitor for heat or cold stress as outlined in the Health and Safety Plan (see Section 7.0).		
	• Muscle strains	• Know your limits, and do not overextend yourself.		
	• Poisonous plants and animals	• Be able to recognize poisonous plants and animals and avoid them. • If bitten by a snake or spider, apply cold compresses. Get to a hospital as quickly as possible.		
	• Wildlife	• Avoid, if possible, and leave the area. • Make yourself look large by raising arms and shouting. • Slowly back away, without turning your back to the animal.		

Tasks	Hazards	Controls	Air Monitoring Requirements	PPE Required
General Work Practices	• First aid injuries	• Report injuries to buddy for first aid. • Seek additional medical attention, if necessary. • Notify the PSO.	Not required.	Minimum: hard-hat, safety glasses, boots, long pants, and cotton shirt. Additional: heavy work gloves and hearing protection, as necessary.
	• Slips/trips/falls	• Practice good housekeeping, and remove or reduce slip/trip/fall hazards. • Maintain general awareness of surroundings.		
	• Cuts/scrapes	• Report injuries to buddy for first aid. • Come to work alert and ready—make sure that general awareness of site surroundings is part of job planning and execution. • Wear heavy work gloves when handling sharp objects and point sharp objects towards the ground.		
	• Heat or cold stress	• Monitor for heat and cold stress as outlined in the Health and Safety Plan (see Section 7.0).		
	• Muscle strain	• Alternate activities as needed to give muscles rest.		
	• Slips/trips/falls	• Practice good housekeeping to remove or reduce slip/trip/fall hazards.		

Tasks	Hazards	Controls	Air Monitoring Requirements	PPE Required
General Work Practices (continued)	• Hearing loss.	• Use hearing protection when operating loud equipment.		
	• Electrocution.	• Use GFCI on portable power equipment.		
	• Power equipment	• See manufacturers instructions for the use of hand and portable power tools.		

Appendix B
Emergency Contacts

EMERGENCY SERVICES

Security (Police/Sheriff)	911
Fire/Rescue	911
Ambulance	911
Caribou Memorial Hospital Emergency Room	208-547-3341
Pocatello Hospital and Medical Center Emergency Room	208-239-2200
Star Valley Hospital Emergency Room	307-886-5821
Idaho Poison Control Center	800-632-8000

EMERGENCY CONTACT NUMBERS

William Wright (MWH Program Manager)	425-896-6938
Paul Stenhouse (MWH Field Team Leader)	425-896-6930
Paul Stenhouse (MWH Program Safety Officer, On Site Safety Officer)	425-896-6930
Bob Geddes (P_4 Production Project Manager)	208-547-1234
Michael Vice (P_4 Production on-site client contact)	208-574-6132
Emergency	911

Note: It may be necessary to dial a ‘9’ to access an outside line at mine sites when calling.

HOSPITAL FACILITIES

The closest hospital and the specific route to the hospital will depend on where field activities are taking place. The following are the hospitals closest to the project sites:

Caribou Memorial Hospital	208-547-3341 (Information)
300 South 3rd West	208-547-3341 (Emergency Room)
Soda Springs, Idaho	911 (Search and Rescue/Sheriff's Dispatch)
Portneuf Medical Center (East Campus)	208-234-0777 (Information)
777 Hospital Way	208-239-2200 (Non-Emergency Care)
Pocatello, Idaho	911 (Search and Rescue/Sheriff's Dispatch)
At Pine Ridge Mall	208-238-2000 (Urgent Care)
Portneuf Medical Center (West Campus)	208-239-1000 (Information)
651 Memorial Drive	208-239-1800 (Emergency Room)
Pocatello, Idaho	911 (Search and Rescue/Sheriff's Dispatch)
Star Valley Medical Center	307-886-5800 (Information)
110 Hospital Lane	307-886-5821 (Emergency Room)
Afton, Wyoming	911 (Search and Rescue/Sheriff's Dispatch)

In general, to get to the Caribou Memorial Hospital, proceed to Highway 30 in Soda Springs, which is also known as 2nd South. Proceed to 3rd West, and turn south to 3rd South. To get to the Portneuf Medical Center (East Campus), proceed to I-15 and take the Clark Street exit. The hospital is at the top of a hill and is visible from the freeway. To get to the Portneuf Medical Center (West Campus), proceed to I-15 through Pocatello and take the Clark Street exit. Drive West on Clark, turning South on 15th Street. The West Campus is on the right side. To get to the Star Valley Hospital, proceed to Highway 89 and turn onto Hospital Lane. When making calls from mine offices, it may be necessary to dial '9' to access an outside line.

MWH INJURY AND ILLNESS PREVENTION PROGRAM (IIPP)

I. PURPOSE

MWH is committed to the establishment, implementation and maintenance of an effective Injury and Illness Prevention Program (IIPP). This commitment is further clarified in the Occupational Safety and Health Policy, document number 101 of the MWH Safety and Health Policies and Procedures Manual. This IIPP is intended to conform with requirements of the California Labor Code, Section 6401.7, and implementing regulations, commonly known as California SB198. This program is mandatory in California (California Code of Regulations Title 8, Sections 1509 [construction] and 3203 [general industry] under the California Occupational Safety and Health Administration (Cal-OSHA) in the Department of Industrial Relations). It is the company's intent to implement the basic requirements of this policy in all other MWH offices in the United States. The company's overall goal is to ensure that every employee has a safe and healthful work environment and the knowledge to properly and safely perform his/her work.

Besides company employees, this IIPP covers all other workers (temporary, part time, contractor) that MWH controls, directs, or supervises on the job, to the extent these workers are exposed to work-site and job assignment specific hazards.

II. RESPONSIBILITIES

In order to accomplish the objectives of this program a "team" effort on the part of all MWH employees is needed. It is essential that all personnel take an interest and participate actively in all phases of the IIPP. Every employee must accept responsibility for his/her own actions and conduct, follow safety and health procedures, and recognize and report hazards in his/her work area.

A. Corporate Health and Safety Manger

The responsibility for overseeing and maintaining the IIPP has been designated to the Corporate Health and Safety Manager, Mrs. Beth Darnell, CIH**.** Mrs**.** Darnell currently resides in the WCK-1 office at (925) 975-3544. The Corporate Health and Safety Manager works with each of MWH's operating groups to develop function-specific safety procedures and implementation plans. The various MWH Americas operating groups are:

- State and Local Government - West
- State and Local Government - East
- Domestic Energy and Industry
- Federal Operations
- Global Energy and Natural Resources
- Automation and Information Solutions
- Construction Management Group
- Applied Research Department
- Corporate Support

B. MWH Operating Groups

Each of the operating groups is responsible for developing specific procedures and specialized applications that improve the effectiveness of this IIPP. These specific procedures are contained in the Company Safety and Health Policies and Procedures Manual, as is this IIPP document, or as separately bound project specific documents. Examples for each operating group include:

- Confined Space procedures for municipal sewer entries
- Chemical Hygiene Plan for the laboratory operations
- Site-specific Safety and Health Plans for hazardous waste site work
- Construction safety instructions contained in documents addressing safe use of cranes, ladders, and hand tools
- Office ergonomics program aimed at support personnel in the offices

C. Senior MWH Management

MWH senior management representatives include Cost/Profit Center managers and others with functional management over personnel, such as field supervisors or construction superintendents. Each of these people has the responsibility to implement the MWH IIPP at their location. As further discussed in this document, it is this individual's responsibility to identify and evaluate location-specific or function-specific workplace hazards, follow company policy or procedure related to the activity under his/her control, conduct inspections, correct unsafe conditions, participate in accident investigations, communicate the requirements of the IIPP to employees, train employees and perform the necessary safety program-related record keeping tasks. When needed, this person is responsible for contacting the Corporate Health and Safety Manger, or other company safety and health professional for assistance.

For each location (office or field), the name of the person responsible to implement the IIPP, and his or her authority, must be provided in writing, either in this document below, or as part of a Safety Plan being used for a project, program, or office location.

MWH Location: ___Bellevue, WA, 98005_____
MWH Senior Management Representative/Phone Number: Mr. Donald Caldwell, (425) 602-4000_____

D. MWH Employees

Each MWH employee is responsible for conducting his or her job in a safe and healthful manner. If an employee does not know how to do his or her job safely it is his/her responsibility to notify an immediate supervisor or program manager. It

is also the responsibility of each employee to follow all company health and safety guidelines pertaining to his or her job.

III. IDENTIFYING AND EVALUATING WORKPLACE HAZARDS

A. General

The identification and control of hazards is essential in order to maintain a safe and healthful workplace. Our system for identifying and evaluating hazards includes three general components: (1) an operational review when the task or job is first established or when a new substance, process, procedure, or operation is introduced to the workplace, (2) the determination of Cal-OSHA/OSHA standards applicability, and (3) the utilization of worksite inspections.

B. Hazard Control System

The MWH system for identifying and evaluating workplace **hazards** to prevent occupational health and safety injuries and illnesses includes the following:

- Hazard assessment survey of MWH operations and facilities when they are first started, or when the health and safety program is being updated
- Review of regulatory standards, such as the OSHA General Industry Safety Orders (GISO) and other Safety Orders that apply to MWH's work
- Review of industry and general information (including Material Safety Data Sheets for chemicals used) on potential occupational health and safety hazards
- Review and utilization of information and resources of insurance carrier loss control services, other health and safety consultants, and OSHA consultation
- Identification and development of job safety classes applicable to MWH that utilize common work conditions and hazard potential to group employees into general categories (i.e., hazardous waste site operations and workers)
- Periodic and scheduled inspections of general work areas and specific work sites, including formal follow-up procedures for corrective actions
- Investigation of all occupational accidents, injuries, and illnesses to determine cause and eliminate repeat occurrences
- Encouraging employees to inform management of hazards in the workplace without fear of reprisal

IV. INSPECTIONS

A. General

At MWH, inspections are an integral component of our comprehensive health and safety program. Inspections perform two roles in injury and illness prevention: first, they are a means of identifying potential hazards not previously recognized; second, they are used to verify ongoing compliance with controls and safe practices designed to prevent previously identified occupational hazards.
In terms of the MWH IIPP, inspections are formal, regularly scheduled, involve careful observation to detect new hazards, properly documented, and utilize written checklists to identify unsafe conditions and work practices.

- Senior management representatives have the responsibility to ensure that proper inspections are scheduled, conducted, documented, and discrepancies corrected.

- Program Health and Safety Coordinators (PHSC) have general program oversight, through regular review audits, to insure compliance.

B. Frequency

As a part of the IIPP, all MWH senior management representatives will perform, either personally or through directive, periodic scheduled inspections of their work areas. In general, inspections are based on hazard potential and severity. The frequency of these inspections depends on the operations involved, the magnitude of the hazards, the proficiency of employees, changes in equipment or work processes, and the history of workplace injuries and illnesses.

The following guidelines may serve as a general approach in determining the appropriate frequency of inspections for each MWH senior management representatives.

Quarterly: Shop (print), sites with chemical usage or hazardous wastes, laboratory, construction sites

Annually: Office areas
In addition to scheduled periodic inspections based on the hazard potential of a work area, there are other situations where an inspection is required. These situations include:

- When the IIPP was first established

- Whenever new substances, processes, procedures, or equipment are introduced that present new occupational health and safety hazards

- Whenever MWH is made aware of a new or previously unrecognized hazard

- When investigating an occupational injury or illness

- Special inspections required by an OSHA/Cal-OSHA standard or other regulatory agency on a prescribed timetable

V. CORRECTING UNSAFE CONDITIONS

All hazards discovered during an inspection or coming to the attention of MWH must be corrected in a timely manner consistent with the seriousness of the hazard. All reasonable efforts should be made to abate recognized hazards as soon as possible and to advise employees of any uncorrected hazards. However, if there is an imminent danger of serious harm, an immediate corrective action, such as taking the piece of equipment or work station out of service, is required. If an imminent hazard exists that cannot be immediately abated without endangering people/property, then all potentially exposed personnel will be removed from the area except those necessary to correct the hazardous condition. Employees correcting the hazardous condition shall be provided with the necessary safeguards.

In regard to the correcting of unsafe conditions, MWH senior management representatives shall ensure the health and safety of their employees/guests by:

- Promptly correcting unsafe or unhealthy conditions
- Setting a target date for correcting any hazard that cannot be immediately corrected, and following-up to confirm the hazard abatement
- Utilizing the area inspection checklist or to track and document identified hazards and corrective measures
- Providing interim protection to employees while the correction of hazards is proceeding
- Informing area personnel of the status of the hazardous condition
- Immediately removing/supporting the removal of any personnel exposed or potentially exposed to an imminent hazard
- Securing the resources (maintenance personnel, health and safety specialists, consultants) necessary to assess the hazard severity and recommend corrective action/abate the hazard

VI. ACCIDENT INVESTIGATION

The MWH IIPP requires that all occupational injury and illness cases be thoroughly investigated to determine the cause and to prevent recurrence. Any accident, injury or other exposure to hazardous substances will trigger an investigative inspection of the subject work area, in accordance with the guidelines outlined in the document titled Incident Reporting Procedure and Forms (number 402 of the MWH Safety and Health Policies and Procedures Manual).

VII. COMMUNICATIONS

A. General

All MWH employees will be provided and are encouraged to seek/request information regarding occupational health and safety. MWH's system for communicating with employees on occupational health and safety matters includes the following:

- Written communications (memos, paycheck inserts, booklets)
- Electronic mail messages
- Postings (posters, general bulletins)
- Meetings (safety, staff)
- Training programs
- MWH Safety Committees (i.e., Laboratory and Nevada Operations)
- Safety & Health Videos (contact a PHSC or the Corporate Health and Safety Manager for latest listing of videos)

In addition, all employees are encouraged to inform senior management representatives about any workplace hazards they are aware of. No MWH employee will incur any form of reprisal or discrimination if they disclose a safety hazard. If they so choose, employees may report the potential hazard anonymously to either the PHSC or the Corporate Health and Safety Manager.

B. Ensuring Employee Compliance

In order to have an effective IIPP, all MWH employees must contribute by complying with the safety-related requirements of their jobs. The majority of all accidents are a result of unsafe acts, and most of these can be prevented by following safe work practices. The MWH system for ensuring employee compliance with safe and healthy work practices includes the following:

- Providing relevant information to employees on health and safety issues.
- Training and retraining personnel on the specific safe work practices associated with each job assignment.
- A communications system that encourages the reporting of occupational hazards by employees and a company commitment to correct all hazardous conditions.
- An inspection program that identifies violations of safe work practices.
- Ensuring that management understands and enforces safety rules and policies.
- Human Resources Administration procedures on disciplinary action including violation of MWH environmental or occupational health and safety standards. This includes verbal and written disciplinary notices; time off without pay and

up to and including termination of employment. The type of disciplinary action administered depends on the nature of the infraction, the intent of the person creating the infraction, and the number of times this person has disobeyed a safety standard. The Human Resources Representative for the person's charge center will assist in the determination of appropriate disciplinary action.

- Recognizing employees who follow safe and healthful work practices. This is commonly accomplished through the company's Spot Bonus Program.

VIII. EMPLOYEE TRAINING

A. General

Training of employees is considered one of the most effective means of achieving an injury-and illness-free workplace. Employees who understand the hazards of their work environment, and safe work practices, have a lower injury frequency and are able to identify and report problems before an injury or illness results.

The IIPP serves as an umbrella for MWH environmental and occupational health and safety training efforts. Other previous employee health and safety training designed to meet the requirements of a specific standard must continue but the IIPP incorporates additional employer responsibilities. Under the IIPP, employees must be instructed in general safe and healthy work practices and specifically on the hazards of each employee's job assignment. All employees must be advised of the following:

- Potential occupational hazards identified in their workplace generally and those specifically related to their job assignment;

- Means of minimizing potential hazards, including work conditions, safe work practices, and personal protective equipment; and,

- Any new hazards introduced by a change in equipment, processes, raw materials, etc.

This training is provided by the employee's immediate supervisor, an approved vendor, if appropriate, a company safety and health professional, or other suitable means.

B. Frequency

The frequency of IIPP health and safety training is dependent on the potential severity of the hazards associated with an assignment/area. To maximize time and efficiency, IIPP training should be incorporated with any other required training efforts such as Hazard Communication, Emergency Preparedness, Respiratory Protection, etc. In addition to ongoing efforts, training must also be provided as follows:

- When the IIPP was first established;
- To all new employees;
- To all employees given new job assignments for which training has not been previously received;
- Whenever new substances, processes, procedures, or equipment are introduced to the workplace and represent a new hazard;
- Whenever MWH is made aware of a new or previously unrecognized hazard; and,
- For company supervisors to familiarize them with the health and safety hazards to which employees under their immediate direction and control may be exposed.

IX. RECORD KEEPING

Every MWH supervisor is responsible for maintaining the records associated with the development, implementation, and maintenance of the IIPP for his or her employees or business unit. All records must be maintained for a minimum of three years, but other specific regulatory standards may impose longer time requirements. Individual employee training, chemical exposure, and disciplinary action documentation should be placed in the respective employee's department and corporate personnel folders.

The following documents and actions are required to be maintained as part of each record keeping system:

- Records of scheduled and periodic inspections including persons conducting the inspection, any identified unsafe condition or work practice, and all corrective action taken.
- Documentation of health and safety training for each employee including employee name, employee number, training dates, type(s) of training and training providers.
- Descriptions of the content of the training that details what the employees were trained on.
- Complete and thorough accident investigations including records of inspection and corrective action.
- Records of safety meetings and classes (include topics covered), individual training, employee communications, field training, safety meetings, etc.
- Records of employee exposure to hazardous materials.

- Records of employee disciplinary action taken as a result of non-compliance with a company safety/health policy.

The following records must be forwarded immediately by an employee's supervisor to the Corporate Health and Safety Manager:

- Disciplinary Action Notices;
- Injury/Illness Investigation Reports; and,
- Open Items (previously identified, serious discrepancies).

X. OBLIGATIONS & RESPONSIBILITIES CONCERNING NON-MWH EMPLOYEES

It is not uncommon for MWH personnel to interface with client, contractor, or subcontractor personnel on a daily basis. This is an integral and necessary part of the company's business activities.

There exist other considerations, however, when dealing with workplace health and safety issues. These may include OSHA regulations, various Labor Codes, and contractual provisions.

Unless clearly stated and authorized in a contract, the supervisor must ensure that MWH employees observe the following when dealing with client, contractor, or subcontractor personnel on health and safety issues:

- MWH employees must not train or certify non-employees on any health and safety issue. This is a legal responsibility of each employer. However, voluntary attendance without any obligation of non-employees in MWH health and safety training courses is acceptable.

- MWH employees must not issue personal protective equipment to non-employees, unless specifically stated and identified in a contract. Again, the providing of this type equipment is the responsibility of each employer.

- MWH employees must not direct non-employees in carrying out specific, step-by-step elements of a work task. The general work product or expected end result must, of course, be conveyed to a non-employee. However, the incremental completion of the task and the methodologies used must be left to the non-employee who should receive appropriate training from his/her employer.

- If an MWH employee observes any unsafe act that could jeopardize his/her personal safety, or the personal safety of others, including the contract employee, the MWH employee must take steps to resolve the issue.

Appendix D
Acknowledgement Form

PERSONAL ACKNOWLEDGMENT FORM

HEALTH AND SAFETY PROGRAM

_____
PROGRAM OR SITE

As a component of the Health and Safety Plan designed to provide personnel safety during the investigation of the southeast Idaho phosphate resource area, you are required to read and understand the Health and Safety Plan. When you have fulfilled this requirement, please sign and date this personal acknowledgment form, and return the form to the On-Site Safety Officer.

_____ _____
Signature Name (Printed)

_____
Date

Appendix E
Tailgate Safety Meeting Form

Appendix E—Tailgate Safety Meeting Form

Date: _____ Time: _____ Job Number: _____

Client: _____

Location: _____

Safety Topics Presented

Protective Clothing/Equipment: _____

Chemical Hazards: _____

Physical Hazards: _____

Special Equipment: _____

Other (IIPP): _____

Emergency Procedures: _____

Hospital: _____ Phone: _____

Ambulance Phone: _____

Hospital Address and Route: _____

Attendees

Name (Printed)	(Signature)
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting Conducted By:

_____	_____
Name Printed	Signature
Program Safety Officer:_____	Program Manager:_____

Appendix F
Occupational Injury/Illness/Incident Report Forms

402 OCCUPATIONAL INJURY/ILLNESS REPORTING AND INVESTIGATION

I. PURPOSE

To set forth the essential components and responsibilities for implementation of the MWH accident investigation procedure. Accidents are investigated to identify unsafe conditions and acts which contribute to injury, illness, and/or property damage so that solutions for accident prevention may be developed.

II. ATTACHMENTS

MWH Occupational Injury/Illness/Incident Report Form (OIIIR)

III. DISCUSSION

Effective accident investigations lead to procedures which can reduce or eliminate occupational injuries and illnesses. It is important for MWH management and employees to understand and comply with the accident investigation procedures.

IV. DEFINITIONS

Accident/Incident: is an occurrence in a sequence of events that usually produces unintended injury or illness, or death, and/or property damage.

First Aid: is any one-time treatment and any follow up visit for the purpose of observation of minor scratches, cuts, burns, splinters, and so forth, which do not ordinarily require medical care, but may be administered by a physician.

Near-Miss Situations: are accidents without injury, illness or property damage, but have the potential for serious harm.

V. PROCEDURE

A. GENERAL

Every accident/incident, regardless of whether it results in injury, property damage, or a near miss, should be investigated to determine the actual cause and to take proper action to prevent recurrence.

It is the responsibility of the Business Unit Manager to assure that a thorough investigation into the cause of each employee injury occurs immediately after the event, and to initiate corrective action to prevent a similar recurrence.

The Business Unit Manager must ensure that accidents/incidents are reported to the company health and safety manager to comply with the Occupational Safety and Health Administration (OSHA) recordkeeping/reporting requirements for occupational injuries and illnesses (see MWH Safety and Health Policies No. 403).

It should be noted that incidents resulting in a fatality or the hospitalization of 4 or more people must be reported to the local OSHA office within 8 hours of the

incident. It is preferable for the company health and safety manager to place the report with OSHA, however, if the health and safety manager is not available, the most senior MWH person at the scene of the incident shall make the report. Contact the local telephone information service to obtain the OSHA phone number.

B. ACCIDENT/INCIDENT INVESTIGATIONS

Once an accident occurs (whether it involves personal injury or illness, property damage or is a near miss), whether the victim is a MWH employee, contractor, or visitor, the below listed procedures are to be carried out.

1. Attend to the victim's medical needs.

2. Secure the accident/incident area.

3. Complete the MWH Occupational Injury/Illness/Incident Report Form.

4. Assemble the personnel and tools needed to perform an accident investigation.

5. Call the Health and Safety Coordinator or Health and Safety Manager **immediately** after the scene is secure, to report the accident and to initiate workers compensation coverage, if needed.

6. Begin the accident investigation.

C. MWH OCCUPATIONAL INJURY/ILLNESS/INCIDENT REPORT FORM

The MWH Occupational Injury/Illness/Incident Report Form (OIIIR), Attachment A, shall be completed by the designated MWH employee representative after an employee injury occurs. Each section of the report should be addressed and completed or marked “na” for not applicable. The degree of detail in the report and any additional data should be commensurate with the degree of the incident. That is, the report should be simple and concise for a twisted ankle resulting from someone tripping out of a van. The report should be detailed with additional background for a near miss that resulted from a pressure grout packer being expelled from a well which could have caused a fatality.

Note: Forms that provide essentially the same information may be used in lieu of the MWH form. Regardless of which form is used, the distribution stated on the MWH form must be used.

The OIIIR shall be promptly submitted to the Health & Safety Coordinator and to the Company Health & Safety Manager.

D. ACCIDENT INVESTIGATION REPORT FORMAT

The various sections of the OIIIR are intended to clearly identify the incident, describe its cause(s), and insure that information is gathered that can be used to

prevent recurrence, either for this particular instance, or similar situations. While the OIIIR is basically self-explanatory, it is important that the persons completing and reviewing the form observe the following:

1. Do not speculate as to the facts, nor make unsubstantiated accusations. We all, however, are free to make reasonable assumptions based on a good faith understanding of the facts at hand. Remember that this form becomes an official, MWH legal document.

2. Handle any samples or physical evidence with care, insuring against even inadvertent tampering.

3. Keep all handwritten notes used in gathering the facts of the case in the office master file, along with the completed OIIIR. Raw data and notes may be helpful in a possible future evaluation.

E. RECORDKEEPING

Insure prompt distribution of complete OIIIR, i.e. within 24 hours, to:

1. Company Health & Safety Manager
2. The Local Health and Safety Coordinator
3. The Business Unit Manager or Program Director
4. The Direct Supervisor of the affected employee or project

VI. REFERENCES

A. Title 29, Code of Federal Regulations, Part 1904

B. Various States' Labor, Health and Safety, and Workers' Compensation Codes

OCCUPATIONAL INJURY/ILLNESS/INCIDENT REPORT FORM

This Report is for (Check All that Apply):

__ MWH __ Non-MWH

__ Repetitive Motion
__ Field Incident
__ Theft
__ Injury
__ Office Incident
__ Spill/Leak
__ Property Damage
__ Illness
__ Near Miss
__ Fire
__ Vehicle Damage
__ Other (Describe):_____
_____

In the event of a Fatality or the Hospitalization of an Individual, Contact the Company Health & Safety Manager Immediately.

Section 1 - Employee Information

Name:_____ Title:_____Sex:_____

Business Unit:_____ Employee Number:_____ Date Hired:_____

Birth Date:_____Social Security Number:_____ Phone Number:_____

Address (office or home):_____

Section 2 - Incident Information

Date of Incident:_____ Day of Week: S M T W TH F S Time:_____

Weather Conditions: SUN CLEAR OVERCAST RAIN SNOW

Temperature: TO 32°F 32-50°F 50-70°F 70-85°F 85°F & UP

Wind: STILL MODERATE HIGH

Location of Incident:_____

Project Name:_____

Contractor or Subcontractor involved?_____

Did employee leave work site?_____ If so, time employee left:_____

Section 3 - Injury/Illness Information (If applicable)

Date/Time Injury Reported:_____ Reported to whom?_____

Type of Injury Sustained (Check All that Apply):

__ Bruise, Contusion
__ Chemical Exposure
__ Concussion
__ Dismemberment
__ Electrical Burn
__ Loss of Senses (hearing, sight, smell, etc.)
__ Electrical Shock
__ Fatality
__ Foreign Object in Eye
__ Fracture
__ Hernia
__ Unconsciousness
__ Joint Sprain
__ Laceration, Puncture
__ Muscle Strain
__ Suffocation
__ Thermal Burn
__ Other (Specify):_____
_____

Specific Parts of Body Affected (e.g., Head, Left Leg, Right Ear, Left Index Finger, etc.):
_____

Type of Illness Resulted (Check All that Apply):

__ Cardiovascular (heart/circulatory system)
__ Eye
__ Respiratory
__ Effect of Hazardous Substance/Material (Specify):_____
__ Central Nervous System (brain/spine)
__ Skin
__ Heat/Cold Stress
__ Cumulative Trauma Disorder (i.e., carpal tunnel syndrome)
__ Systemic (Liver, Kidney, Heart, etc.)
__ Hearing Loss
__ Other (Specify):_____
_____

What Caused the Injury of Illness? (Check All that Apply)

__ Caught In, Under, Between
__ Contact w/ Electrical Current
__ Contact w/ Material
__ Contact w/ Plant, Animal, Insect
__ Contact w/ Temperature Extremes
__ Fall from Higher Elevation
__ Fall on Same Level
__ Inhalation of Material
__ Ingestion of Material
__ Involuntary Body Reaction
__ Over Exertion
__ Rubbed or Abraded
__ Slip
__ Struck Against
__ Struck By
__ Trip
__ Other (Specify):
_____

Method of Treatment

__ On-Site First Aid
__ Doctor's Care
__ Clinic/Doctor First Aid
__ Hospitalization

Name of service, physician, location:_____

Phone number:_____

Address:_____

Will Injury-Illness Result in Restricted Activity?

__ No __ Yes __ Do Not Know

Will Injury-Illness Result in Lost Workday(s)?
__ No __ Yes, How Many?____ __ Do Not Know

Section 4 - Incident Description

Description of Incident:_____

_____

What was person doing at time of incident?_____

_____

Why did incident occur?_____

Was use or lack of safety equipment a factor in this incident?_____

If so, explain:_____

Were any safety regulations violated?_____ Explain:_____

_____

Were any regulatory agencies notified?_____ Explain:_____

_____

Action taken by regulatory agency:_____

Property damage?_____ Extent of damage:_____

Property owner:_____ Phone Number:_____

Address:_____

Space for Sketch or Additional Narrative

Section 5 - Incident Witnesses/Documentation

Incident Witness:_____ Phone Number:_____

Address:_____

Employer:_____

Statements Attached? __ No __ Yes

Were any photographs taken of the site after the incident? __ No __ Yes

Photographs taken by whom?_____

Photographs stored at:_____

Section 6 - Corrective Action/Recommendations

Recommended Corrective Action(s):_____

_____

_____

Assigned to:_____ Targeted Completion Date:_____

Was this corrective action shared with all affected employees? __ No __ Yes, Date?_____

Section 7 - Acknowledgment/Distribution

Printed Name	Signature	Date
Employee Reporting Incident:		
_____	_____	_____
Direct Supervisor:		
_____	_____	_____
Business Unit Manager/Program Director:		
_____	_____	_____
Program Health and Safety Coordinator:		
_____		
Health and Safety Manager:		
_____		

Section 8 - Follow-Up

Follow-up necessary? __ No __ Yes

Recommendation:_____

Completed by:_____ Date:_____

Note: For each MWH incident or work-related injury/illness, this form must be completed, and faxed/mailed to the distribution list above within 24 hours. In addition, for injuries and illnesses, an Employer's First Report of Injury Form, and an Employee's Claim for Workers' Compensation Benefits form must be completed within 24 hours and sent to Human Resources.

If a fatality occurs or 4 or more people are hospitalized, the local OSHA office <u>must</u> be notified of the incident within 8 hours (regardless of the day of the week, if after hours, leave a message). If the Company Health and Safety Manager can not be contacted with a reasonable time, the most senior MWH person at the scene shall make the notification.

Appendix G
OSHA Job Safety and Health Protection Poster

Appendix G—OSHA Job Safety and Health Protection Poster

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct periodic inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory civil penalties against employers of up to $7,000 for each serious violation and for optional penalties of up to $7,000 for each nonserious violation. Penalties of up to $7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $70,000 for each such violation. A minimum penalty of $5,000 may be imposed for each willful violation. A violation of posting requirements can bring a penalty of up to $7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to $250,000 (or $500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of $10,000 or up to six months in jail or both.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, GA	(404) 562-2300
Boston, MA	(617) 565-9860
Chicago, IL	(312) 353-2220
Dallas, TX	(214) 767-4731
Denver, CO	(303) 844-1600
Kansas City, MO	(816) 426-5861
New York, NY	(212) 337-2378
Philadelphia, PA	(215) 596-1201
San Francisco, CA	(415) 975-4310
Seattle, WA	(206) 553-5930

Washington, DC
1997 (Reprinted)
OSHA 2203

Alexis M. Herman, Secretary of Labor

U.S. Department of Labor
Occupational Safety and Health Administration

This information will be made available to sensory impaired individuals upon request. Voice phone: (202) 219-8615; TDD message referral phone: 1-800-326-2577.