Appendix A

Work Plan

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List of Abbreviations

AA	Atomic Absorption
BLM	Bureau of Land Management
COC	Contaminant of Concern
FIAA	Flame Ionization Atomic Absorption
GFAA	Graphite Furnace Atomic Absorption
GIS	Geographic Information System
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDW	Investigation Derived Wastes
KRMC	Kingman Regional Medical Center
NAU	Northern Arizona University
PA	Preliminary Assessment
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
SAP	Sampling and Analysis Plan
SI	Site Inspection
SRL	Soil Remediation Level
XRF	X-ray Fluorescence

1.0 Introduction

Magma Consulting will conduct a field investigation at the AZ Magma Mine for the Bureau of Land Management (BLM) to determine contaminants at the site and possible risks they pose to the public. This Work Plan details a Sampling and Analysis Plan (SAP) and a Health and Safety Plan (HASP). It is developed specifically for the field investigation, including sampling techniques, data collection, and sample analysis.

The purpose of the SAP is to describe sampling objectives, locations, procedures, quality assurance and control, and analysis, including X-ray fluorescence (XRF) and acid digestion. This SAP specifically describes details for only surface soil samples from the mine. The SAP can be found in Appendix B of this document.

The purpose of the HASP is to include safety control measures and emergency information to consider during the field investigation. The HASP can be found in Appendix B of this document.

1.1 Project Objectives

The objective of the field investigation is to obtain physical, chemical, and analytical data to support evaluations and decisions made within the preliminary assessment and site inspection (PA/SI). The PA/SI will contain a human and ecological risk assessment to determine the risk of the site for humans, plants, and animals. Thus, the data quality objectives are to obtain data of quality acceptable for screening-level assessment/decision making.

1.2 Project Scope

The field work at AZ Magma Mine and analysis in the lab will include:

- Completion of a Work Plan containing a SAP and HASP.
- Collect up to 100 surface soil samples at the mine, including background and hotspot samples.
- Analyze all samples through XRF analysis to determine concentrations of the contaminants of concern (COC).
- Analyze 20% of samples through atomic absorption to correlate with XRF results.
- Completion of a PA/SI to determine risk at the site.

1.3 Work Plan Schedule

The Work Plan (including the SAP and HASP), completed December 2016, details sampling and analysis to be performed January to May 2017. Surface sampling will occur January 20-21, 2017. If requested by BLM, summary reports of data analyses can be submitted throughout this time period. Otherwise, data collected according to the SAP will be reported in the PA/SI. The PA/SI will be completed by May 2017.

2.0 Project Management

2.1 Project Management Approach

To ensure project organization, team roles were assigned with responsibilities attached to each role. The Project Manager is responsible for overall management and coordination of the team and must maintain communications with the BLM contact, Eric Zielske, Technical Advisor Taylor Oster, and Grading Instructor Bridget Bero. The Health and Safety Specialist is responsible for ensuring the HASP is followed explicitly in the field. The Lab Analysis Lead is responsible for maintaining quality assurance and control during lab analysis.

2.2 Project Procedures

All procedures detailed in this Work Plan follow American Society for Testing and Materials (ASTM) standard operating procedures or Environmental Protection Agency (EPA) Methods. All personnel working in the field or lab must follow procedures implicitly. Oversight of all personnel will be the responsibility of Bridget Bero. Field and lab procedures are detailed in the SAP (Appendix B).

2.3 Quality Management

Quality will be managed by Bridget Bero, the Northern Arizona University (NAU) person-in-charge, in the field through following all procedures detailed in the SAP. Quality assurance and quality control (QA/QC) are detailed in Section 8.0 of the SAP (Appendix B).

2.4 Subcontract Management

A subcontract for this project includes atomic absorption (AA) analysis completed by the NAU Chemistry Lab located in the Wettaw Building. All subcontract management will be the responsibility of the project manager, including communication with Jeffrey Propster, a research specialist at NAU, and transportation of the samples to the lab. Further discussion of what work will be subcontracted is detailed in section 3.2.3 of the SAP (Appendix B).

3.0 Site Background Information

This section provides a summary of the site location and previous operations that occurred at the site.

3.1 Site Location

The Arizona Magma Mine (Latitude N 35°25'00" Longitude W114°13'27") is located approximately one mile west of Chloride, Arizona with a population of 250 residents (McNeely, 2016). The mine is also located 28 miles north of Kingman, with a population of nearly 30,000 (ADMMR, 1995). Figure A-1 shows the mine's location in reference to both towns and Figure A-2 shows its proximity to Chloride.

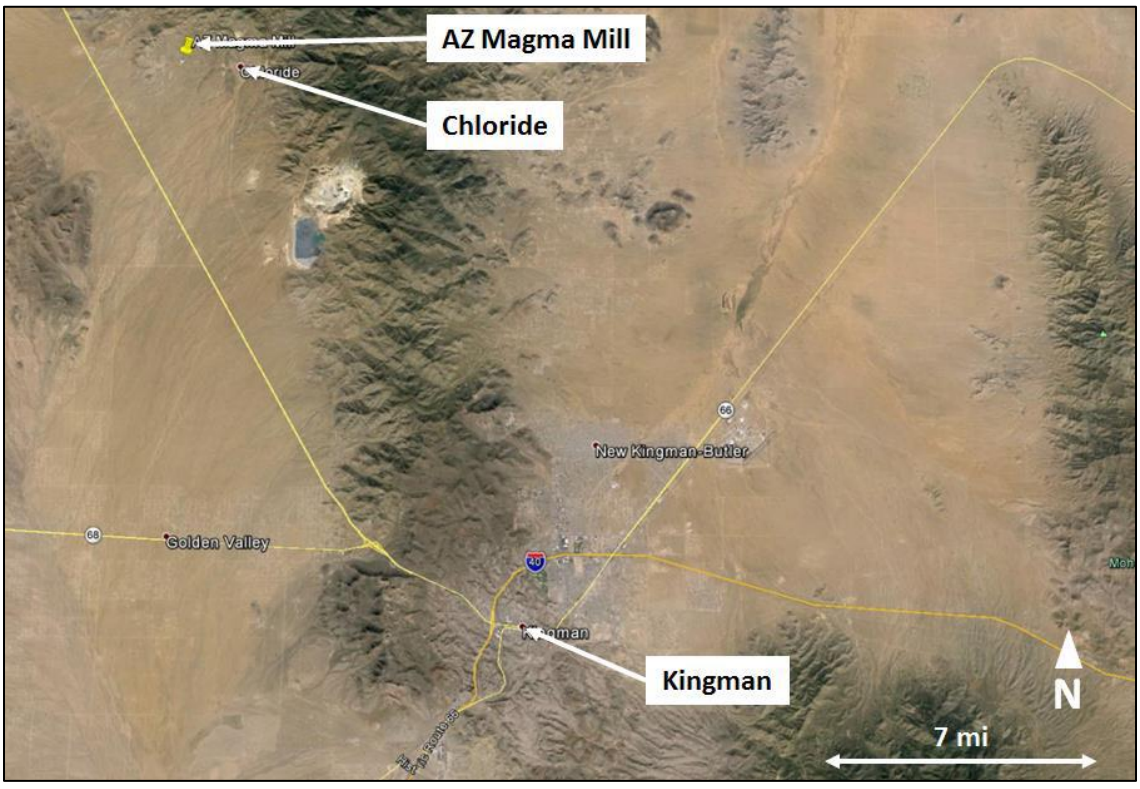

Figure A-1. AZ Magma Mine in Reference to Chloride and Kingman (Google Earth, 2016)

Figure A-2. AZ Magma Mine's Proximity to Chloride (Google Earth, 2016)

3.2 Site Description

The site belongs to the BLM and is considered open and accessible to the public. While mine operations shut down in the early 1940's, tailings about 10 feet deep are still present on the site (Zielske, 2016). These tailings may contain lead or arsenic (Zielske, 2016). A photo of the tailings can be seen in Figure A-3.

Figure A-3. Current Condition of Tailings (Zielske, 2016)

The tailings have also washed down into the nearby wash (Figure A-4) and onto the road that connects the mine to Chloride (Figure A-5).

Figure A-4. Tailings in the Wash (Zielske, 2016)

Figure A-5. Tailings on the Road (Zielske, 2016)

The site is also located near several water wells, as seen in Figure A-6. Wells are signified by red dots on the map.

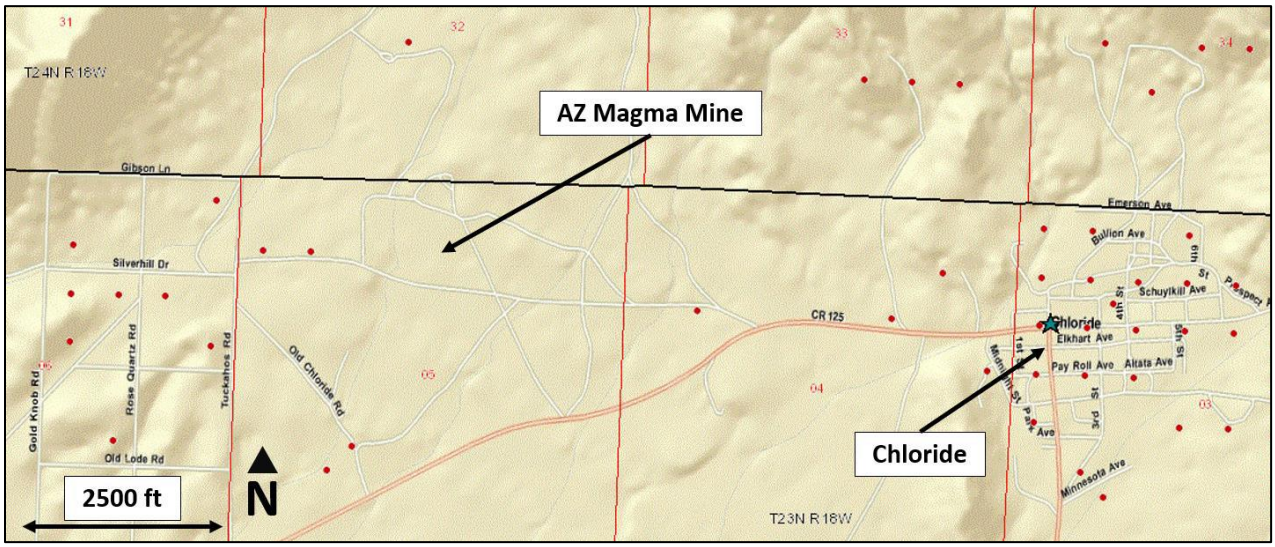

Figure A-6. Wells Near AZ Magma Mine (ADWR, 2016)

The depth to groundwater for these wells varies from 100 to 150 feet and may be at risk for contamination from the mine (ADWR, 2016).

3.3 Previous Operations and Investigation

Mining began at this site, originally called Arizona Diana Mine, around 1890. It experienced a period of inactivity until the 1920's where its commodities were primarily silver, gold, and lead (ADMMR, 1995). The mine closed again in the 1920's and was reopened and named after its new operating company, Magma Mine, in 1934 (ADMMR, 1995). For the mine's reopening, a new mill was built that was initially reported to provide a steady stream of revenue for years to come. However, after an investigation in 1940, it was found to be run down and in need of repair (ADMMR, 1995). A high-grade ore with ruby silver was mined at the site in its early years, while a low-grade ore with zinc and lead was its primary export in its later years. The mine was reviewed several times from 1940 to 1945 due to lack of funding and difficulty in extracting anything lucrative. As a result of these site investigations, Arizona Magma Mine was advised to close in 1945. The site has been inactive ever since, however, there have been no site investigations completed during this time.

4.0 Investigative Approach

This section discusses the objectives and approach of the site investigation.

4.1 Site Investigation Objective

The objective of this site investigation is to collect and analyze soil samples from AZ Magma Mine for possible COCs to use in a screening level risk assessment. Further discussion of the site investigation objectives can be seen in Section 1.1 of the SAP (Appendix B).

4.2 Site Investigation General Approach

The site investigation approach includes sample collection of surface soil at the mine site following all procedures detailed in the SAP. The samples will then be analyzed using XRF and AA analysis.

5.0 Field Investigation Methods and Procedures

The field investigation methods and procedures are detailed in Section 4.3-4.5 of the SAP (Appendix B). These procedures will be followed exactly how they are written to ensure QA/QC.

6.0 Investigative Derived Waste Management

Investigative Derived Waste (IDW) will include, but is not limited to soil and sediment, decontamination fluids, and disposable sampling equipment/PPE. How these wastes will be managed is detailed in Section 5.0 of the SAP (Appendix B).

7.0 Sample Collection Procedures and Analysis

This section describes how samples will be collected, stored and labeled, as well as QA/QC in the field.

7.1 Sample Containers, Preservation, and Storage

The samples will be collected using hand trowels and stored in labeled, gallon-sized plastic bags. A detailed description of sample containers and storage is in Section 6.0 of the SAP (Appendix B).

7.2 Sample Documentation and Shipment

All samples collected will be documented in the field notes by all participating members of the field investigation. This documentation will include the location of the sample (grid

number and picture), who took the sample, what kind of sample it is, etc. The soil samples will be transported from the site to NAU in storage totes. An in-depth description of logbooks and sample transport is detailed in Section 7.0 of the SAP (Appendix B).

7.3 Field Quality Assurance and Quality Control

To ensure quality assurance and control in the field, samples will be collected following the exact procedures detailed in the SAP (Appendix B). Background samples will also be taken to compare the mine site soil with surrounding soils. To ensure quality assurance and control while analyzing the soil samples in the lab, all QA/QC procedures and considerations from EPA Method 6200 (Field Portable X-Ray Fluorescence Spectrometry for the Determination of Elemental Concentrations in Soil and Sediment) and EPA Method 3050B (Acid Digestion of Sediments, Sludges, and Solids) will be followed. Further discussion of field and lab quality assurance and control is detailed in Section 8.0 of the SAP (Appendix B).

8.0 Deviations from the Work Plan

All deviations from the Work Plan will be recorded in the field logbook and must be approved by the on-site supervisor, Bridget Bero. The documentation will include what the deviation was and the rationale for the change. Further discussion on how to deal with deviations can be seen in Section 4.1 of the SAP (Appendix B).

9.0 PA/SI Reporting

The preliminary assessment and site inspection for this site will be completed after samples are collected and analyzed for COCs concentrations and a human and ecological risk assessment is finished. These documents will include human and ecological risk assessments to determine the risk these COCs pose to any humans that will come into contact with the site. If the COCs are above the action level and pose a serious risk, further action should be taken by the BLM.

10.0 Project Schedule

The activities and analysis discussed in this Work Plan will be completed during the winter and spring of 2017 (January 20 - May 5). Activities include training, sampling, lab analysis, analytical analysis, risk assessment, geographic information system (GIS) analysis, and documentation of the PA/SI.

11.0 References

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