



Reno Office
815 Maestro Dr.
Reno, NV 89511
Ph: 775.829.2245
Fax: 775.829.2213

Las Vegas Office
6280 So. Valley View Blvd.
Suite 604
Las Vegas, NV 89118
Ph: 702.260.4961
Fax: 702.260.4968

www.mcgin.com

SAMPLING AND ANALYSIS PLAN

Comstock Mining Inc. Soils Assessment Areas Affected by the Carson River Mercury Site Gold Hill, NV

Prepared for:

*Comstock Mining Inc.
1200 American Flat Road
Gold Hill, Nevada*

| Soil and Groundwater Remediation

| Regulatory Compliance

| Environmental Audits

| Hydrogeology

| Hazmat Response

January 25, 2012

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ACRONYMN LIST

BCA	Bureau of Corrective Actions
CAS	Columbia Analytical Services
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CMI	Comstock Mining Inc.
COC	Chemical of Concern
Comstock	Comstock Mining Inc.
CRMS	Comstock River Mercury Superfund
DQI	Data Quality Indicator
DQO	Data Quality Objective
ESC	ESC Lab Sciences
HASP	Health and Safety Plan
LTSRP	Long-Term Sampling and Response Plan
MDL	Method Detection Limit
MGA	McGinley & Associates
MQO	Measurement Quality Objective
NBP	Nevada Brownfields Program
NDEP	Nevada Division of Environmental Protection
NPL	National Priorities List
PARCCS	Precision, Accuracy, Representativeness, Completeness, Comparability and Sensitivity
PPE	Personal Protective Equipment
QA	Quality Assurance
QC	Quality Control
RL	Reporting Limit
RPD	Relative Percent Difference
SAP	Sampling and Analysis Plan
SD	Standard Deviation
TBD	To Be Determined
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

1. INTRODUCTION

McGinley and Associates, Inc. (MGA) has prepared this Sampling and Analysis Plan (SAP) for assessment activities to be conducted at the Comstock Mining Inc. (Comstock) site located in Gold Hill, Nevada. Specifically, this SAP addresses areas of the Comstock site (Site) that are affected by the Carson River Mercury Superfund (CRMS) site.

The purpose of the SAP is to satisfy the following goals:

- Identify Site areas with no historic milling infrastructure or mill tailings that can be excluded from the CRMS.
- Evaluate the land that is or will be directly utilized by Comstock for its potential to have been impacted by CRMS Contaminants of Concern (COCs) which include mercury, arsenic and lead in their areal and vertical extents.
- Evaluate potential fluvial redistribution areas within the Site.
- Demonstrate via soil sampling analysis the levels of COCs contained in any identified CRMS-impacted solid media within the Comstock area of operation.
- Provide information for assessment of human health risks via analyses of soil sample analytical results.
- Develop standard procedures for future sampling, risk evaluations and mitigation efforts.
- Inform Comstock workers of site COC levels.
- Identify background concentrations of COCs.
- Propose certain Comstock operational areas for removal from the CRMS that do not contain COCs above current screening/action levels based on appropriately verified soil sampling evidence.
- Satisfy Nevada Division of Environmental Protection (NDEP)-Bureau of Corrective Actions (BCA) and United States Environmental Protection Agency (USEPA) Superfund site sampling guidance while conducting Comstock operations.

1.1 Site Name

Comstock Mining Inc.

1.2 Site Location

The Site includes portions of the Comstock site potentially impacted by the CRMS in Storey and Lyon Counties in Nevada as shown on Figure 1. Figure 2 shows the locations of the Comstock holdings and Figures 3-11 show the locations of the Comstock holdings potentially impacted by the CRMS site.

1.3 Responsible Agency

This project is being conducted for the NDEP through the BCA Superfund Branch.

1.4 Project Organization

Title/Responsibility	Name	Phone
Comstock		
Director of Environmental and Regulatory Management	Cindi Byrns	(775) 847-5272
NDEP		
Program Coordinator for BCA Superfund Branch	Jeff Collins	(775) 687-9381
Case Officer – Review SAP, quality assurance	Jack Yates	(775) 687-9547
Case Officer – Review SAP, quality assurance	David Friedman	(775) 687-9385
McGinley and Associates, Inc. (Contractor to Comstock)		
Principal – Senior review, regulatory liaison	Joe McGinley	(775) 829-2245
Project Manager – Project management, regulatory liaison, coordinate field activities, data review, report preparation.	Brian A. Rakvica	(702) 260-4961
Quality Manager – Oversee implementation of SAP, review QA/QC procedures, data validation.	Brian Giroux	(775) 829-2245
Environmental Scientist – Conduct sampling activities	Doug Parcels	(775) 829-2245
CAD Operator – CAD support	Tim Dory	(775) 829-2245
Administrative Assistant – Administrative support	Linda Comstock	(775) 829-2245
Contractors/Vendors		
ESC Lab Sciences and Columbia Analytical Services – drying, sieving and laboratory analysis of soil samples	Jarred Willis Howard Holmes	(615) 773-9678 (360) 501-3364
TBD – disposal of investigation-derived wastes	TBD	TBD
Neptune and Company, Inc. – validation of data.	David Gratson	(505) 662-0707
TBD – drilling services	TBD	TBD

Note that some contractors and vendors are listed as TBD due to the extended time frame and scope of this SAP. It is expected that multiple vendors may be used to provide these services over time. If the analytical laboratory is revised, the pertinent updates to this SAP will be provided to NDEP.

The Project Manager will be responsible for overseeing the implementation of the sampling project and coordination of activities among NDEP, Storey and Lyon Counties, the Contractor and the laboratories. The Project Manager will also be responsible for data review and identification of quality assurance problems.

The Site Contractor will be responsible for the implementation of the sampling project and

supporting Comstock with data management and analysis.

1.5 Statement of the Specific Problem

Comstock plans to conduct exploration, mining and processing at the Site. Areas of the Site are potentially impacted by the CRMS. Comstock needs to assess those areas of the Site that it proposes to access or disturb in connection with its operations for the presence or absence of COCs where historic mining, milling infrastructure or mill tailings are identified. It is noted that the names of the historic workings identified in NDEP's *Draft Carson River Mercury Superfund Site Long-Term Sampling and Response Plan Risk Assessment and Soil Management (LTSRP)* dated November 10, 2011 (NDEP, 2011) are not always consistent with the names used by the locals. The SAP is using the names identified in the LTSRP as well as the local names for clarity. This analytical data will be compared to the current screening/action levels for the CRMS as listed in the LTSRP. Based on the results of these comparisons, certain portions of the Site may need to be remediated, mitigated, or removed from the CRMS. Specifically, areas of the Site with COCs below screening/action levels will be proposed for official removal from the CRMS, including removal from CRMS Risk Area maps.

2. BACKGROUND

Mining in the Carson River drainage basin commenced in 1850 when placer gold deposits were discovered near Dayton at the mouth of Gold Canyon. Throughout the 1850s, mining consisted of working placer deposits for gold in Gold Canyon and Sixmile Canyon. These placer deposits ultimately led to the discovery of the underground ore deposits known as the Comstock Lode.

The initial ore discovered was extremely rich in gold and silver. Gold was more abundant in Gold Canyon while silver was more abundant in Sixmile Canyon (Smith, 1943). Early mining methods concentrated on exposing as much of the lode as possible in wide trenches. Throughout 1859, ore was shipped to San Francisco for processing. After local ore processing began in 1860, most major mines operated their own mills, but there were also a large number of private mills. Initial ore processing techniques were slow and inefficient and a fair amount of trial and error experimentation led to the development of an effective ore-processing technique known as the Washoe pan process. Refinements were aimed primarily at increasing the speed of gold and silver recovery, increasing the percentage of gold and silver recovered and decreasing the amount of gold and silver discarded in tailings piles. The general milling process employed before 1900 involved pulverizing ore with stamp mills, creating a slurry, and then directing the slurry across a copper plate coated with mercury. The precious metals would adhere to the mercury on the copper plate in an amalgamation of recoverable metals. The millwrights would scrape the mercury amalgam from the copper plates and recover the precious metals through use of a smelting furnace. The majority of the mercury was recovered and reused in the process, however, some mercury was consumed in the process because of inefficiencies and losses in the amalgamation process, as well as in the smelting and retort process. After 1906, cyanide leaching and flotation processes replaced amalgamation and mercury use was generally discontinued.

Gold and silver production from the Comstock Lode increased slowly during the early years and 1863 was the first year of large production. Throughout the remainder of the 1860s and most of the 1870s, production remained high as rich ore bodies continued to be discovered at progressively deeper depths. The bottom of the lode was abruptly reached in 1877 at a depth of about 1,650 feet, and 1878 was the first year of dramatically reduced production. Between 1877 and 1878, ore production dropped from 562,519 tons to 272,909 tons and the total value decreased from \$36,301,536 to \$19,661,394. In 1879, production and value dropped even

further. In 1901, the first cyanide-leaching operation began in Sixmile Canyon. Cyanide leaching was capable of recovering more gold and silver from lower- grade material than was possible by amalgamation methods and during the early 1900s mining operations consisted of mining lower-grade material and reworking former ore dumps and tailings piles. Between approximately 1920 and 1950, large tonnages of low-grade ores were mined (Bonham, 1969).

2.1 Sampling Area Description

The Site study area occupies 6,099 acres of joint mineral estate which includes a combination of 999 acres of patented and 5,100 acres of unpatented active lode mining claims in the Comstock District as shown on Figure 2. The scope of the sampling applies to areas of the Site where historic disturbance has been documented by archaeological verification and aerial photo analysis. The Site is conceptually broken down into several categories listed below and shown on Figures 2 through 30. Due to the size, scope and duration of this project it is expected that the areas to be addressed will evolve as additional information is collected. Comstock plans to provide periodic updates to NDEP as significant changes are forecasted.

1. Past modern mining (post-Comstock era)disturbed areas which have been reclaimed but will be sampled to verify COC levels are below residential screening/action levels and document that Comstock's operations have not interacted with high COC concentration areas, as directed by NDEP.
2. Currently used areas (roads, drill pads and other generally disturbed areas used by Comstock) which will undergo surface sampling to verify COC levels are acceptable for workers and adjacent residents due to dust and direct contact. Please note that this item is addressed by the sampling conducted for the identified sampling areas presented on Figures 17-30. Areas outside these areas will need to be carefully evaluated as to whether sampling will be necessary based on: data collected via this SAP; future evidence from additional site assessment by CMI or NDEP or EPA; and/or direct field evidence. These areas are shown as the "areas to be assessed" on Figures 10 and 11. If additional areas are identified, they will be sampled in a manner consistent with this SAP and the LTSRP. NDEP will be informed and an addendum to this SAP will be developed.
3. Known historic tailings areas that Comstock will agree to reprocess during its operations and will sample per LTSRP guidance to maintain a mercury budget to show that Comstock operations benefit the CRMS by removing mercury as part of the mining/milling process. At this time it is noted that no areas have been identified for reprocessing outside of the Hartford/Lucerne Pit Area and the Hartford Mill site.
4. Areas which will not require sampling because they are in an undisturbed condition. Areas believed to be disturbed were based upon the NDEP's figures in the LTSRP. These areas were then compared to historic aerial photographs. In addition, Comstock conducted field verification and an archaeological survey of the areas believed to be disturbed. This archaeological survey field-verified the presence or absence of historical mill sites and tailings. A number of sites were found to contain no evidence of historic mining activities. The results of this survey are presented on Figures 14-16.
5. Areas which will ultimately be reclaimed and will undergo final verification sampling where tailings have been removed. These areas have not yet been identified other than portions of the Hartford/Lucerne Pit area and the Hartford Mill site as shown on Figures 21-23. This area is being sampled as historic cyanide mills are known to have reprocessed earlier tailings and therefore have the potential to contain COCs. If additional areas are identified, they will be sampled in a manner consistent with this SAP and the LTSRP. NDEP will be informed and an addendum to this SAP will be developed.

6. Areas which may have been affected by fluvial redistribution of COCs will be sampled. These areas are shown on Figure 2 and as part of the sampling for the identified sampling areas presented on Figures 17-30. As an initial step, at least the first quarter acre downgradient of a known source area will be sampled. Based upon the results of this sampling additional sampling may be required.
7. Areas which are outside the “known areas of disturbance” will undergo sampling to establish background concentrations of COCs. These locations are shown on Figure 12.
8. Where access is permitted, specific residential areas committed to by Comstock in public hearings. These areas are being sampled as a courtesy to the community.

These categories are subject to change, however, this document presents the path forward for each of the categories discussed above. It is also noted that each of these categories will be subdivided into the four zones developed by NDEP to identify the likelihood of the presence of CRMS COCs: “very low”, “low”, “medium”, and “high” risk zones within the CRMS.

In terms of phasing, Comstock envisions that the work will be completed as follows:

1. Investigate the Hartford/Lucerne Pit Area.
2. Investigate exploration areas, roads, drill pads, etc. within the applicable portions of Storey County and the Dayton Resource Area. The Storey County areas will be completed first. The Dayton Resource Area will be completed following.
3. Investigate the Plum Mining Area.
4. Investigate other exploration areas (to be addressed with addenda to this SAP at a later date).
5. Report sampling data to the NDEP and, where appropriate, request formal removal of Site areas from the CRMS as discussed above (to be completed in parallel with other activities over time).
6. Where access is permitted, sample specific residential areas committed to by Comstock in public hearings. These areas are being sampled as a courtesy to the community. This will be a high priority for phasing once the access agreements are secured.
7. Areas which may be affected by fluvial redistribution of COCs will be addressed as part of each of these activities, as applicable. In addition, the issue of fluvial redistribution will be addressed as part of future activities discussed in addenda. It is noted that the United States Army Corp of Engineers (USACE) Nationwide Permit 6 allows for the sampling within these fluvial areas without additional permitting.

2.2 Operational History

The operational history for the Site is covered above in Section 2.

2.3 Previous Investigations/Regulatory Involvement

In the 1970's the United States Geological Survey (USGS) discovered high mercury levels in water samples in the Carson River. Subsequently, the USEPA designated the CRMS and placed it on the National Priority List (NPL) regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The USEPA divided the CRMS into two Operable Units (OU's): OU1 consists of the mill sites and those areas where tailings have contaminated surface soil (generally the source areas), and OU2 is the Carson River itself, including sediments and biota (generally the depositional/ecological areas). USEPA designated

NDEP as the CRMS lead agency to manage OU1 of the CRMS and NDEP delegated this responsibility to the BCA. Areas likely to have the highest levels of COCs include former mill sites and associated drainage pathways down-gradient of mill sites as well as within the Carson River system itself.

2.4 Geological Information

The geology of the Site has been mapped as Quaternary Young Alluvium with Tertiary intrusions consisting of Alta Formation, Biotite Hornblende Andesite Dikes, Santiago Canyon Tuff, and Davidson Diorite (Hudson, Castor, Garside and Henry, 2009). The Young Alluvium is described as poorly sorted Holocene deposits of boulder to silt-sized material deposited on alluvial fans and as channel deposits. The Alta Formation, Biotite Hornblende Andesite Dikes, and Davidson Diorite are described as magmatic suites consisting of hornblende andesite dikes and intrusions. Lastly, the Santiago Canyon Tuff is described as Miocene-Oligocene tuff and sediment consisting of light gray to pinkish gray, moderately to strongly welded, rhyolitic tuff and can be as much as 120 m thick (Hudson, 2009).

Based on State of Nevada Division of Water Resources well log data for the vicinity of the Site, groundwater is estimated to be between 12 and 100 feet below ground surface.

2.5 Environmental and/or Human Impact

Historic mining activities in the Comstock region used elemental mercury to amalgamate gold and silver. It has been estimated that 7,500 tons (15,000,000) pounds of elemental mercury was lost in the process of obtaining gold and silver. Additionally, lead and arsenic were concentrated and discharged during the ore extraction and processing. These compounds (mercury, lead and arsenic; also referred to in this SAP as “contaminants of concern” or “COCs”) migrated into soils via fluvial pathways and hence into the Carson River system along a 75-mile stretch of the Carson River from New Empire, just east of Carson City, to its termination points at Carson Lake, Stillwater Wildlife Refuge and the Carson Sink. Episodic flooding and fluvial deposition have produced areas with high COC levels which represent “hot spots” within a wider area of possible contamination.

3. PROJECT DATA QUALITY OBJECTIVES

3.1 Project Task and Problem Definition

The purpose of this investigation is to assess the soil for contamination from historical activities at or in the Site. Definitive data will be collected to determine the extent of soil contamination, if any.

3.2 Data Quality Objectives (DQOs)

The DQO process (EPA 2006) is a systematic planning tool that is used to establish performance or acceptance criteria. These criteria, in turn, serve as the basis for designing a plan for collecting data of sufficient quality and quantity to support the goals of a study. The DQO process consists of seven iterative steps, as described in the following sections and summarized in Table 1.

3.2.1 Step 1: State the Problem

Historical use of the Site may have imparted contamination to soils within the study area. The extent of contamination in soil is not known. Additional data are needed to define the extent of contamination and to evaluate whether soils will require remediation, mitigation or removal from the CRMS. Specifically, areas of the Site with COCs below screening/action levels will be proposed for official removal from the CRMS, including removal from CRMS Risk Area maps. Additional data are also needed to establish background concentrations of COCs.

3.2.2 Step 2: Identify Decisions

Analytical data for collected samples will be evaluated to determine if concentrations of COCs exceed screening/action levels. Analytical data will be compared to screening/action levels as published in the LTSRP (NDEP, 2011). Comstock has elected to utilize the residential screening/action levels identified in the LTSRP. Results of the investigations will be used to determine if additional assessment and/or regulatory notification in connection with remediation or mitigation are required. Results will also be used to confirm non-impacted areas of the Site which will be proposed for official removal from the CRMS, including removal from CRMS Risk Area maps.

3.2.3 Step 3: Identify Inputs

Information required to address project objectives includes proposed quantitative data to be collected under this study, and the screening/action levels in the LTSRP (NDEP, 2011).

Analytical testing of soil samples shall be conducted by ESC Lab Sciences (ESC) of Nashville, Tennessee and Columbia Analytical Services (CAS) of Kelso, Washington. ESC's and CAS's DQOs for the analytical testing are provided in Appendix A.

3.2.4 Step 4: Define Study Boundaries

The proposed investigation of soils will include those soils believed to be impacted by the CRMS as shown on Figures 14-16. The soils investigation shall extend from the surface to a depth of two feet below ground surface (bgs) with the exception of the Hartford/Lucerene Pit Area which may extend to 80' bgs or more. The duration of the assessment activities described in this SAP is indeterminate as the implementation of the SAP across the various areas will be staggered to coincide with Site development activities.

3.2.5 Step 5: Develop Decision Rules

Decision rules are specified in Table 1, and describe actions based on quantitative data. Laboratory analytical data for the sampled media (soil) will be compared to screening/action levels identified in Section 3.2.2. For contaminants detected above the screening/action levels, remediation or mitigation will be proposed. For contaminants detected below the screening/action levels evaluation for removal from the CRMS will be proposed.

3.2.6 Step 6: Specify Tolerable Limits on Decision Errors

This is not a statistically based study, however, the LTSRP (NDEP, 2011) specifies sample layout and density depending on the anticipated risk category for COC presence of the area being sampled (very low, low, medium and high).

3.2.7 Step 7: Optimize the Sampling Design

The number of samples selected is believed to appropriately represent the number of samples that will be needed to develop an adequate data set based on the LTSRP and professional judgment and experience.

The DQOs are summarized in Table 1. Analytical testing of soil samples shall be conducted by ESC and CAS, as noted above. ESC's and CAS's DQOs for the analytical testing are provided in Appendix A.

3.3 Data Quality Indicators (DQIs)

Data quality indicators (precision, accuracy, representativeness, completeness, comparability and sensitivity [i.e., PARCCS parameters]) refer to quality control criteria established for various aspects of data gathering, sampling, and/or analyses. Precision is the degree of mutual agreement between or among independent measurements of a similar property (usually reported as standard deviation (SD) or relative percent difference) and relates to the analysis of duplicate laboratory or field samples. Accuracy is the degree of agreement of a measurement with a known or true value and is determined by comparing the reported laboratory value for a sample to a known or true concentration (i.e. matrix spikes, surrogate spikes, laboratory control samples and performance samples). Representativeness is the expression of the degree to which data accurately and precisely represent a characteristic of an environmental condition or population and relates to the method of collecting samples and determining sampling locations. Completeness is expressed as the percent of valid usable data obtained compared to the amount that was expected. Comparability expresses the degree of confidence with which one data set can be compared to another. Sensitivity is defined by the laboratory detection limits and are generally expressed in terms of method detection limits (MDLs) or reporting limits (RLs).

Precision and Accuracy: The measurement quality objectives (MQOs) for precision and accuracy for the analyses of the specific chemicals of concern (COCs) are summarized in Table 2.

Representativeness: Sample locations were selected using professional judgment and knowledge of geologic and hydrogeologic conditions and will adequately represent Site conditions in the area being investigated.

Completeness: Data collection may be inhibited by geologic conditions and/or underground utilities. The project goal is to obtain at least 90% of the soil samples outlined in this SAP.

Comparability: The laboratories that will be used for analytical testing of soil samples collected during this investigation (ESC and CAS) are certified by the NDEP for standard analyses under the Clean Water Act and the Safe Drinking Water Act as described in Appendix A of the NBP QA Program Plan (NDEP, 2007). Relevant SOPs from ESC and CAS for the analyses to be conducted during this investigation are provided in Appendix B.

Sensitivity: The laboratory reporting limit for each analyte is summarized in Table 2. The reporting limits are well below the action levels and provisional action levels and are adequate for this investigation

3.4 Data Review and Validation

Data verification is the process of evaluating the completeness, correctness, conformance, and compliance of a specific data set against the method, procedural, or contractual requirements. Data verification evaluates whether sampling protocols, SOPs, and analytical methods were followed during data generation. Verification also involves examining the data for errors or omissions. Field and laboratory staff will verify that the work is producing appropriate outputs.

Data validation is a systematic process for reviewing a body of data against a pre-established set of acceptance criteria defined in this plan. Data validation is an analyte and sample specific process that extends the evaluation of data beyond data verification and is performed to determine the analytical quality of a specific data set. Validation involves a detailed examination of the data package to determine whether MQOs for precision, accuracy, and sensitivity have been met. For this environmental assessment, the intent of the data review and validation process is to verify that the specified levels of precision, accuracy, reproducibility, completeness, comparability, and analytical sensitivity of the final results are achieved, with respect to the project MQOs, and that the data fulfill project DQOs.

MGA's QA officer will supervise or perform data quality assessment tasks. MGA will consistently evaluate and document measurement data to monitor consistency with MQOs, to quantitatively assess data quality, and to identify potential limitations to data use. MGA will review field and analytical laboratory data generated for this project, including the following:

- Chain of custody documentation;
- Laboratory batch QC frequency; and,
- Results of batch and field QC analyses;

Laboratory Data: The laboratory will generate and review all laboratory data. Each data point will be assessed as non-qualified or qualified based upon the acceptance criteria. Data may be qualified as "estimated" (J-qualified); these data are used as is. Some data may be qualified as "rejected" (R-qualified) if critical QC parameters are not met; these data are unusable for any purpose. Sample re-analysis, for data not meeting MQOs, will be considered as a possible corrective action. Third-party data validation will be performed to Stage 2B with at least 10% of the data being validated to Level IV.

3.5 Data Management

Sampling will be conducted in accordance with MGA's standard operating procedures (SOPs). A unique identification number will be assigned to each sample. The number will be an alphanumeric sequence that serves as an acronym to identify the sample. The following format will be used for the sample designation:

Soil Samples:

Sample ID: COM001-SS-01-1.0

COM001 - MGA Project Number

SS-01 – Soil Sample Number (i.e., #1)

1.0 – Depth of Soil Sample (feet below ground surface)

Field logs shall be maintained throughout the project. The following information shall be included on the field logs: description of activities conducted, dates and times, field observations, deviations from sampling program, names of onsite personnel, sampling locations.

Soil samples shall be preserved or cooled as required for each laboratory analysis. Samples shall be delivered or shipped to the laboratory under chain-of-custody protocol.

3.6 Assessment Oversight

Prior to commencing with field activities, the SAP will be reviewed by the Project Team. The MGA QA Officer will oversee QC of all field activities. If modifications to the proposed sampling program are required due to field conditions, the Project Manager shall be notified for direction. Any modifications to the sampling plan will be documented in the field logs and in the project report as "deviations from the sampling plan."

4. SAMPLING RATIONALE

The sampling rationale is based upon the LTSRP (NDEP, 2011) and the *Superfund Lead-Contaminated Residential Sites Handbook* (USEPA, 2003). The LTSRP provides a sampling design (layout and density) for sites designated as very low, low, medium and high risk based upon a per lot basis. In addition, the LTSRP references a figure which designates the very low, low, medium and high risk sites within the CRMS. The Site location versus the CRMS designation is presented as Figure 3. It is noted that these designations are not based on soil sample evidence but instead on the potential for COC presence above NDEP Screening/Action Levels. This SAP will further refine these areas based on Site-specific topography, disturbance history, GIS analysis, aerial photo interpretation, field inspections, archaeological survey and direct soil sample results. Figure 4 presents the Comstock land holdings versus known land disturbances based upon aerial photograph interpretation and field inspection. Figure 5 presents these same areas versus the CRMS-defined risk zones. Figure 6 presents the information on Figure 5 versus the areas of Comstock holdings that are outside of the CRMS-defined risk zones and areas of disturbance. Based upon multiple lines of evidence, the areas presented in green are not expected to be impacted from historic or more recent mining operations and will not be sampled.

In addition, as shown on Figure 6, there are areas of the site that are within the CRMS Risk Area maps which are not proposed for sampling at this time. These areas have no visual evidence of historic impacts as verified by aerial photo interpretation and archaeological survey. These areas, however, are adjacent to areas which do have evidence of historic impacts. The areas with defined historic impacts (as shown on Figures 17-30) will be sampled and pathways for contaminant transport will also be sampled. Specifically, roads and fluvial transport areas will be sampled for the first linear quarter acre. Based upon the results of the first round of sampling, additional sampling may be required if COCs are found above the Screening/Action Levels. These areas are shown as the “areas to be assessed” on Figures 10 and 11. Addenda will be provided to this SAP to define this additional sampling, as necessary.

The LTSRP does not, however, define the size of the subject lot, but the concept of a lot is intended to apply to a residential development scenario. Since the majority of the Site is undeveloped and is expected to remain undeveloped for the foreseeable future Comstock has applied professional judgment, and in consultation with the NDEP, and has determined that an appropriate sampling area size is a maximum of one acre. The sampling areas will be divided into quadrants and will have at least one five point composite per quarter acre. Some areas of the Site such as roads and drill pads will not be subject to this lot size and will need to be addressed in an alternate manner, as discussed further below. Comstock’s interpretation of the LTSRP’s intent with USEPA, 2003 is referred to as the Comstock Mining Sampling and Analysis Strategy (Comstock SAS) below. The specific sampling issues are discussed further below.

The Site is large and will be screened based upon the decision logic outlined below and discussed in the project DQOs (Table 1). Please note that the samples shown on Figures 17-30 represent 5-point composite samples. The specific locations of each of the points of the composite will be laid out in the field based upon field conditions. For example, if visual evidence of tailings or historic disturbance is noted within the area of a five-point composite, the sampling points of the composite will be biased towards areas of visual evidence. Every point of the 5-point composite will be located with GIS grade equipment and this information will be provided to NDEP in the

report for each area. This reporting will include mapping as well as an electronic relational database that contains the locational and chemical information. Each type of sampling is first discussed in general terms and then the specific sampling to be conducted in the near term is discussed in subsequent sub-sections.

1. If an area of the Site is designated as undisturbed land based upon the absence of visual evidence of disturbance (archaeological survey and aerial photo interpretation) it will not be sampled. As discussed above, these areas may require sampling in the future based upon the results of the analyses described in this SAP. Specifically, if adjacent areas are investigated and concentrations of COCs are above Screening/Action Levels the investigation will be expanded as needed to determine the nature and extent of contamination within the boundaries of the Site. These areas are shown as the “areas to be assessed” on Figures 10 and 11. Additional sampling will be described in addenda to this SAP, as needed.
2. If an area of the Site is designated as previously disturbed land and there is visual evidence of it being disturbed it will be sampled based upon the high risk designation in the Comstock SAS. Examples include currently used roads and drill pads; and tailings piles. The scope of this sampling is constrained to the sampling proposed on Figures 17-30. Additional sampling will be described in addenda to this SAP, as needed.
 - a. For areas that are amenable to being handled as a one acre sampling area, each one acre sampling area will be divided into quadrants and each quadrant will have at least two five point composite samples. Samples will be collected from 0-6”, 6-12”, 12-18” and 18-24” bgs. Samples will be biased towards areas of visual evidence of contamination.
 - b. For roads, each five point composite per quadrant will be laid out in a linear fashion and will be spread over a maximum of an equivalent one quarter acre area (approximate road width times an appropriate number of linear feet). Samples will be collected from 0-6”, 6-12”, 12-18” and 18-24” bgs. Samples will be biased towards areas of visual evidence of contamination.
 - c. For drill pads, at least one five point composite will be taken per drill pad due to the small size of drill pads. Drill pads are generally expected to be less than 1/10th of an acre in size. Samples will be collected from 0-6”, 6-12”, 12-18” and 18-24” bgs. Samples will be biased towards areas of visual evidence of contamination.
 - d. For tailings piles, discrete samples will be taken across, through, and below the piles. Based upon the depth of the tailings pile, the number and depths of samples will vary. The current, known tailings piles proposed to be sampled are the Hartford/Lucerne Pit Area which is discussed in detail below and tailings piles throughout the Dayton Resource Area and the Storey County portions of the Site. Tailings piles will be sampled from 0-6” bgs. Additional samples will be collected at the 2’ bgs interval and every 2’ thereafter for tailings piles up to 10’ in depth. Additional samples will be collected at the 4’ bgs interval and every 4’ thereafter for tailings piles 10’ - 20’ in depth. For tailings piles greater than 20’ in depth samples will be collected at 0-6” bgs, at the 10’ bgs depth interval and every 10’ thereafter. In addition, for all tailings piles, a sample will be collected at the interface with native land surface and 2’ below this contact.
 - e. Additional tailings piles, if identified, will be explored for depths and addenda to this SAP will be provided to the NDEP.
3. Post-ore removal areas will be sampled based upon the low risk designation in the Comstock SAS. Specifically, each one acre sampling area will be divided into quadrants and each

- quadrant will have one five point composite sample. These samples will be collected from 0-6" below ground surface (bgs). This part of the scope of work will occur at an indeterminate point in the future. When this implementation can be forecasted, addenda to the SAP will be submitted to the NDEP.
4. The backfilled portion of the Hartford/Lucerne pit area and the area immediately surrounding the Hartford Mill will be treated as high risk designation in the Comstock SAS. Specifically, the area will be sampled with a representative number of sampling locations within the pit area as shown on Figures 21-23. Samples will be collected from 0-6", 6-12", 12-18" and 18-24" bgs and/or to the depth of disturbance for areas outside the tailings. Samples would be biased towards areas of visual evidence of contamination. Additional details are provided on Figures 21-23. It is expected that over 310 samples will be collected in this area.
 - a. In some areas, the tailings/waste rock/ore (mixed backfill) are expected to be 70-80' in depth. In these areas, discrete surface samples will be taken from 0-6" 'bgs; additional discrete samples will be collected every 10'; a sample will be taken at the contact with native soils below the tailings; and a sample will be taken at 2' below the contact with native soils.
 - b. In addition to these samples, Comstock will insure that samples are taken whenever a notable change in lithology is seen. For example, from waste rock to tailings or from tailings to soils or soils to bedrock. Additionally, if differing types of tailings are encountered each type of tailings will be sampled to verify any differences in COC concentrations.
 - c. In addition, it is noted that there are tailings near the former Hartford Mill Site as shown on Figure 23 per the tailings symbol. Due to the scale of the drawing and the limited amount of tailings in this area the symbol covers the entire area where tailings have been visually observed. These tailings appear to be less than 10' in depth. Based upon this, a sample will be taken from 0-6" bgs, at 2' bgs and every 2' after that until contact with the native surface is established. A sample will be taken at the contact with native soils below the tailings; and a sample will be taken at 2' below the contact with native soils.
 - d. The extent and depths of sampling are unknown, however, exploratory drilling will be utilized to determine the necessary depths of sampling. The final depths of sampling will be reported in the final report to the NDEP.
 5. If an area appears to be potentially affected by fluvial redistribution it will be sampled based upon the perceived risk levels of adjacent source areas. For example, if the redistribution area is near a former mill site it will be sampled as a high risk area.
 6. Comstock also agrees to sample select residential properties if specifically requested by the resident owner/occupant and agreed to by Comstock in previous public meetings, subject to an access agreement. These areas are being sampled as a courtesy to the community. Such residential areas will be sampled based upon the low risk designation in the Comstock SAS unless one of the criteria above is met to suggest a higher density is warranted. Specifically, each one acre sampling area or actual lot will be divided into quadrants and each quadrant will have one five point composite sample. These samples would be collected from 0-6", 6-12", 12-18" and 18-24" bgs. If the lot is smaller than an acre, no less than two five point composite samples will be taken. The potential areas to be sampled will be addressed as addenda to this SAP when access agreements are secured.
 7. The visually disturbed areas of the Plum Mining Area will be treated as high risk designation in the Comstock SAS, excluding the active, permitted minerals processing area. Specifically, the areas will be sampled with a representative number of sampling locations within areas

shown on Figure 9. Samples will be collected from 0-6", 6-12", 12-18" and 18-24" bgs and/or to the depth of disturbance for areas outside the tailings. Samples would be biased towards areas of visual evidence of contamination. Additional details are provided on Figure 9. The number of samples to be taken in this area are yet to be determined and will be provided in addenda to this SAP.

Each of these areas is presented on Figures 9, 10, 11 and 14-30. It is noted that based upon the results of this initial sampling, additional sampling may be needed to fully delineate the nature and extent of contamination. This first round of sampling is expected to include the collection of over 1,300 samples.

4.1 Specific Near-Term Sampling

4.1.1 Hartford/Lucerne Pit Area and the Hartford Mill Site

As noted above in Section 4, item 4, Comstock has proposed to USEPA and NDEP, as a service to the community, to perform reprocessing of tailings, where that action is determined to be appropriate in consultation with the NDEP. The lower portion of the Hartford/Lucerne Pit Area is believed to have been backfilled in certain areas with tailings and waste rock. These tailings/waste rock/ore (mixed backfill) within the affected portions of the Hartford/Lucerne Pit Areas are believed to be up to 70-80' in depth. The Hartford Mill Site and related tailings are believed to be less than 10' in depth. The detailed sampling proposed for these areas are discussed above in Section 4, item 4, Additional details are provided on Figures 21-23. It is expected that over 290 samples will be collected in this area. It is expected that additional sampling and analysis may be proposed once the depth and extent of tailings is assessed in this area. These sampling efforts will be detailed in addenda provided to the NDEP, as necessary.

4.1.2 Dayton Resource Area

As noted above in Section 4, item 2, the Dayton Resource Area (DRA) may be mined for ore removal, initially this area is slated for ore exploration. The initial sampling for all areas within the DRA are shown on Figures 15 and 24-27 and are discussed further below. There are areas within the DRA where historic mill sites and historic tailings have been identified. Before exploration or mining is commenced, these areas will be sampled based upon the high risk designation discussed above in Section 4, item 2. A number of areas within the DRA have been verified (via archaeological survey and aerial photo interpretation) to contain no evidence of historic disturbance. These areas will not be sampled as discussed in Section 4, item 1 above. Roads and fluvial redistribution areas near historic mill/tailings sites will also be sampled as discussed above in Section 4, items 2 and 6. It is noted that these samples will generally be collected using hand tools or a powered auger and a drill rig will not be utilized. If samples deeper than 2' bgs are required or if use of hand tools is not practical a drill rig may be necessary. For the initial sampling effort, Comstock intends to collect over 490 samples for laboratory analysis. Based upon the results of this analysis, additional samples may be required. The data will be reviewed and addenda will be provided to the NDEP, as necessary for additional sampling.

It is noted that NDEP's Bureau of Mining Regulation and Reclamation (BMRR) has also issued a permit (Permit #0315). The sampling requirements for this permit are addressed by items 3, 12, 18, 19, 20 and 21 of the NDEP's Notice of Final Decision for this permit. These items defer to

this SAP Section 4.1.2 and Figures 15 and 24-27 and additional sampling is not required for the BMRR permit.

4.1.3 Storey County

As noted above in Section 4, item 2, the Storey County portion of the Site is projected to be utilized for ore exploration and possibly mined for ore removal. The initial sampling for all areas within the Storey County portion of the Site are shown on Figures 14, and 16-23, and 28-30 and are discussed further below. There are areas within Storey County where historic mill sites and historic tailings have been identified. These areas will be sampled based upon the high risk designation discussed above in Section 4, item 2. A number of areas within Storey County have been verified (via archaeological survey and aerial photo interpretation) to contain no evidence of historic disturbance. These areas will not be sampled as discussed in Section 4, item 1 above. Roads and fluvial redistribution areas near historic mill/tailings sites will also be sampled as discussed above in Section 4, items 2 and 6. It is noted that these samples will generally be collected using hand tools or a powered auger and a drill rig will not be utilized. If samples deeper than 2' bgs are required or if use of hand tools is not practical a drill rig may be necessary. For the initial sampling effort, Comstock intends to collect over 450 samples for laboratory analysis. Based upon the results of this analysis, additional samples may be required. The data will be reviewed and addenda will be provided to the NDEP, as necessary for additional sampling.

It is also noted that the "Mill Site (Name Unknown)" site is privately owned and will be sampled contingent upon obtaining access from the current owner. For reference, this site is located in Section 8, Township 16N, Range 21E.

The area behind the Gold Hill Hotel was requested to be sampled by the NDEP. This area is referred to as the Kentuck Claim. The Kentuck Claim is mostly privately owned (Figure 30), however, it is leased by Comstock and will be sampled as shown on Figure 30.

Storey County has issued a special use permit (SUP #2011-016). The requirements of this SUP as pertaining to sampling are detailed in item 11. This item defers to this SAP Section 4.1.3 and Figures 14, 16-23, and 28-30 and additional sampling is not required for the SUP.

4.1.4 Residential Properties

As noted above in Section 4, item 6, Comstock also agrees to sample select residential properties if specifically requested by the resident owner/occupant and agreed to in previous public meetings by Comstock, subject to an access agreement. These areas are being sampled as a courtesy to the community. Such residential areas will be sampled based upon the low risk designation in the Comstock SAS unless one of the criteria above is met to suggest a higher density is warranted. Specifically, each one acre sampling area or actual lot will be divided into quadrants and each quadrant will have one five point composite sample. These samples would be collected from 0-6", 6-12", 12-18" and 18-24" below ground surface (bgs). If the lot is smaller than an acre, no less than two five point composite samples will be taken per the LTSRP. The LTSRP suggests that one sample be placed in the front yard and one sample be placed in the back yard. Comstock will utilize this methodology for residential properties less than one acre. It is noted that these samples will be collected using hand tools or a powered auger and a drill rig will

not be utilized. The potential areas to be sampled will be addressed as addenda to this SAP when access agreements are secured.

4.1.5 Plum Mining Area

The Plum Mining disturbance areas are identified on Figure 9. Areas previously disturbed by Plum Mining mining and exploration activities are generally incorporated in the proposed sampling schedule for other areas. These areas will be sampled based upon the high risk designation discussed above in Section 4, item 7 with the exception of the active permitted minerals processing area. Operations began at the permitted minerals processing area in the late 1990s. The permitted area was not previously impacted by any historic mining operations. To the extent that limited historic tailings were incorporated into the heap, those materials are confined on a lined pad. Accordingly, sampling will not be conducted in the permitted minerals processing area. Additional areas within the Plum Mining Area have been verified (via archaeological survey and aerial photo interpretation) to contain no evidence of historic disturbance, these areas will not be sampled as discussed in Section 4, item 1 above. Regardless, based upon NDEP's requests, a limited number of samples will be collected as shown on Figure 28. In addition, Comstock needs to relocate a power line to the north of the process area. This area will be sampled as shown on Figure 29. Roads and fluvial redistribution areas near disturbance areas will also be sampled as discussed above in Section 4, items 2 and 6 and as shown on Figure 27. It is noted that these samples will generally be collected using hand tools or a powered auger and a drill rig will not be utilized. If samples deeper than 2' bgs are required or if use of hand tools is not practical a drill rig may be necessary. For the initial sampling effort, Comstock intends to collect approximately 210 samples for laboratory analysis. The number and location of samples will be described in addenda to this SAP and will be submitted to NDEP.

4.2 Soil Sampling

The depth of soil sampling is discussed above. All soil samples will be lab sieved to 250 microns (60 mesh). All soil samples from 0-2' bgs will be collected using hand tools or a powered auger unless this is not practical in which case a drill rig will be utilized.

4.3 Sediment Sampling

Sampling of sediments is not included in the scope of this investigation.

4.4 Water Sampling

Sampling of water/groundwater is not included in the scope of this investigation.

4.5 Biological Sampling

Biological sampling is not included in the scope of this investigation.

5. REQUEST FOR ANALYSIS

Laboratory analyses are discussed in Section 5.1 below.

5.1 Analyses Narrative

5.1.1 Soil Samples

The soil samples will be collected as described in Section 4.1 and analyzed for the following (per the NDEP's LTSRP guidance):

- Mercury – USEPA Method 7471A or B sieved to 250 microns (60 mesh)
- Arsenic and Lead – USEPA Method 6010B or C, digestion 3050, sieved to 250 microns (60 mesh)

5.2 Analytical Laboratory

All analytical testing shall be conducted by ESC and CAS. Analytical testing and sample handling shall be conducted in accordance with ESC's and CAS's SOPs (Appendices A and B).

6. FIELD METHODS AND PROCEDURES

6.1 Field Equipment

6.1.1 List of Equipment Needed

- Field logbook and field data sheets;
- Personal protective equipment (Level C);
- Tape measure;
- Camera;
- 4-oz glass sample containers;
- Cooler and ice;
- Sample labels;
- Pick axe;
- Shovel;
- Hand auger and/or power auger;
- Stainless steel bowls and scoops; and
- Decontamination supplies;

6.1.2 Calibration of Field Equipment

All field equipment will be calibrated according to the manufacturer's guidelines and specifications.

6.2 Field Screening

Field screening will not be utilized in this investigation.

6.3 Soil Sampling

6.3.1 Surface Samples

Surface soils sampling will be conducted in accordance with the MGA's SOP in Appendix C.

6.3.2 Sub-surface Samples

Sub-surface soils sampling will be conducted in accordance with the MGA's SOP in Appendix C.

6.4 Sediment Sampling

Not applicable, sediment sampling is not included in the scope of this investigation.

6.5 Water Sampling

Not applicable, water sampling is not included in the scope of this investigation.

6.6 Decontamination Procedures

All field equipment which comes in contact with potentially contaminated soil will be decontaminated in accordance with MGA's SOP (Appendix C). Decontamination will occur prior to and after each use of a piece of equipment.

7. SAMPLE CONTAINERS, PRESERVATION AND STORAGE

7.1 Soil Sample Containers

Soil samples will be collected in dedicated sample containers provided by the analytical laboratory. The soil samples will be delivered to the laboratory within one week of sample collection. Appendix C provides MGA's SOPs for sampling.

7.2 Soil Sample Preservation and Storage

Collected soil samples will be chilled to 4°C within a laboratory supplied cooler upon collection and during transport to the laboratory. Soil samples may be stored in a refrigeration unit prior to shipment to the laboratory.

8. DISPOSAL OF RESIDUAL MATERIALS

Waste generated during this investigation includes decontamination fluids, used personal protective equipment (PPE) and disposable sampling equipment.

Decontamination fluids will consist of deionized or distilled water, residual contaminants, and water with non-phosphate detergent. The water and water with detergent will be poured into drums.

Waste soil and decontamination fluids will be drummed and will be disposed of after analytical data are received from the laboratory. Drums will be labeled as waste with "characterization pending" until the analytical data are received. While waiting for the analytical data, the drums will be stored on-site in a secure location.

Disposable sampling equipment and used PPE will be double bagged and placed in a municipal refuse dumpster.

9. SAMPLE DOCUMENTATION AND SHIPMENT

9.1 Field Notes

9.1.1 Field Logbooks

Field logs will be completed describing all field activities. The following information will be included in the field logs:

- Project name and location;
- Sampling location and description;
- Site plan showing sample locations;
- Sampler's name (s);
- Date and time of sample collection;
- Type of sample (e.g., soil);
- Type of sampling equipment used;
- Field instrument readings and calibration;
- Field observations and details related to analysis or integrity of samples (e.g., noticeable odors, colors, etc.);
- Sample preservation;
- Lot number of the sample containers, sample identification numbers and explanatory

- codes, and chain-of-custody form numbers; and
- Name of recipient laboratory.

9.1.2 Photographs

Photographs will be taken at the selected sampling locations. They will serve to verify information entered in the field logbook. For each photograph taken, the following information, at a minimum, will be written in the logbook:

- Time, date, location, and weather conditions;
- Description of the subject photographed; and
- Name of person taking the photograph.

9.2 Labeling

All samples collected will be labeled in a clear and precise manner for proper identification in the field and for tracking in the laboratory. The samples will have pre-assigned, identifiable, and unique numbers. At a minimum, the sample labels will contain the following information:

- Sample location;
- Date and time of collection;
- Analytical parameter(s) requested; and
- Method of preservation.

9.3 Sample Chain-of-Custody Forms and Custody Seals

All samples shall be delivered to the laboratory under chain-of-custody protocol. A copy of ESC's and CAS's chain-of-custody forms are provided in Appendix D. Laboratory supplied custody seals shall be used to seal the screw lid of each sample container.

9.4 Packaging and Shipment

Samples shall be placed in a sturdy cooler. Bubble wrap shall be placed in the bottom of the cooler. Sample containers shall be placed in containers provided by the laboratory. Ice shall be packed in zipper-locked, double plastic bags. Empty space in the cooler shall be filled with bubble wrap. Appendix C provides MGA's SOP for sample packaging and shipping.

10. QUALITY CONTROL

10.1 Field Quality Control Samples

Samples will be collected in accordance with industry standard procedures. No equipment blanks will be collected during this investigation.

10.2 Background Samples

Approximately 56 background samples will be collected from 28 sample locations from unimpacted areas near the Site. The proposed locations of these samples are shown on Figure 12. These samples are all expected to be five point composite surface samples. Samples will be taken from 0-2" and 2-6" bgs. The 0-2" samples are being taken to determine if anthropogenic background has been influenced by aerial deposition of mercury from the historic mill sites. It is

expected that these background samples may be used to develop alternate screening levels, if background concentrations are higher than the screening/action levels in the LTSRP.

10.3 Field Screening and Confirmation Samples

No confirmation samples will be collected during this investigation.

10.4 Assessment of Field Variability (Field Duplicates or Co-located Samples)

A duplicate soil sample will be collected for laboratory quality control purposes for each discrete area sampled or for one in every 20 samples. When collecting the duplicate soil sample, the sample containers with the two different sample identification numbers will alternate in the filling sequence. The duplicate samples will be preserved, packaged, and sealed in the same manner as the other samples of the same matrix. A separate sample number and station number will be assigned to the duplicate sample such that it is blind to the laboratory.

In addition, it is noted that the USEPA or NDEP may request to take splits or duplicate samples; therefore MGA will provide a minimum of 72-hour advance notice via e-mail delivery to all NDEP Superfund Staff working with NDEP/BCA before initiating sampling activities. If this occurs the split/duplicate samples will be preserved, packaged, and sealed in the same manner as the other samples of the same matrix.

10.5 Laboratory Quality Control Samples

Laboratory QC (e.g., matrix spike/matrix spike duplicate samples) samples will be analyzed to monitor the precision and accuracy of its analytical procedures.

11. FIELD VARIANCES

As conditions in the field may vary, it may become necessary to implement minor modifications to sampling as presented in this SAP. Modifications to the approved SAP will be documented in the relevant reports to the NDEP.

The Site is a geographically large area and the use of the Site is expected to be long-term. Hence, this SAP cannot anticipate every possible discovery at the Site and every possible scenario that may unfold. Supplemental SAPs will be generated using this SAP as a template and submitted to the NDEP as needed to address these special cases.

12. REPORTING, DATA EVALUATION AND DELIVERABLES

As noted above, all sampling results will be evaluated for quality assurance and quality control and be consolidated into a sampling report for submission to NDEP.

Comstock anticipates that soil sampling will demonstrate that certain portions of the Site currently believed to be (or identified as) CRMS-affected areas contain COCs at levels which do not exceed residential screening/action levels. These areas will be proposed for official removal from the CRMS, including removal from the CRMS Risk Area maps.

Should sampling of COC levels verify above residential or commercial/industrial screening/action levels, then the exceedance area may require mitigation and/or remediation. It is noted that the commercial/industrial screening/action levels will only be applied to active

exploration and mining areas. Once the exploration and mining activities are completed, final reclamation will evaluate these areas under the residential screening/action levels.

Depending on stage of use, areas may undergo temporary mitigation measures to allow safe use or undergo final reclamation procedures to promptly reduce potential health hazards to acceptable levels.

Comstock will document sample results and include a section on proposed actions for all such areas in the respective sampling reports. The sampling report will be submitted to NDEP for approval (the affected County will also receive a copy). Reclamation actions may trigger the need for final surface verification soil sampling. Final verification sampling will be submitted to NDEP in a report for final assessment and approval.

Alternatives for final surface reclamation involve verification that the top two feet of material meets residential screening/action levels and implementation of institutional controls that include a deed notice to serve as a durable notification mechanism (DNM) or soil removal and disposal of any area which exceeds residential screening/action levels to the full depth of contamination to a suitable treatment or disposal area approved by the NDEP.

It is noted that once Comstock has determined the nature and extent of contamination in an area, the reclamation/mitigation or remediation plan will be developed and submitted to NDEP for approval.

Regarding the mercury budget for reprocessed tailings, as noted above, Comstock has proposed to USEPA and NDEP, as a service to the community, to perform reprocessing of tailings, where that action is determined to be appropriate in consultation with the NDEP. For example, it is expected that the tailings from the Hartford/Lucerne pit areas will be addressed as part of this SAP.

As noted above, the tailings will be sampled *in-situ*. Based upon this analytical data and the volume of tailings, a mass of mercury will be calculated. It is expected that the tailings will be excavated and placed on the lined heap leach pad.

In order to maintain a mercury budget per the LTSRP guidance, Comstock will collect samples of tailings and conduct bench scale testing of these tailings. The samples would be treated with a leaching solution for a period of time and the mercury reduction would be determined by sampling the leachate and reanalyzing the tailings. The mass of mercury in the tailings would be known based on pre-leaching chemical analysis. The post-leaching mass of mercury could be calculated based upon the mass of mercury in the leachate. It is expected that periodic leachate measurements will be conducted. After a reasonable period of time and as a final verification the tailings will be reanalyzed to validate the mass calculations from the leachate analysis. Comstock would then be able to extrapolate this mass removal efficiency to the volume of tailings placed on the heap leach pad. This bench scale test would be repeated for each set of tailings that was collected from different mill sites. Also, as an example, if the tailings within the pit appeared to be non-homogenous the test may be conducted with several samples from the same set of tailings.

In addition, Comstock will also note the amount of mercury captured in the facility's retort furnace and provide receipts for any mercury sold or shipped off-site as an additional line of evidence for removal of mercury from the environment.

All reports to the NDEP will be provided in both hard copy and digital formats. Digital format will include Adobe PDF as well as native file formats; GIS files will be provided with all sample locational information; a relational database will be provided to correlate sample locations to chemical data; survey data will be provided in UTM 11N NAD83; all laboratory data will be

provided as a Microsoft Access 2010 database; all laboratory QC backup will be provided in Adobe PDF.

13. FIELD HEALTH AND SAFETY PROCEDURES

A Site-specific Health and Safety Plan is provided in Appendix E. The HASP shall be reviewed by all on-Site MGA personnel prior to commencing with field activities.

14. SCHEDULE FOR SAMPLING ACTIVITIES

MGA will commence with the activities proposed herein upon receiving NDEP approval of this SAP. MGA will provide 72-hour advance notice to BCA staff before initiating sampling activities. Field activities will likely continue over a period of months or years throughout the various areas of the Site. Comstock will provide periodic reports to the NDEP as area investigations are completed. Near-term schedules for sampling activities are discussed below:

1. Sampling of the southern portion of the Hartford/Lucerne pit area
 - a. Initiate work within three weeks of the NDEP approval of the SAP.
 - b. Drilling and sampling – four weeks, pending drill rig availability
 - c. Laboratory analysis – two weeks from date submitted to laboratory.
 - d. Data validation – two weeks after laboratory analysis.
 - e. Data analysis – two weeks after data validation.
 - f. Report to NDEP – four weeks after data analysis.
 - g. It is expected that over 140 samples will be collected from this area.
2. Plum Mining Area
 - a. Initiate work following completion of the Hartford/Lucerne Pit Area scope of work.
 - b. Drilling and sampling – four weeks, pending drill rig availability
 - c. Laboratory analysis – two weeks from date submitted to laboratory.
 - d. Data validation – two weeks after laboratory analysis.
 - e. Data analysis – two weeks after data validation.
 - f. Report to NDEP – four weeks after data analysis.
 - g. It is expected that over 210 samples will be collected from this area and these will be described in addenda to this SAP and provided to NDEP.
3. Sampling of the northern portion of the Hartford/Lucerne pit area
 - a. Initiate work within three weeks of the NDEP approval of the SAP.
 - b. Drilling and sampling – four weeks, pending drill rig availability
 - c. Laboratory analysis – two weeks from date submitted to laboratory.
 - d. Data validation – two weeks after laboratory analysis.
 - e. Data analysis – two weeks after data validation.
 - f. Report to NDEP – four weeks after data analysis.
 - g. It is expected that over 150 samples will be collected from this area.
4. Dayton Resource Area.
 - a. Initiate work following completion of the Plum Mining Area scope of work and pending appropriate weather.
 - b. Laboratory analysis – two weeks from date submitted to laboratory.
 - c. Data validation – two weeks after laboratory analysis.
 - d. Data analysis – two weeks after data validation.
 - e. Report to NDEP – four weeks after data analysis.
 - f. It is noted that some historic mill sites may require Comstock executing additional

- access agreements with land owners. The schedule for these sites is contingent upon execution of access agreements.
- g. It is expected that over 490 samples will be collected from this area.
5. Storey County portion of the Site.
 - a. Initiate work following completion of the Dayton Resource Area scope of work.
 - b. Laboratory analysis – two weeks from date submitted to laboratory.
 - c. Data validation – two weeks after laboratory analysis.
 - d. Data analysis – two weeks after data validation.
 - e. Report to NDEP – four weeks after data analysis.
 - f. It is noted that some historic mill sites may require Comstock executing additional access agreements with land owners. The schedule for these sites is contingent upon execution of access agreements.
 - g. It is expected that over 450 samples will be collected from this area.
 6. Sampling of specific residential properties – pending executed access agreement and NDEP approval of SAP addenda. An unknown number of samples are expected to be collected from these areas.
 7. Sampling and reporting for mercury budget – to be determined as discussed above. An unknown number of samples are expected to be collected for this task.
 8. Upon acceptance of this SAP by NDEP, Comstock will apply for official removal from the CRMS, of areas identified as not requiring sampling. These areas are shown on Figure 7 as the green areas. Once NDEP and the USEPA has approved areas submitted by Comstock for removal from the CRMS, exploration and mining activities conducted on these areas will no longer involve CRMS-related guidance or requirements.

15. REFERENCES

ASTM, 1998. *Standard Test Method for Particle Size Analysis of Soils. D 422-63.*

NDEP, 2007. *Final Nevada Brownfields Program Quality Assurance Program Plan*, May.

NDEP, 2011. *Draft Carson River Mercury Superfund Site Long-Term Sampling and Response Plan Risk Assessment and Soil Management*. November 10.

USACE, 2007, *Nationwide Permit 6 Department of the Army Corps of Engineers Final Notice of Issuance and Modification of Nationwide Permits*. March 19

USEPA, 2003. *Superfund Lead-Contaminated Residential Sites Handbook*. August. OSWER 9285.7-50

USEPA, 2006. *Guidance on Systematic Planning using the Data Quality Objectives Process*. February. EPA QA/G-4, EPA/240/B-06/001

Table 1. DQO Summary Table for Soil Investigation for Comstock

STEP 1	STEP 2	STEP 3	STEP 4	STEP 5	STEP 6	STEP 7
State the Problem	Identify the Decisions	Identify the Inputs to the Decisions	Define Study Boundaries	Develop Decision Rules	Specify Tolerable Limits on Errors	Optimize Sampling Design
<p>Historical property uses within the Site included mining that utilized mercury for the amalgamation of gold.</p> <p>Soils within the Site may have been contaminated by mercury, arsenic and lead. The magnitude and extent of this contamination in soils is not known.</p>	<ol style="list-style-type: none"> 1) Do mercury, arsenic and lead concentrations in soil exceed the Screening / Action Levels established in the LTSRP? 2) Is there a potentially complete pathway for contaminated soil to adversely affect human health or the environment (per the previously conducted USEPA health risk assessment (HRA)? 3) Is additional assessment 	<p>Analytical data for soil samples (quantitative data)</p> <p>NDEP Screening/Action Levels established in the LTSRP.</p> <p>Potential receptors and completed exposure pathways (per the previously conducted USEPA HRA).</p> <p>Pathways for impacts to human health.</p> <p>Knowledge of future usage</p>	<p>Sampling to be conducted within site boundaries as established on Figure 2. Sampling will occur within areas of the CRMS; areas of known disturbance; and areas of proposed exploration and or processing.</p> <p>Investigation shall extend laterally and vertically as required to adequately delineate the lateral and vertical extent of soil</p>	<ol style="list-style-type: none"> 1) If mercury, arsenic or lead concentrations reported by the analytical laboratory exceed the Screening/Action Levels for soils then Comstock will conduct remediation or mitigation. 2) If there is a potentially complete pathway for contaminated soil to adversely affect human health or the environment Comstock will conduct remediation or mitigation (per the previously conducted USEPA HRA). 3) If additional assessment is required by the NDEP to assess potential risks to human health from contaminated soils the SAP will be modified 	<p>The number of samples to be collected is based upon the LTSRP and USEPA, 2003 and professional judgment.</p> <p>The locations and number of samples to be collected varies based upon the inferred risk as dictated by visual observations and the CRMS risk zone designations.</p> <p>MQOs and DQIs established for the analytical data are</p>	<p>Analytical data in soil samples will be evaluated to select locations for additional sampling and investigation, if warranted.</p>

<p>Additional data are needed to assess the magnitude and or delineate the extent of soil contamination.</p> <p>The exact extent and boundary of the CRMS is not currently known.</p>	<p>required to assess potential risks from contamination of soils at the site?</p>	<p>or development plans.</p> <p>Background data for COCs.</p>	<p>contamination.</p> <p>The investigation is expected to take place over a number of years as the exploration of the Site progresses.</p>	<p>as needed.</p>	<p>described in the laboratory SOPs in Table 2 and Appendix A.</p>	
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Table 2. Reporting Limits and CRMS Action Levels for Contaminants of Concern (ESC/CAS)			
Contaminant of Concern	Laboratory Reporting Limit	CRMS Action Level (Residential)	CRMS Action Level (Industrial)
	Soil (mg/Kg)	Soil¹ (mg/Kg)	Soil¹ (mg/Kg)
Mercury	0.02 / 0.02	80	300
Arsenic	1.0 2.0	32	32
Lead	0.25 / 2.0	400	800

¹ NDEP, 2011

Table 3: Method Precision and Accuracy Goals for Select Metals (ESC/CAS)		
Matrix Spike Compound	Soil	
	% Recovery	RPD%
Mercury	80-120 / 71-128	20
Arsenic	80-120 / 78-122	20
Lead	80-120 / 79-121	20

RPD Relative Percent Difference

APPENDIX A1 - ESC

Laboratory Data Quality Objectives, Sample Handling Procedures, and SOPs (on disk only)

APPENDIX A2 - CAS

Laboratory Data Quality Objectives, Sample Handling Procedures, and SOPs (on disk only)

APPENDIX B

MGA SOPs



GENERAL FIELD SAMPLING GUIDELINES

SOP#: 2001
DATE: 08/11/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide general field sampling guidelines that will assist REAC personnel in choosing sampling strategies, location, and frequency for proper assessment of site characteristics. This SOP is applicable to all field activities that involve sampling.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent on site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. EPA endorsement or recommendation for use.

2.0 METHOD SUMMARY

Sampling is the selection of a representative portion of a larger population, universe, or body. Through examination of a sample, the characteristics of the larger body from which the sample was drawn can be inferred. In this manner, sampling can be a valuable tool for determining the presence, type, and extent of contamination by hazardous substances in the environment.

The primary objective of all sampling activities is to characterize a hazardous waste site accurately so that its impact on human health and the environment can be properly evaluated. It is only through sampling and analysis that site hazards can be measured and the job of cleanup and restoration can be accomplished effectively with minimal risk. The sampling itself must be conducted so that every sample collected retains its original physical form and chemical composition. In this way, sample integrity is insured, quality assurance standards are maintained, and the sample can accurately represent the larger body of

material under investigation.

The extent to which valid inferences can be drawn from a sample depends on the degree to which the sampling effort conforms to the project's objectives. For example, as few as one sample may produce adequate, technically valid data to address the project's objectives. Meeting the project's objectives requires thorough planning of sampling activities, and implementation of the most appropriate sampling and analytical procedures. These issues will be discussed in this procedure.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected, and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest. Sample preservation, containers, handling, and storage for air and waste samples are discussed in the specific SOPs for air and waste sampling techniques.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

The nature of the object or materials being sampled may be a potential problem to the sampler. If a material is homogeneous, it will generally have a uniform composition throughout. In this case, any sample increment can be considered representative of the material. On the other hand, heterogeneous samples present problems to the sampler because of changes in the material over distance, both laterally and vertically.

Samples of hazardous materials may pose a safety threat to both field and laboratory personnel. Proper health and safety precautions should be implemented when handling this type of sample.

Environmental conditions, weather conditions, or non-target chemicals may cause problems and/or interferences when performing sampling activities or when sampling for a specific parameter. Refer to the specific SOPs for sampling techniques.

5.0 EQUIPMENT/APPARATUS

The equipment/apparatus required to collect samples must be determined on a site specific basis. Due to the wide variety of sampling equipment available, refer to the specific SOPs for sampling techniques which include lists of the equipment/apparatus required for sampling.

6.0 REAGENTS

Reagents may be utilized for preservation of samples and for decontamination of sampling equipment. The preservatives required are specified by the analysis to be performed. Decontamination solutions are specified in ERT SOP #2006, Sampling Equipment Decontamination.

7.0 PROCEDURE

7.1 Types of Samples

In relation to the media to be sampled, two basic types of samples can be considered: the environmental sample and the hazardous sample.

Environmental samples are those collected from streams, ponds, lakes, wells, and are off-site samples that are not expected to be contaminated with hazardous materials. They usually do not require the special handling procedures typically used for concentrated wastes. However, in certain instances, environmental samples can contain elevated concentrations of pollutants and in such cases would have to be handled as hazardous samples.

Hazardous or concentrated samples are those collected from drums, tanks, lagoons, pits, waste piles, fresh spills, or areas previously identified as contaminated, and require special handling procedures because of their potential toxicity or hazard. These samples can be further subdivided based on their degree of hazard; however, care should be taken when handling and shipping any wastes believed to be concentrated regardless of the degree.

The importance of making the distinction between environmental and hazardous samples is two-fold:

- (1) Personnel safety requirements: Any sample thought to contain enough hazardous materials to pose a safety threat should be designated as hazardous and handled in a manner which ensures the safety of both field and laboratory personnel.
- (2) Transportation requirements: Hazardous samples must be packaged, labeled, and shipped according to the International Air Transport Association (IATA) Dangerous Goods Regulations or Department of Transportation (DOT) regulations and U.S. EPA guidelines.

7.2 Sample Collection Techniques

In general, two basic types of sample collection techniques are recognized, both of which can be used for either environmental or hazardous samples.

Grab Samples

A grab sample is defined as a discrete aliquot representative of a specific location at a given point in time. The sample is collected all at once at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples will decrease.

Composite Samples

Composites are nondiscrete samples composed of more than one specific aliquot collected at various sampling locations and/or different points in time. Analysis of this type of sample produces an average value and can in certain instances be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing can mask problems by diluting isolated concentrations of some hazardous compounds below detection limits.

Compositing is often used for environmental samples and may be used for hazardous samples under certain conditions. For example, compositing of hazardous waste is often performed after compatibility tests have

been completed to determine an average value over a number of different locations (group of drums). This procedure generates data that can be useful by providing an average concentration within a number of units, can serve to keep analytical costs down, and can provide information useful to transporters and waste disposal operations.

For sampling situations involving hazardous wastes, grab sampling techniques are generally preferred because grab sampling minimizes the amount of time sampling personnel must be in contact with the wastes, reduces risks associated with compositing unknowns, and eliminates chemical changes that might occur due to compositing.

7.3 Types of Sampling Strategies

The number of samples that should be collected and analyzed depends on the objective of the investigation. There are three basic sampling strategies: random, systematic, and judgmental sampling.

Random sampling involves collection of samples in a nonsystematic fashion from the entire site or a specific portion of a site. Systematic sampling involves collection of samples based on a grid or a pattern which has been previously established. When judgmental sampling is performed, samples are collected only from the portion(s) of the site most likely to be contaminated. Often, a combination of these strategies is the best approach depending on the type of the suspected/known contamination, the uniformity and size of the site, the level/type of information desired, etc.

7.4 QA Work Plans (QAWP)

A QAWP is required when it becomes evident that a field investigation is necessary. It should be initiated in conjunction with, or immediately following, notification of the field investigation. This plan should be clear and concise and should detail the following basic components, with regard to sampling activities:

- C Objective and purpose of the investigation.
- C Basis upon which data will be evaluated.
- C Information known about the site including location, type and size of the facility, and length of operations/abandonment.
- C Type and volume of contaminated material, contaminants of concern (including

concentration), and basis of the information/data.

- C Technical approach including media/matrix to be sampled, sampling equipment to be used, sample equipment decontamination (if necessary), sampling design and rationale, and SOPs or description of the procedure to be implemented.
- C Project management and reporting, schedule, project organization and responsibilities, manpower and cost projections, and required deliverables.
- C QA objectives and protocols including tables summarizing field sampling and QA/QC analysis and objectives.

Note that this list of QAWP components is not all-inclusive and that additional elements may be added or altered depending on the specific requirements of the field investigation. It should also be recognized that although a detailed QAWP is quite important, it may be impractical in some instances. Emergency responses and accidental spills are prime examples of such instances where time might prohibit the development of site-specific QAWPs prior to field activities. In such cases, investigators would have to rely on general guidelines and personal judgment, and the sampling or response plans might simply be a strategy based on preliminary information and finalized on site. In any event, a plan of action should be developed, no matter how concise or informal, to aid investigators in maintaining a logical and consistent order to the implementation of their task.

7.5 Legal Implications

The data derived from sampling activities are often introduced as critical evidence during litigation of a hazardous waste site cleanup. Legal issues in which sampling data are important may include cleanup cost recovery, identification of pollution sources and responsible parties, and technical validation of remedial design methodologies. Because of the potential for involvement in legal actions, strict adherence to technical and administrative SOPs is essential during both the development and implementation of sampling activities.

Technically valid sampling begins with thorough planning and continues through the sample collection and analytical procedures. Administrative requirements involve thorough, accurate

documentation of all sampling activities. Documentation requirements include maintenance of a chain of custody, as well as accurate records of field activities and analytical instructions. Failure to observe these procedures fully and consistently may result in data that are questionable, invalid and non-defensible in court, and the consequent loss of enforcement proceedings.

8.0 CALCULATIONS

Refer to the specific SOPs for any calculations which are associated with sampling techniques.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

Refer to the specific SOPs for the type and frequency of QA/QC samples to be analyzed, the acceptance criteria for the QA/QC samples, and any other QA/QC activities which are associated with sampling techniques.

10.0 DATA VALIDATION

Refer to the specific SOPs for data validation activities that are associated with sampling techniques.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA, and corporate health and safety procedures.



SAMPLING EQUIPMENT DECONTAMINATION

SOP#: 2006
DATE: 08/11/94
REV. #: 0.0

1.0 SCOPE AND APPLICATION

The purpose of this Standard Operating Procedure (SOP) is to provide a description of the methods used for preventing, minimizing, or limiting cross-contamination of samples due to inappropriate or inadequate equipment decontamination and to provide general guidelines for developing decontamination procedures for sampling equipment to be used during hazardous waste operations as per 29 Code of Federal Regulations (CFR) 1910.120. This SOP does not address personnel decontamination.

These are standard (i.e. typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitation, or limitations imposed by the procedure. In all instances, the ultimate procedures employed should be documented and associated with the final report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (U.S. EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Removing or neutralizing contaminants from equipment minimizes the likelihood of sample cross contamination, reduces or eliminates transfer of contaminants to clean areas, and prevents the mixing of incompatible substances.

Gross contamination can be removed by physical decontamination procedures. These abrasive and non-abrasive methods include the use of brushes, air and wet blasting, and high and low pressure water cleaning.

The first step, a soap and water wash, removes all visible particulate matter and residual oils and grease. This may be preceded by a steam or high pressure

water wash to facilitate residuals removal. The second step involves a tap water rinse and a distilled/deionized water rinse to remove the detergent. An acid rinse provides a low pH media for trace metals removal and is included in the decontamination process if metal samples are to be collected. It is followed by another distilled/deionized water rinse. If sample analysis does not include metals, the acid rinse step can be omitted. Next, a high purity solvent rinse is performed for trace organics removal if organics are a concern at the site. Typical solvents used for removal of organic contaminants include acetone, hexane, or water. Acetone is typically chosen because it is an excellent solvent, miscible in water, and not a target analyte on the Priority Pollutant List. If acetone is known to be a contaminant of concern at a given site or if Target Compound List analysis (which includes acetone) is to be performed, another solvent may be substituted. The solvent must be allowed to evaporate completely and then a final distilled/deionized water rinse is performed. This rinse removes any residual traces of the solvent.

The decontamination procedure described above may be summarized as follows:

1. Physical removal
2. Non-phosphate detergent wash
3. Tap water rinse
4. Distilled/deionized water rinse
5. 10% nitric acid rinse
6. Distilled/deionized water rinse
7. Solvent rinse (pesticide grade)
8. Air dry
9. Distilled/deionized water rinse

If a particular contaminant fraction is not present at the site, the nine (9) step decontamination procedure specified above may be modified for site specificity. For example, the nitric acid rinse may be eliminated if metals are not of concern at a site. Similarly, the solvent rinse may be eliminated if organics are not of

concern at a site. Modifications to the standard procedure should be documented in the site specific work plan or subsequent report.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

The amount of sample to be collected and the proper sample container type (i.e., glass, plastic), chemical preservation, and storage requirements are dependent on the matrix being sampled and the parameter(s) of interest.

More specifically, sample collection and analysis of decontamination waste may be required before beginning proper disposal of decontamination liquids and solids generated at a site. This should be determined prior to initiation of site activities.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

C The use of distilled/deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment provided that it has been verified by laboratory analysis to be analyte free (specifically for the contaminants of concern).

C The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.

C If acids or solvents are utilized in decontamination they raise health and safety, and waste disposal concerns.

C Damage can be incurred by acid and solvent washing of complex and sophisticated sampling equipment.

5.0 EQUIPMENT/APPARATUS

Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment. Most equipment and supplies can be easily procured. For example, soft-

bristle scrub brushes or long-handled bottle brushes can be used to remove contaminants. Large galvanized wash tubs, stock tanks, or buckets can hold wash and rinse solutions. Children's wading pools can also be used. Large plastic garbage cans or other similar containers lined with plastic bags can help segregate contaminated equipment. Contaminated liquid can be stored temporarily in metal or plastic cans or drums.

The following standard materials and equipment are recommended for decontamination activities:

5.1 Decontamination Solutions

- C Non-phosphate detergent
- C Selected solvents (acetone, hexane, nitric acid, etc.)
- C Tap water
- C Distilled or deionized water

5.2 Decontamination Tools/Supplies

- C Long and short handled brushes
- C Bottle brushes
- C Drop cloth/plastic sheeting
- C Paper towels
- C Plastic or galvanized tubs or buckets
- C Pressurized sprayers (H₂O)
- C Solvent sprayers
- C Aluminum foil

5.3 Health and Safety Equipment

Appropriate personal protective equipment (i.e., safety glasses or splash shield, appropriate gloves, aprons or coveralls, respirator, emergency eye wash)

5.4 Waste Disposal

- C Trash bags
- C Trash containers
- C 55-gallon drums
- C Metal/plastic buckets/containers for storage and disposal of decontamination solutions

6.0 REAGENTS

There are no reagents used in this procedure aside from the actual decontamination solutions. Table 1 (Appendix A) lists solvent rinses which may be required for elimination of particular chemicals. In

general, the following solvents are typically utilized for decontamination purposes:

- C 10% nitric acid is typically used for inorganic compounds such as metals. An acid rinse may not be required if inorganics are not a contaminant of concern.
- C Acetone (pesticide grade)⁽¹⁾
- C Hexane (pesticide grade)⁽¹⁾
- C Methanol⁽¹⁾

⁽¹⁾ - Only if sample is to be analyzed for organics.

7.0 PROCEDURES

As part of the health and safety plan, a decontamination plan should be developed and reviewed. The decontamination line should be set up before any personnel or equipment enter the areas of potential exposure. The equipment decontamination plan should include:

- C The number, location, and layout of decontamination stations.
- C Decontamination equipment needed.
- C Appropriate decontamination methods.
- C Methods for disposal of contaminated clothing, equipment, and solutions.
- C Procedures can be established to minimize the potential for contamination. This may include: (1) work practices that minimize contact with potential contaminants; (2) using remote sampling techniques; (3) covering monitoring and sampling equipment with plastic, aluminum foil, or other protective material; (4) watering down dusty areas; (5) avoiding laying down equipment in areas of obvious contamination; and (6) use of disposable sampling equipment.

7.1 Decontamination Methods

All samples and equipment leaving the contaminated area of a site must be decontaminated to remove any contamination that may have adhered to equipment. Various decontamination methods will remove contaminants by: (1) flushing or other physical action, or (2) chemical complexing to inactivate

contaminants by neutralization, chemical reaction, disinfection, or sterilization.

Physical decontamination techniques can be grouped into two categories: abrasive methods and non-abrasive methods, as follows:

7.1.1 Abrasive Cleaning Methods

Abrasive cleaning methods work by rubbing and wearing away the top layer of the surface containing the contaminant. The mechanical abrasive cleaning methods are most commonly used at hazardous waste sites. The following abrasive methods are available:

Mechanical

Mechanical methods of decontamination include using metal or nylon brushes. The amount and type of contaminants removed will vary with the hardness of bristles, length of time brushed, degree of brush contact, degree of contamination, nature of the surface being cleaned, and degree of contaminant adherence to the surface.

Air Blasting

Air blasting equipment uses compressed air to force abrasive material through a nozzle at high velocities. The distance between nozzle and surface cleaned, air pressure, time of application, and angle at which the abrasive strikes the surface will dictate cleaning efficiency. Disadvantages of this method are the inability to control the amount of material removed and the large amount of waste generated.

Wet Blasting

Wet blast cleaning involves use of a suspended fine abrasive. The abrasive/water mixture is delivered by compressed air to the contaminated area. By using a very fine abrasive, the amount of materials removed can be carefully controlled.

7.1.2 Non-Abrasive Cleaning Methods

Non-abrasive cleaning methods work by forcing the contaminant off a surface with pressure. In general, the equipment surface is not removed using non-abrasive methods.

Low-Pressure Water

This method consists of a container which is filled with water. The user pumps air out of the container to create a vacuum. A slender nozzle and hose allow the user to spray in hard-to-reach places.

High-Pressure Water

This method consists of a high-pressure pump, an operator controlled directional nozzle, and a high-pressure hose. Operating pressure usually ranges from 340 to 680 atmospheres (atm) and flow rates usually range from 20 to 140 liters per minute.

Ultra-High-Pressure Water

This system produces a water jet that is pressured from 1,000 to 4,000 atmospheres. This ultra-high-pressure spray can remove tightly-adhered surface films. The water velocity ranges from 500 meters/second (m/s) (1,000 atm) to 900 m/s (4,000 atm). Additives can be used to enhance the cleaning action.

Rinsing

Contaminants are removed by rinsing through dilution, physical attraction, and solubilization.

Damp Cloth Removal

In some instances, due to sensitive, non-waterproof equipment or due to the unlikelihood of equipment being contaminated, it is not necessary to conduct an extensive decontamination procedure. For example, air sampling pumps hooked on a fence, placed on a drum, or wrapped in plastic bags are not likely to become heavily contaminated. A damp cloth should be used to wipe off contaminants which may have adhered to equipment through airborne contaminants or from surfaces upon which the equipment was set.

Disinfection/Sterilization

Disinfectants are a practical means of inactivating infectious agents. Unfortunately, standard sterilization methods are impractical for large equipment. This method of decontamination is typically performed off-site.

7.2 Field Sampling Equipment Decontamination Procedures

The decontamination line is setup so that the first station is used to clean the most contaminated item. It progresses to the last station where the least contaminated item is cleaned. The spread of contaminants is further reduced by separating each decontamination station by a minimum of three (3) feet. Ideally, the contamination should decrease as the equipment progresses from one station to another farther along in the line.

A site is typically divided up into the following boundaries: Hot Zone or Exclusion Zone (EZ), the Contamination Reduction Zone (CRZ), and the Support or Safe Zone (SZ). The decontamination line should be setup in the Contamination Reduction Corridor (CRC) which is in the CRZ. Figure 1 (Appendix B) shows a typical contaminant reduction zone layout. The CRC controls access into and out of the exclusion zone and confines decontamination activities to a limited area. The CRC boundaries should be conspicuously marked. The far end is the hotline, the boundary between the exclusion zone and the contamination reduction zone. The size of the decontamination corridor depends on the number of stations in the decontamination process, overall dimensions of the work zones, and amount of space available at the site. Whenever possible, it should be a straight line.

Anyone in the CRC should be wearing the level of protection designated for the decontamination crew. Another corridor may be required for the entry and exit of heavy equipment. Sampling and monitoring equipment and sampling supplies are all maintained outside of the CRC. Personnel don their equipment away from the CRC and enter the exclusion zone through a separate access control point at the hotline. One person (or more) dedicated to decontaminating equipment is recommended.

7.2.1 Decontamination Setup

Starting with the most contaminated station, the decontamination setup should be as follows:

Station 1: Segregate Equipment Drop

Place plastic sheeting on the ground (Figure 2, Appendix B). Size will depend on amount of

equipment to be decontaminated. Provide containers lined with plastic if equipment is to be segregated. Segregation may be required if sensitive equipment or mildly contaminated equipment is used at the same time as equipment which is likely to be heavily contaminated.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

As indicated in 7.1.2, a high-pressure wash may be required for compounds which are difficult to remove by washing with brushes. The elevated temperature of the water from the high-pressure washers is excellent at removing greasy/oily compounds. High pressure washers require water and electricity.

A decontamination pad may be required for the high-pressure wash area. An example of a wash pad may consist of an approximately 1 1/2 foot-deep basin lined with plastic sheeting and sloped to a sump at one corner. A layer of sand can be placed over the plastic and the basin is filled with gravel or shell. The sump is also lined with visqueen and a barrel is placed in the hole to prevent collapse. A sump pump is used to remove the water from the sump for transfer into a drum.

Typically heavy machinery is decontaminated at the end of the day unless site sampling requires that the machinery be decontaminated frequently. A separate decontamination pad may be required for heavy equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Prior to setting up Station 3, place plastic sheeting on the ground to cover areas under Station 3 through Station 10.

Fill a wash basin, a large bucket, or child's swimming pool with non-phosphate detergent and tap water. Several bottle and bristle brushes to physically remove contamination should be dedicated to this station. Approximately 10 - 50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 4: Water Basin

Fill a wash basin, a large bucket, or child's swimming

pool with tap water. Several bottle and bristle brushes should be dedicated to this station. Approximately 10-50 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 5: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to contain the water during the rinsing process. Approximately 10-20 gallons of water may be required initially depending upon the amount of equipment to decontaminate and the amount of gross contamination.

Station 6: Nitric Acid Sprayers

Fill a spray bottle with 10% nitric acid. An acid rinse may not be required if inorganics are not a contaminant of concern. The amount of acid will depend on the amount of equipment to be decontaminated. Provide a 5-gallon bucket or basin to collect acid during the rinsing process.

Station 7: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 8: Organic Solvent Sprayers

Fill a spray bottle with an organic solvent. After each solvent rinse, the equipment should be rinsed with distilled/deionized water and air dried. Amount of solvent will depend on the amount of equipment to decontaminate. Provide a 5-gallon bucket or basin to collect the solvent during the rinsing process.

Solvent rinses may not be required unless organics are a contaminant of concern, and may be eliminated from the station sequence.

Station 9: Low-Pressure Sprayers

Fill a low-pressure sprayer with distilled/deionized water. Provide a 5-gallon bucket or basin to collect water during the rinsate process.

Station 10: Clean Equipment Drop

Lay a clean piece of plastic sheeting over the bottom

plastic layer. This will allow easy removal of the plastic in the event that it becomes dirty. Provide aluminum foil, plastic, or other protective material to wrap clean equipment.

7.2.2 Decontamination Procedures

Station 1: Segregate Equipment Drop

Deposit equipment used on-site (i.e., tools, sampling devices and containers, monitoring instruments radios, clipboards, etc.) on the plastic drop cloth/sheet or in different containers with plastic liners. Each will be contaminated to a different degree. Segregation at the drop reduces the probability of cross contamination. Loose leaf sampling data sheets or maps can be placed in plastic zip lock bags if contamination is evident.

Station 2: Physical Removal With A High-Pressure Washer (Optional)

Use high pressure wash on grossly contaminated equipment. Do not use high- pressure wash on sensitive or non-waterproof equipment.

Station 3: Physical Removal With Brushes And A Wash Basin

Scrub equipment with soap and water using bottle and bristle brushes. Only sensitive equipment (i.e., radios, air monitoring and sampling equipment) which is waterproof should be washed. Equipment which is not waterproof should have plastic bags removed and wiped down with a damp cloth. Acids and organic rinses may also ruin sensitive equipment. Consult the manufacturers for recommended decontamination solutions.

Station 4: Equipment Rinse

Wash soap off of equipment with water by immersing the equipment in the water while brushing. Repeat as many times as necessary.

Station 5: Low-Pressure Rinse

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 6: Nitric Acid Sprayers (required only if metals are a contaminant of concern)

Using a spray bottle rinse sampling equipment with nitric acid. Begin spraying (inside and outside) at one end of the equipment allowing the acid to drip to the other end into a 5-gallon bucket. A rinsate blank may be required at this station. Refer to Section 9.

Station 7: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure sprayer.

Station 8: Organic Solvent Sprayers

Rinse sampling equipment with a solvent. Begin spraying (inside and outside) at one end of the equipment allowing the solvent to drip to the other end into a 5-gallon bucket. Allow the solvent to evaporate from the equipment before going to the next station. A QC rinsate sample may be required at this station.

Station 9: Low-Pressure Sprayers

Rinse sampling equipment with distilled/deionized water with a low-pressure washer.

Station 10: Clean Equipment Drop

Lay clean equipment on plastic sheeting. Once air dried, wrap sampling equipment with aluminum foil, plastic, or other protective material.

7.2.3 Post Decontamination Procedures

1. Collect high-pressure pad and heavy equipment decontamination area liquid and waste and store in appropriate drum or container. A sump pump can aid in the collection process. Refer to the Department of Transportation (DOT) requirements for appropriate containers based on the contaminant of concern.
2. Collect high-pressure pad and heavy equipment decontamination area solid waste and store in appropriate drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
3. Empty soap and water liquid wastes from basins and buckets and store in appropriate

drum or container. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.

4. Empty acid rinse waste and place in appropriate container or neutralize with a base and place in appropriate drum. pH paper or an equivalent pH test is required for neutralization. Consult DOT requirements for appropriate drum for acid rinse waste.
5. Empty solvent rinse sprayer and solvent waste into an appropriate container. Consult DOT requirements for appropriate drum for solvent rinse waste.
6. Using low-pressure sprayers, rinse basins, and brushes. Place liquid generated from this process into the wash water rinse container.
7. Empty low-pressure sprayer water onto the ground.
8. Place all solid waste materials generated from the decontamination area (i.e., gloves and plastic sheeting, etc.) in an approved DOT drum. Refer to the DOT requirements for appropriate containers based on the contaminant of concern.
9. Write appropriate labels for waste and make arrangements for disposal. Consult DOT regulations for the appropriate label for each drum generated from the decontamination process.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/ QUALITY CONTROL

A rinsate blank is one specific type of quality control sample associated with the field decontamination process. This sample will provide information on the effectiveness of the decontamination process employed in the field.

Rinsate blanks are samples obtained by running analyte free water over decontaminated sampling

equipment to test for residual contamination. The blank water is collected in sample containers for handling, shipment, and analysis. These samples are treated identical to samples collected that day. A rinsate blank is used to assess cross contamination brought about by improper decontamination procedures. Where dedicated sampling equipment is not utilized, collect one rinsate blank per day per type of sampling device samples to meet QA2 and QA3 objectives.

If sampling equipment requires the use of plastic tubing it should be disposed of as contaminated and replaced with clean tubing before additional sampling occurs.

10.0 DATA VALIDATION

Results of quality control samples will be evaluated for contamination. This information will be utilized to qualify the environmental sample results in accordance with the project's data quality objectives.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow OSHA, U.S. EPA, corporate, and other applicable health and safety procedures.

Decontamination can pose hazards under certain circumstances. Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion.

The decontamination solutions must be determined to be acceptable before use. Decontamination materials may degrade protective clothing or equipment; some solvents can permeate protective clothing. If decontamination materials do pose a health hazard, measures should be taken to protect personnel or substitutions should be made to eliminate the hazard. The choice of respiratory protection based on contaminants of concern from the site may not be appropriate for solvents used in the decontamination process.

Safety considerations should be addressed when using abrasive and non-abrasive decontamination

equipment. Maximum air pressure produced by abrasive equipment could cause physical injury. Displaced material requires control mechanisms.

Material generated from decontamination activities requires proper handling, storage, and disposal. Personal Protective Equipment may be required for these activities.

Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard (i.e., acetone, alcohol, and trisodiumphosphate).

In some jurisdictions, phosphate containing detergents (i.e., TSP) are banned.

12.0 REFERENCES

Field Sampling Procedures Manual, New Jersey Department of Environmental Protection, February, 1988.

A Compendium of Superfund Field Operations Methods, EPA 540/p-87/001.

Engineering Support Branch Standard Operating Procedures and Quality Assurance Manual, USEPA Region IV, April 1, 1986.

Guidelines for the Selection of Chemical Protective Clothing, Volume 1, Third Edition, American Conference of Governmental Industrial Hygienists, Inc., February, 1987.

Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH/OSHA/USCG/EPA, October, 1985.

APPENDIX A

Table

Table 1. Soluble Contaminants and Recommended Solvent Rinse

TABLE 1 Soluble Contaminants and Recommended Solvent Rinse		
SOLVENT ⁽¹⁾	EXAMPLES OF SOLVENTS	SOLUBLE CONTAMINANTS
Water	Deionized water Tap water	Low-chain hydrocarbons Inorganic compounds Salts Some organic acids and other polar compounds
Dilute Acids	Nitric acid Acetic acid Boric acid	Basic (caustic) compounds (e.g., amines and hydrazines)
Dilute Bases	Sodium bicarbonate (e.g., soap detergent)	Acidic compounds Phenol Thiols Some nitro and sulfonic compounds
Organic Solvents ⁽²⁾	Alcohols Ethers Ketones Aromatics Straight chain alkalines (e.g., hexane) Common petroleum products (e.g., fuel, oil, kerosene)	Nonpolar compounds (e.g., some organic compounds)
Organic Solvent ⁽²⁾	Hexane	PCBs

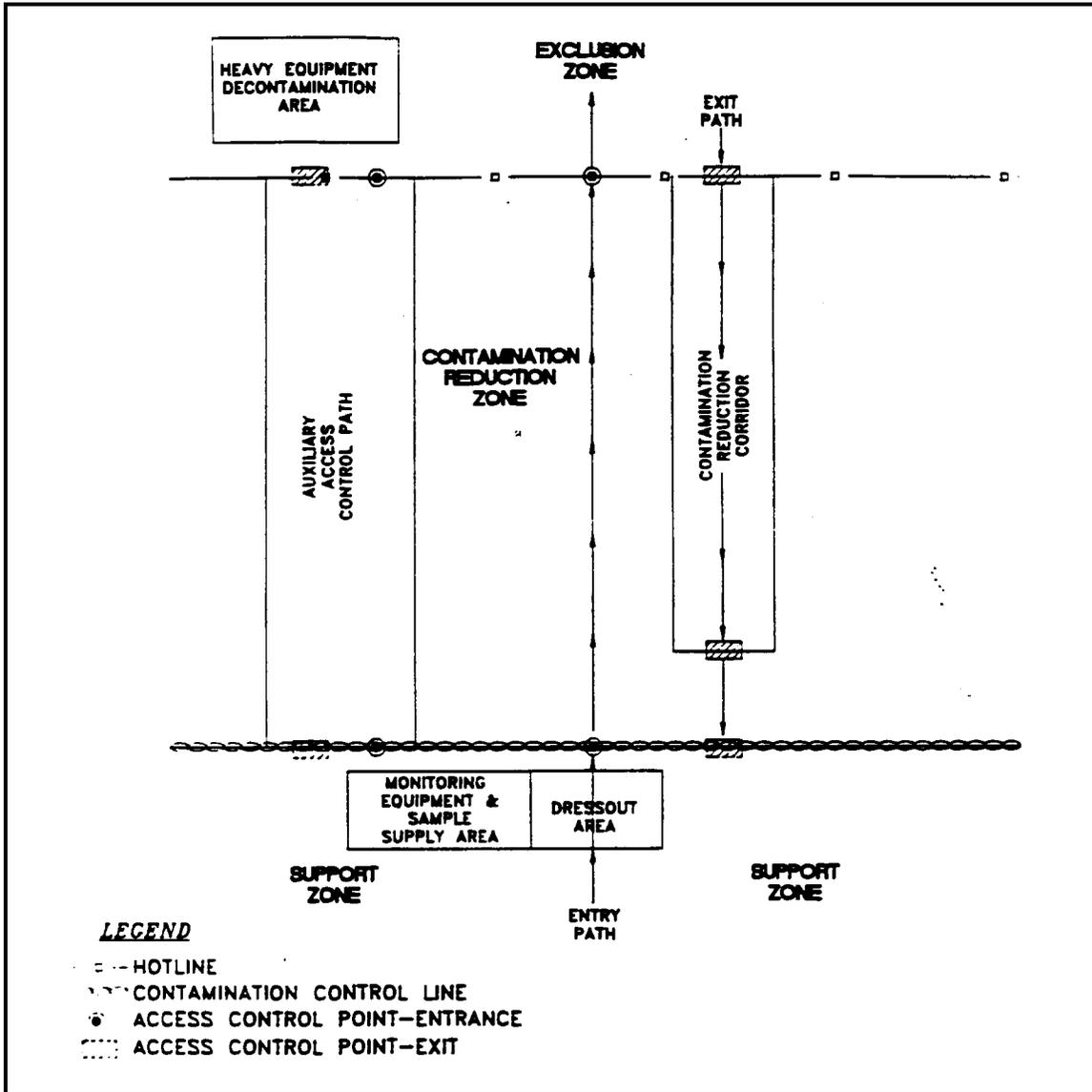
⁽¹⁾ - Material safety data sheets are required for all decontamination solvents or solutions as required by the Hazard Communication Standard

⁽²⁾ - WARNING: Some organic solvents can permeate and/or degrade the protective clothing

APPENDIX B

Figures

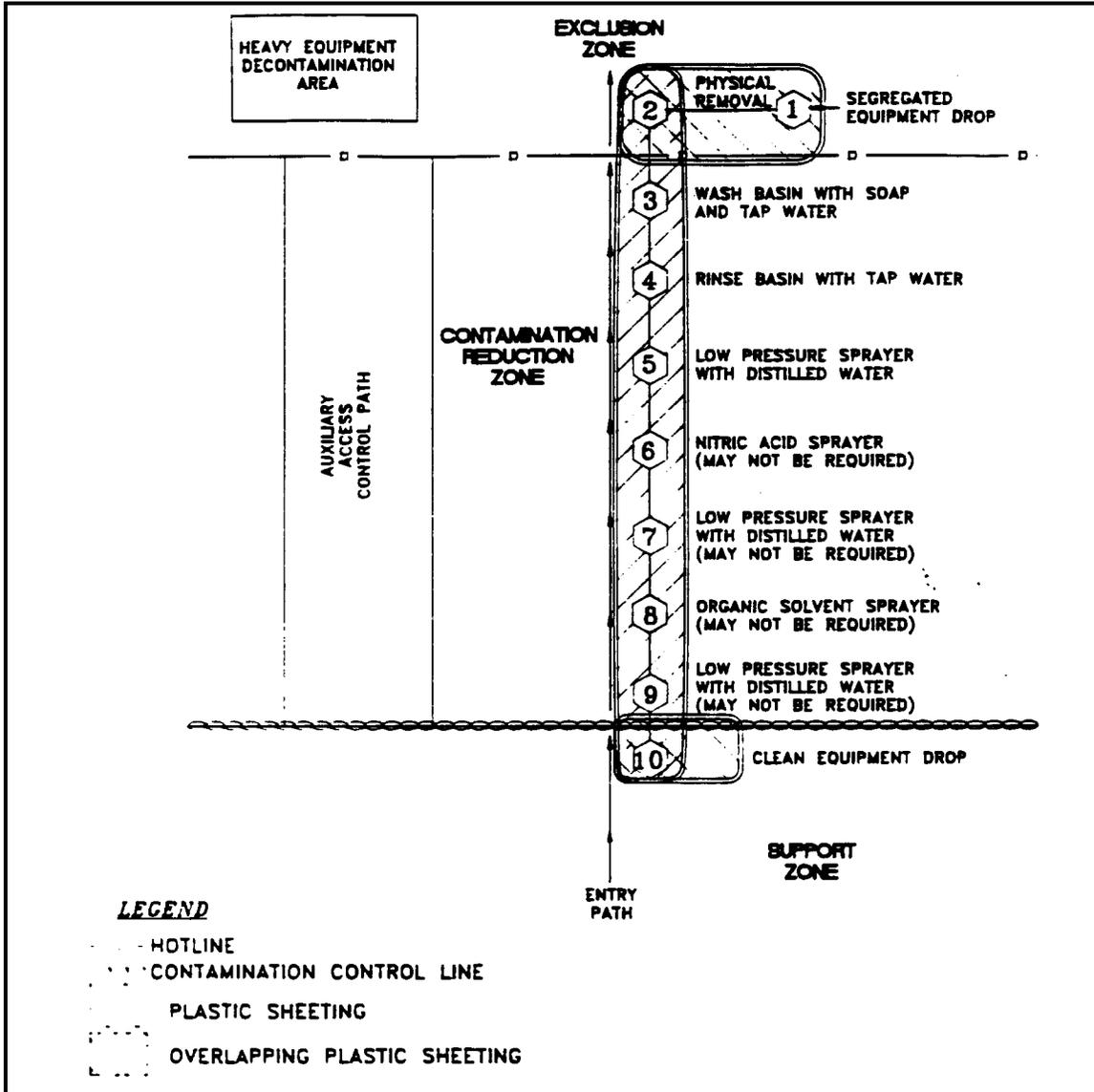
Figure 1. Contamination Reduction Zone Layout



APPENDIX B (Cont'd.)

Figures

Figure 2. Decontamination Layout





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- 4.0 POTENTIAL PROBLEMS
- 5.0 EQUIPMENT
- 6.0 REAGENTS
- 7.0 PROCEDURES
 - 7.1 Preparation
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 - 7.2.1 Surface Soil Samples
 - 7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers
 - 7.2.3 Sampling at Depth with a Trier
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SOIL SAMPLING

1.0 SCOPE AND APPLICATION

The purpose of this standard operating procedure (SOP) is to describe the procedures for the collection of representative soil samples. Sampling depths are assumed to be those that can be reached without the use of a drill rig, direct-push, or other mechanized equipment (except for a back-hoe). Analysis of soil samples may determine whether concentrations of specific pollutants exceed established action levels, or if the concentrations of pollutants present a risk to public health, welfare, or the environment.

These are standard (i.e., typically applicable) operating procedures which may be varied or changed as required, dependent upon site conditions, equipment limitations or limitations imposed by the procedure. In all instances, the actual procedures used should be documented and described in an appropriate site report.

Mention of trade names or commercial products does not constitute U.S. Environmental Protection Agency (EPA) endorsement or recommendation for use.

2.0 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment depending on the depth of the desired sample, the type of sample required (disturbed vs. undisturbed), and the soil type. Near-surface soils may be easily sampled using a spade, trowel, and scoop. Sampling at greater depths may be performed using a hand auger, continuous flight auger, a trier, a split-spoon, or, if required, a backhoe.

3.0 SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Chemical preservation of solids is not generally recommended. Samples should, however, be cooled and protected from sunlight to minimize any potential reaction. The amount of sample to be collected and proper sample container type are discussed in ERT/REAC SOP #2003 Rev. 0.0 08/11/94, *Sample Storage, Preservation and Handling*.

4.0 INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary potential problems associated with soil sampling - cross contamination of samples and improper sample collection. Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, then decontamination of sampling equipment is necessary. Improper sample collection can involve using contaminated equipment, disturbance of the matrix resulting in compaction of the sample, or inadequate homogenization of the samples where required, resulting in variable, non-representative results.

5.0 EQUIPMENT



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Soil sampling equipment includes the following:

- Maps/plot plan
- Safety equipment, as specified in the site-specific Health and Safety Plan
- Survey equipment or global positioning system (GPS) to locate sampling points
- Tape measure
- Survey stakes or flags
- Camera and film
- Stainless steel, plastic, or other appropriate homogenization bucket, bowl or pan
- Appropriate size sample containers
- Ziplock plastic bags
- Logbook
- Labels
- Chain of Custody records and custody seals
- Field data sheets and sample labels
- Cooler(s)
- Ice
- Vermiculite
- Decontamination supplies/equipment
- Canvas or plastic sheet
- Spade or shovel
- Spatula
- Scoop
- Plastic or stainless steel spoons
- Trowel(s)
- Continuous flight (screw) auger
- Bucket auger
- Post hole auger
- Extension rods
- T-handle
- Sampling trier
- Thin wall tube sampler
- Split spoons
- Vehimeyer soil sampler outfit
 - Tubes
 - Points
 - Drive head
 - Drop hammer
 - Puller jack and grip
- Backhoe



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Reagents are not used for the preservation of soil samples. Decontamination solutions are specified in ERT/REAC SOP #2006 Rev. 0.0 08/11/94, *Sampling Equipment Decontamination*, and the site specific work plan.

7.0 PROCEDURES

7.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies required.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or pre-clean equipment, and ensure that it is in working order.
4. Prepare schedules and coordinate with staff, client, and regulatory agencies, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site specific Health and Safety Plan.
6. Use stakes, flagging, or buoys to identify and mark all sampling locations. Specific site factors, including extent and nature of contaminant, should be considered when selecting sample location. If required, the proposed locations may be adjusted based on site access, property boundaries, and surface obstructions. All staked locations should be utility-cleared by the property owner or the On-Scene-Coordinator (OSC) prior to soil sampling; and utility clearance should always be confirmed before beginning work.

7.2 Sample Collection

7.2.1 Surface Soil Samples

Collection of samples from near-surface soil can be accomplished with tools such as spades, shovels, trowels, and scoops. Surface material is removed to the required depth and a stainless steel or plastic scoop is then used to collect the sample.

This method can be used in most soil types but is limited to sampling at or near the ground surface. Accurate, representative samples can be collected with this procedure depending on the care and precision demonstrated by the sample team member. A flat, pointed mason trowel to cut a block of the desired soil is helpful when undisturbed profiles are required. Tools plated with chrome or other materials should not be used. Plating is particularly common with garden implements such as potting trowels.

The following procedure is used to collect surface soil samples:



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1. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
2. Using a pre-cleaned, stainless steel scoop, plastic spoon, or trowel, remove and discard a thin layer of soil from the area which came in contact with the spade.
3. If volatile organic analysis is to be performed, transfer the sample directly into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval or location into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.2 Sampling at Depth with Augers and Thin Wall Tube Samplers

This system consists of an auger, or a thin-wall tube sampler, a series of extensions, and a "T" handle (Figure 1, Appendix A). The auger is used to bore a hole to a desired sampling depth, and is then withdrawn. The sample may be collected directly from the auger. If a core sample is to be collected, the auger tip is then replaced with a thin wall tube sampler. The system is then lowered down the borehole, and driven into the soil to the completion depth. The system is withdrawn and the core is collected from the thin wall tube sampler.

Several types of augers are available; these include: bucket type, continuous flight (screw), and post-hole augers. Bucket type augers are better for direct sample recovery because they provide a large volume of sample in a short time. When continuous flight augers are used, the sample can be collected directly from the flights. The continuous flight augers are satisfactory when a composite of the complete soil column is desired. Post-hole augers have limited utility for sample collection as they are designed to cut through fibrous, rooted, swampy soil and cannot be used below a depth of approximately three feet.

The following procedure is used for collecting soil samples with the auger:

1. Attach the auger bit to a drill rod extension, and attach the "T" handle to the drill rod.



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2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, litter). It may be advisable to remove the first three to six inches of surface soil for an area approximately six inches in radius around the drilling location.
3. Begin augering, periodically removing and depositing accumulated soils onto a plastic sheet spread near the hole. This prevents accidental brushing of loose material back down the borehole when removing the auger or adding drill rods. It also facilitates refilling the hole, and avoids possible contamination of the surrounding area.
4. After reaching the desired depth, slowly and carefully remove the auger from the hole. When sampling directly from the auger, collect the sample after the auger is removed from the hole and proceed to Step 10.
5. Remove auger tip from the extension rods and replace with a pre-cleaned thin wall tube sampler. Install the proper cutting tip.
6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Do not scrape the borehole sides. Avoid hammering the rods as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler, and unscrew the drill rods.
8. Remove the cutting tip and the core from the device.
9. Discard the top of the core (approximately 1 inch), as this possibly represents material collected before penetration of the layer of concern. Place the remaining core into the appropriate labeled sample container. Sample homogenization is not required.
10. If volatile organic analysis is to be performed, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly.

When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.



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11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly, and follow steps 3 through 11, making sure to decontaminate the auger and tube sampler between samples.
12. Abandon the hole according to applicable state regulations. Generally, shallow holes can simply be backfilled with the removed soil material.

7.2.3 Sampling with a Trier

The system consists of a trier, and a "T" handle. The auger is driven into the soil to be sampled and used to extract a core sample from the appropriate depth.

The following procedure is used to collect soil samples with a sampling trier:

1. Insert the trier (Figure 2, Appendix A) into the material to be sampled at a 0° to 45° angle from horizontal. This orientation minimizes the spillage of sample.
2. Rotate the trier once or twice to cut a core of material.
3. Slowly withdraw the trier, making sure that the slot is facing upward.
4. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.

7.2.4 Sampling at Depth with a Split Spoon (Barrel) Sampler

Split spoon sampling is generally used to collect undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted with a split spoon sampler to give a complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to its sampling depth through the bottom of the augured hole and the core extracted.

When split spoon sampling is performed to gain geologic information, all work should



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be performed in accordance with ASTM D1586-98, "Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils".

The following procedures are used for collecting soil samples with a split spoon:

1. Assemble the sampler by aligning both sides of barrel and then screwing the drive shoe on the bottom and the head piece on top.
2. Place the sampler in a perpendicular position on the sample material.
3. Using a well ring, drive the tube. Do not drive past the bottom of the head piece or compression of the sample will result.
4. Record in the site logbook or on field data sheets the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth.
5. Withdraw the sampler, and open by unscrewing the bit and head and splitting the barrel. The amount of recovery and soil type should be recorded on the boring log. If a split sample is desired, a cleaned, stainless steel knife should be used to divide the tube contents in half, longitudinally. This sampler is typically available in 2 and 3 1/2 inch diameters. A larger barrel may be necessary to obtain the required sample volume.
6. Without disturbing the core, transfer it to appropriate labeled sample container(s) and seal tightly.

7.2.5 Test Pit/Trench Excavation

A backhoe can be used to remove sections of soil, when detailed examination of soil characteristics are required. This is probably the most expensive sampling method because of the relatively high cost of backhoe operation.

The following procedures are used for collecting soil samples from test pits or trenches:

1. Prior to any excavation with a backhoe, it is important to ensure that all sampling locations are clear of overhead and buried utilities.
2. Review the site specific Health & Safety plan and ensure that all safety precautions including appropriate monitoring equipment are installed as required.



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3. Using the backhoe, excavate a trench approximately three feet wide and approximately one foot deep below the cleared sampling location. Place excavated soils on plastic sheets. Trenches greater than five feet deep must be sloped or protected by a shoring system, as required by OSHA regulations.
4. A shovel is used to remove a one to two inch layer of soil from the vertical face of the pit where sampling is to be done.
5. Samples are taken using a trowel, scoop, or coring device at the desired intervals. Be sure to scrape the vertical face at the point of sampling to remove any soil that may have fallen from above, and to expose fresh soil for sampling. In many instances, samples can be collected directly from the backhoe bucket.
6. If volatile organic analyses are required, transfer the sample into an appropriate, labeled sample container with a stainless steel lab spoon, or equivalent and secure the cap tightly. Place the remainder of the sample into a stainless steel, plastic, or other appropriate homogenization container, and mix thoroughly to obtain a homogenous sample representative of the entire sampling interval. Then, either place the sample into appropriate, labeled containers and secure the caps tightly; or, if composite samples are to be collected, place a sample from another sampling interval into the homogenization container and mix thoroughly. When compositing is complete, place the sample into appropriate, labeled containers and secure the caps tightly.
7. Abandon the pit or excavation according to applicable state regulations. Generally, shallow excavations can simply be backfilled with the removed soil material.

8.0 CALCULATIONS

This section is not applicable to this SOP.

9.0 QUALITY ASSURANCE/QUALITY CONTROL

There are no specific quality assurance (QA) activities which apply to the implementation of these procedures. However, the following QA procedures apply:

1. All data must be documented on field data sheets or within site logbooks.
2. All instrumentation must be operated in accordance with operating instructions as supplied by the manufacturer, unless otherwise specified in the work plan. Equipment checkout and calibration



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activities must occur prior to sampling/operation, and they must be documented.

10.0 DATA VALIDATION

This section is not applicable to this SOP.

11.0 HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and corporate health and safety procedures, in addition to the procedures specified in the site specific Health & Safety Plan..

12.0 REFERENCES

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Technique and Strategies. EPA-600/4-83-020.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043.

U.S. Environmental Protection Agency. 1984 Characterization of Hazardous Waste Sites - A Methods Manual: Volume II. Available Sampling Methods, Second Edition. EPA-600/4-84-076.

de Vera, E.R., B.P. Simmons, R.D. Stephen, and D.L. Storm. 1980. Samplers and Sampling Procedures for Hazardous Waste Streams. EPA-600/2-80-018.

ASTM D 1586-98, ASTM Committee on Standards, Philadelphia, PA.



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February 2000



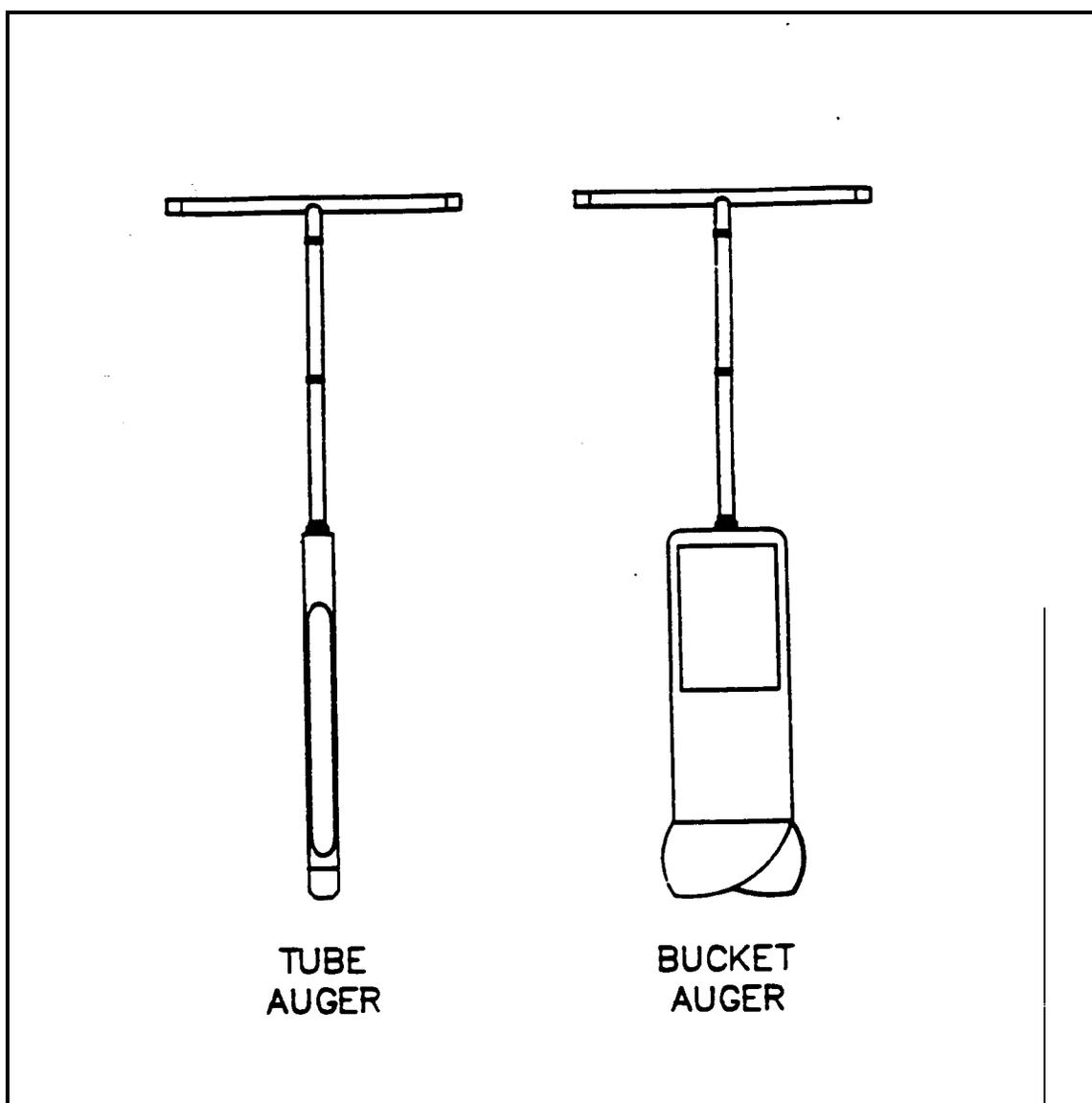
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FIGURE 1. Sampling Augers





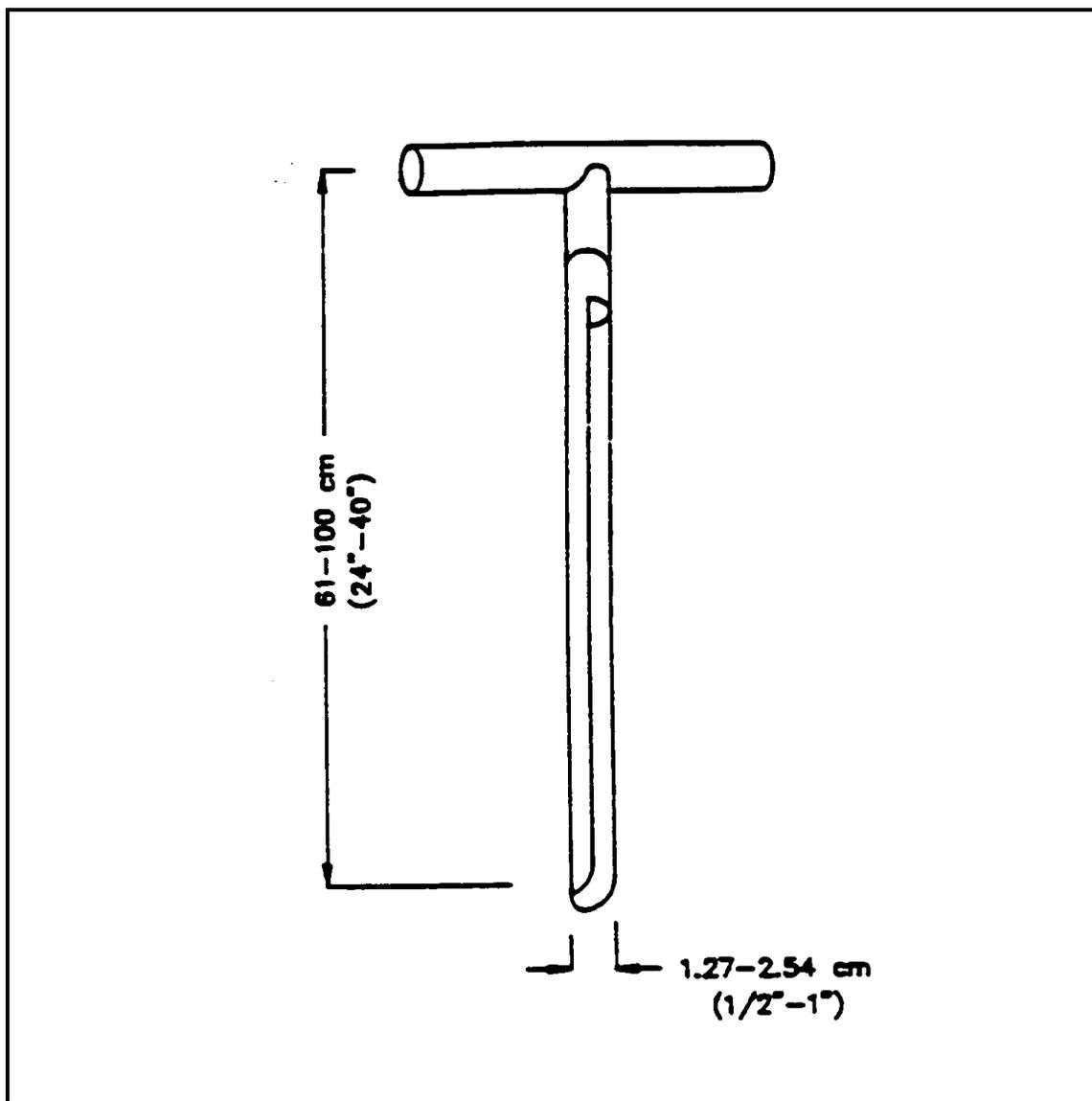
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FIGURE 2. Sampling Trier



ADDENDUM TO SOIL SAMPLING SOP

As discussed in the body of the SAP, all soil samples are to be laboratory sieved to 250 microns (60 mesh). In accordance with USEPA, 2003, the laboratory will generally conform with ASTM, 1998 for the sieving of the soil samples. The steps to be followed are detailed below:

1. Preparation and collection of samples in accordance with sections 7.1 and 7.2 of the SOP.
2. Each of the samples from the five point composite will be placed in a one gallon zipper lock plastic bag and homogenized.
3. This homogenized sample will be transferred to an 8 ounce sample jar and labeled for transport to the laboratory.
4. Sieves will be decontaminated and dried prior to re-use. Sieves will be dried for 24 hours before being re-used.

APPENDIX C1 - ESC

Chain-of-Custody Forms

APPENDIX C2 - CAS

Chain-of-Custody Forms

APPENDIX D1 - ESC

Sample Labels

Prepared by Environmental Science Corp

Project _____

Proj # _____

Sample Location/ID _____

Analysis Req'd _____

Date _____ Time _____

APPENDIX D2 - CAS

Sample Labels

Project Name: _____

Sample Name: _____

Date _____ Time _____ Sampler _____

Analysis _____

Preservative: _____

Comments:

Lab Label #2

APPENDIX E

Site Health and Safety Plan



815 Maestro Drive
Reno, NV 89511

ph: 775.829.2245
fax: 775.829.2213
www.mcgin.com

Las Vegas Office
8260 S. Valley View Blvd.
Suite 604
Las Vegas, NV 89118
Ph: 702.260.4961
Fax: 702.260.4968

www.mcgin.com

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HEALTH AND SAFETY PLAN

Comstock Mining Inc. Soils Assessment Areas Affected by the Carson River Mercury Site Gold Hill, Nevada

Prepared for:

*Comstock Mines Inc.
1200 American Flat Road
Gold Hill, Nevada*

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1. INTRODUCTION

McGinley & Associates Inc. (MGA) is pleased to submit this Health and Safety Plan (HASP) to Comstock Mines Inc. (CMI) for soils assessments and remediation of the areas affected by the Carson River Mercury Site (CRMS) in Storey and Lyon Counties near Gold Hill, Nevada.

1.1 Scope and Applicability of the Site Health and Safety Plan

The purpose of this HASP is to define the requirements and designate protocols to be followed at the site during investigation and remediation activities. Applicability extends to all government employees, property owners, contractors, and sub-contractors.

All personnel on site, contractors and subcontractors included, shall be informed of the site emergency response procedures and any potential fire, explosion, health, or safety hazards of the operation. This HASP summarizes hazards and defines protective measures planned for the site. This plan must be reviewed and an agreement to comply with the requirements must be signed by all personnel prior to entering any hazardous work areas.

During development of this plan consideration was given to current safety standards as defined by EPA/OSHA/NIOSH, health effects and standards for known contaminants, and procedures designed to account for the potential for exposure to unknown substances. Specifically, the following reference sources have been consulted:

- OSHA 29 CFR parts 1910.120, 1910.134, 1926.350 and 1926.650
- U.S. EPA, OERR ERT Standard Operating Safety Guides
- NIOSH/OSHA/USCG/EPA Occupational Health and Safety Guidelines
- (ACGIH) Threshold Limit Values

1.2 On-Site Personnel

All personnel entering the designated hazardous work zones at the site will be required to read and verify compliance with the provisions of this HASP. In addition, personnel, including sub-contractors, will be expected to comply with any relevant OSHA requirements such as: medical monitoring, training, and respiratory protection. Each person will also be expected to provide his or her own protective equipment.

In the event that a person does not adhere to the provisions of the HASP, he/she will be requested to leave the work area. All non-conformance incidents will be recorded in the daily site log.

2. KEY PERSONNEL

The Site Health and Safety Officer (HSO) has total responsibility for ensuring that the provisions of this HASP are adequate and implemented in the field. Changing field conditions may require decisions to be made concerning adequate protection programs. Therefore, it is vital that personnel assigned as HSO be experienced and meet the additional training requirements specified by OSHA in 29 CFR 1910.120. The following personnel and

organizations are critical to the planned activities at the Site. The organizational structure will be reviewed and updated periodically by the remediation project manager.

- CMI: Dennis Anderson, Cindi Byrns
- MGA: Joe McGinley, Brian Rakvica, Brian Giroux, George Hagan

2.1 Site Specific Health and Safety Personnel

The HSO is also responsible for conducting site inspections on a regular basis in order to ensure the effectiveness of this plan.

The HSO at the site is: George Hagan

Designated alternates include: Brian Giroux

2.3 Organizational Responsibility

CMI: Responsible party conducting soil assessment and remediation. CMI provides overall project direction and remediation strategy. Ensures resources are available to comply with HASP.

MGA: Primary contact for the site, providing limited supervision and project oversight of all tasks identified in the sampling and analysis plan(s) and remediation plan(s). MGA is the single point of responsibility for permit compliance and safety. MGA conducts routine and non-routine groundwater, sampling and remediation system performance monitoring. MGA Oversees all construction projects including subcontractor compliance of site-specific safety plans.

MGA Sub-contractors: Provide specialized services beyond that of the contractor such as: drilling, excavation and waste disposal. All work shall be performed under the MGA's HSO supervision.

3. TASK/OPERATION SAFETY AND HEALTH RISK ANALYSIS

This section defines the hazards and methods to protect personnel from hazards as identified by previous site work, background information, current site conditions, and planned site tasks.

3.1 Background

Mining in the Carson River drainage basin commenced in 1850 when placer gold deposits were discovered near Dayton at the mouth of Gold Canyon. Throughout the 1850s, mining consisted of working placer deposits for gold in Gold Canyon and Sixmile Canyon. These placer deposits ultimately led to the discovery of the underground ore deposits known as the Comstock Lode.

The initial ore discovered was extremely rich in gold and silver. Gold was more abundant in Gold Canyon while silver was more abundant in Sixmile Canyon (Smith, 1943). Early mining methods concentrated on exposing as much of the lode as possible in wide trenches. Throughout 1859, ore was shipped to San Francisco for processing. After local ore

processing began in 1860, most major mines operated their own mills, but there were also a large number of private mills. Initial ore processing techniques were slow and inefficient and a fair amount of trial and error experimentation led to the development of an effective ore-processing technique known as the Washoe pan process. Refinements were aimed primarily at increasing the speed of gold and silver recovery, increasing the percentage of gold and silver recovered and decreasing the amount of gold and silver discarded in tailings piles. The general milling process employed before 1900 involved pulverizing ore with stamp mills, creating a slurry and then directing the slurry across a copper plate coated with mercury. The precious metals would adhere to the mercury on the copper plate in an amalgamation of recoverable metals. The millwrights would scrape the mercury amalgam from the copper plates and recover the precious metals through use of a smelting furnace. Some mercury was recovered and reused in the process, however, other mercury was consumed in the process because of inefficiencies and losses in the amalgamation process as well as the smelting and retort process. After 1900, cyanide leaching and flotation processes replaced amalgamation and mercury was typically no longer used.

Gold and silver production from the Comstock Lode increased slowly during the early years and 1863 was the first year of large production. Throughout the remainder of the 1860s and most of the 1870s, production remained high as rich ore bodies continued to be discovered at progressively deeper depths. The bottom of the lode was abruptly reached in 1877 at a depth of about 1,650 feet, and 1878 was the first year of dramatically reduced production. Between 1877 and 1878, ore production dropped from 562,519 tons to 272,909 tons and the total value decreased from \$36,301,536 to \$19,661,394. In 1879, production and value dropped even further. In 1901, the first cyanide-leaching operation began in Sixmile Canyon. Cyanide leaching was capable of recovering more gold and silver from lower-grade material than was possible by amalgamation methods and during the early 1900s mining operations consisted of mining lower-grade material and reworking former ore dumps and tailings piles. Between approximately 1920 and 1950, large tonnages of low-grade ores were mined (Bonham, 1969). Since approximately 1950, mining operations have been extremely limited in scope. Currently, two mining operations are located within the Sixmile Canyon drainage.

3.2 Current Site Conditions

The site is potentially affected by the historic activities of the CRMS. Historic disposal of wastes and tailing is expected to have occurred at numerous locations. Extensive site reconnaissance will affirm the locations of visible impacts. Soil sampling and analysis will confirm the impacts at all applicable locations addressed by the SAP.

3.3 Contaminants of Concern

Based upon previous site investigations, current site conditions, and the NDEP's LTSRP it is known that arsenic, lead and mercury are the site COCs. Material Safety Data Sheets for the COC's are provided in Appendix A. Table 1 below provides a summary of potential chemical hazards at the CMI site.

Table 1. Contaminants of Concern

Contaminant	PEL-8 Hour TWA as mg/m ³	Source	Routes of Exposure
Arsenic	0.010	Historic mining activities.	Abs, Con, Ing, Inh
Lead	0.050	Historic mining activities.	Con, Ing, Inh
Mercury	0.1	Historic mining activities.	Abs, Con, Ing, Inh

Abs: Absorption

Con: Contact

Ing: Ingestion

Inh: Inhalation

PEL: OSHA Permissible Exposure Limit, parts of vapor or gas per million parts of contaminated air by volume.

TWA: Time weighted average

3.4 Task by Task Risk Analysis

The evaluation of hazards is based upon the knowledge of the site conditions and anticipated risks posed by the specific operations.

The following sections describe each task/operation in terms of the associated specific hazards. In addition, the preventive measures to be implemented during initiation of those operations are also identified.

3.4.1 Mobilization and De-mobilization:

General hazards encountered during initial mobilization and de-mobilization for site activities include the following:

- Physical hazards of using heavy equipment in mobilization procedures.
- Buried or overhead electrical utilities.
- Driving vehicles, placing trailers on uneven surfaces creates a possibility of the vehicle rolling, getting stuck in mud or ditches, or of an accident due to flat tires or striking obstacles, and the vehicles.
- Crushing or pinching hazard due to placing equipment, falling debris on operators, workers or observers.
- Noise from heavy equipment operations.

HAZARD PREVENTION

- Keep area clear of all observers; operators need to act with caution during the mobilization process.
- Obtain clearance from appropriate utility services prior to any digging.

- Proper vehicle maintenance will prevent avoidable vehicle breakdown in the field. In order to minimize accidents from uneven terrain, site surveillance should be performed on foot to choose a clear driving path.
- Verify that heavy equipment operations do not affect the existing overhead utilities.
- Heavy equipment operators should have proper training and experience, and documentation of both. The general provisions of CFR1910/1926 apply.
- Wear hearing protection in the immediate vicinity of heavy equipment.

3.4.2 Drilling

Safe work practices for personnel during drilling operations include:

- All overhead and buried utilities must be surveyed, located, marked and noted prior to exploratory boring or excavation activity;
- The drill rig, including its mast and backhoe buckets, shall not be operated within 20 feet of a power line. Remember that hoist lines and overhead power lines can be moved toward each other by the wind;
- All drilling and downhole sampling equipment must be cleaned before proceeding to the site. Drilling or downhole sampling equipment must be cleaned after each use. Cleaning should be done with a hot-water pressure washer or with a trisodium phosphate (TSP) wash and distilled water rinse;
- Work in *cleaner* areas should be conducted first, where practical;
- The minimum number of personnel necessary to achieve the objectives should be within 25 feet of the drilling or excavation activity. If emergency personnel, backup contract/subcontract personnel or observers are at the site, they should remain 25 feet from the drilling or downhole sampling activity, where practical;
- Be aware of the potential for vapors to reach explosive concentrations in confined spaces and the flammability of the volatile organics. Provide adequate ventilation, allow no smoking, and keep hot motors/pumps and/or electrical equipment away from areas with vapors. Confined spaces present special hazards. Do not enter confined spaces without adequate training and preparation;
- When sampling soil, water or product, neoprene or nitrile gloves should be worn to prevent skin contact with sampled media; and
- Air-purifying respirators shall be accessible for immediate use and managed in accordance with OSHA's Respiratory Protection Standard.

Additional safety procedures for monitoring drilling activities include:

- Do not allow the drill rig to be driven from hole-to-hole with the mast in the raised position;
- Surveying of overhead and buried utilities is a "must" on every boring. They should be located, and emphasized on all boring location plans and boring assignment sheets;
- When overhead electrical power lines exist at or near a drilling site, consider all wires to be alive and dangerous;

- Watch for sagging power lines before entering a site. Do not lift power lines to gain entrance. Call your supervisor or project engineer;
- Do not allow the mast to be raised or the drill rig to be operated within 20 feet of a power line, or if known, the minimum clearance stipulated by Federal, State, and local regulations;
- Keep in mind that both hoist lines and overhead power lines can be moved toward each other by the wind;
- Underground electricity is as dangerous as overhead electricity. Be aware and always suspect the existence of underground utilities such as electrical power, gas petroleum, telephone, sewer and water;
- It is the responsibility of the driller to be aware of the dangers of underground utilities and to be on the watch for physical signs of underground utilities. However, the initial responsibility of locating, emphasizing on-site plan and contacting utility owners lies with the project engineer.
- The operator of a drill rig should never leave the controls when the rig is in operation. If the operator must leave the controls, the transmission controlling the rotary must be placed in the neutral position and place the feed control lever in neutral. If the operator leaves the vicinity of the rig, the drill engine must be shut off;
- Practice good housekeeping - keep excess material well out of the way and in a neat pile. All tools and equipment should have its own place and when not in use they should be stored there;
- Use protective clothing, as warranted. Hardhats, close-fitting gloves, welding glasses, safety glasses, safety belts, safety boots, etc. will be worn when appropriate;
- Ear protection must be worn by employees drilling in an enclosed area (i.e., next to high walls or buildings) and when core drilling for a 6- to 8-hour period. OSHA regulations require that ear protection be worn by employees exposed to noise at or above 90 decibels (on a time weighted average); and
- Running is generally not allowed, except in a life-threatening situation.

3.4.3 Collection of Soil Samples

Sampling activities will disturb the soil and cause dust to become airborne, causing the risk of respiratory exposure goes up. Sieving of soil samples increases the dust generated during soil sampling. In addition, dermal contact may occur if care is not taken to avoid contact with skin. Proper PPE is needed to mitigate these risks.

3.4.4 Excavation and Soil Handling:

Hazards encountered during soil and tank excavation may include both chemical and physical hazards, and are as follows:

- Premature exposure of unknown piping.
- Unknown toxic or explosive vapors may be present in excavation areas.
- Sides of excavation can cave in. Possible burying or crushing of workers due to; absence of shoring, misjudgment of stability, defective shoring, and or undercut sides.
- Falling during access / egress or while monitoring or dismounting equipment, or

stumbling into excavation.

- An overhead hazard can result from material, tools, structural members and/or soil falling into the excavation.
- Congested work area due to too many workers in a small area.
- The use of heavy equipment with limited visibility, caution of workers in area.

HAZARD PREVENTION

- Monitor for airborne contaminants. Allow excavation to purge and / or use personal protective equipment.
- In areas where flammable liquids are stored, handled, used, dispensed, or transferred, the use of spark producing devices are prohibited.
- Do not allow any personnel to enter the excavation areas. Or, provide adequate shoring or sloping of sides of the excavation if personnel are expected to enter the pits. Regularly inspect sidewalls for changing conditions. Follow these sloping requirements:

Solid rock, cemented sand or gravel = 90 degrees

Compact angular gravel = 63 degrees 26 ft. deep

Compacted sharp sand = 33 degrees 41 ft. deep

Rounded loose sand = 26 degrees 34 ft. deep

- Provide ramps or ladders to trenches to allow safe access and egress.
- Provide an adequate barrier around open pits. Material from pit must be placed away from edge to prevent cave ins and instability of pit.
- To prevent overexertion, limit manual lifting and emphasize mechanical means where practical.
- Maintain ample room between equipment and workers.

4. PERSONNEL TRAINING REQUIREMENTS

Consistent with OSHA's 29 CFR 1910.120, regulation covering Hazardous Waste Operations and Emergency Response, and OSHA's 29 CFR 1926 Construction Industry Standards, workers are required to be trained in accordance with those standards. At a minimum, all personnel are required to be trained to recognize the hazards on-site and the provisions of this HASP.

4.1 Pre-assignment and Annual Refresher Training

Prior to arrival on site, each employer will be responsible for certifying that his/her employees meet the requirements of training, consistent with OSHA 29 CFR 1910.120 paragraph (e)(3) or (e)(9). The employer should be able to provide a document certifying that each general site worker has received 40 hours of instruction off the site, and 24 hours of training for any workers who are on site only occasionally for a specific task. If an individual employee has work experience and/or training that is equivalent to that provided in the initial

training, an employer may waive the 40-hour training so long as that equivalent experience is documented or certified. All personnel must also receive 8 hours of refresher training annually.

4.2 Site Supervisors Training

Consistent with OSHA 29 CFR 1910.120 paragraph (e)(8) and (e)(9), the following individual(s) are identified as site supervisors:

MGA Brian Giroux, Operations Manager

MGA George Hagan, Operator

4.3 Training and Briefing Topics

The Site Supervisors will discuss the following items at the site pre-entry briefing(s) and at periodic tailgate safety meetings:

- Physical hazards
- Chemical hazards
- Emergency response plan
- Air Monitoring
- Training requirements
- Animal bites and stings
- Respiratory protection
- Medical surveillance
- Site Control
- Personnel protective equipment
- Heavy equipment/machinery
- Spill Containment

5. PERSONAL PROTECTIVE EQUIPMENT (PPE)

This section describes the general requirements of the EPA designated Levels of Protection (A-D), and the specific levels of protection required for each task at the site. For the activities planned for this site, Level C is the highest PPE level of protection anticipated.

5.1 EPA Levels of Protection

Personnel wear protective equipment when response activities involve known or suspected atmospheric contamination vapors, gases, or particulate that may be generated by site activities, or when direct contact with skin-affecting substances may occur. The specific levels of protection and necessary components for each have been divided into four categories according to the degrees of protection afforded:

- Level A: Should be worn when the highest level of respiratory, skin, and eye protection

is needed.

- Level B: Should be worn when the highest level of respiratory protection is needed, but a lesser level of skin protection. Level B is the primary level of choice when encountering unknown environments
- Level C: Should be worn when the criteria for using air-purifying respirators (APR) are met, and a lesser level of skin protection is needed
- Level D: Should be worn only as a work uniform and not in any area with respiratory or skin hazards. It provides minimal protection against chemical hazards.

Modifications of these levels are permitted, and routinely employed during site work activities to maximize efficiency. For example, Level C respiratory protection and Level D skin protection may be required for a given task. Likewise the type of chemical protective ensemble (i.e., material, format) will depend upon contaminants and degrees of contact. The Level of Protection selected is based upon the following:

- Type and measured concentration of the chemical substance in the ambient atmosphere and its toxicity.
- Potential for exposure to substances in air, liquids, or other direct contact with material due to work being done.
- Knowledge of chemicals on-site along with properties such as toxicity, route of exposure, contaminant matrix, and adequate warning properties

In situations where the type of chemical, concentration, and possibilities of contact are not known, the appropriate Level of Protection must be selected based on professional experience and judgment until the hazards can be better identified

5.2 Recommended Levels of Protection- Task Specific

The following specific personnel protective ensembles are recommended for the site:

Level D: Site reconnaissance, mobilization and demobilization.

Level C: Soil sampling, drilling and remediation.

5.2.1 Site Reconnaissance and Mobilization/De-mobilization- (Level D)

Boots - Sturdy steel toe

Outer Gloves - Leather

Outer Garment/Coveralls

Hardhat

Safety Glasses

5.2.2 Drilling- (Level C)

Boots - Sturdy steel toe

Inner Gloves - Nitrile

Outer Gloves - Leather

Outer Garment - Tyvek

Half-Face Respirator with P-100 and Mercury Vapor Cartridge

Hardhat

Safety Glasses

5.2.3 Soil and Pit Excavations - (Level C)

Boots - Sturdy steel toe

Inner Gloves - nitrile

Outer Gloves - leather

Outer Garment - Tyvek

Half-Face Respirator with P-100 and Mercury Vapor Cartridge

Hardhat

Safety Glasses

5.3 Standard Operating Procedure (SOP) for Respiratory Protection

APR Inspection and Checkout

- Visually inspect the entire unit for any obvious damages, defects, or deteriorated rubber. Inspect lens for damage and proper seal in facepiece.
- Exhalation Valve - pull off plastic cover and check valve for debris or for tears in the neoprene valve (which could cause leakage).
- Inhalation Valves (two) - screw off cartridges / canisters and visually inspect neoprene valves for tears. Make sure that the inhalation valves and cartridge receptacle gaskets are in place.
- Make sure a protective cover lens is attached to the lens.
- Make sure that you have the correct cartridge.
- Don and perform negative pressure test.

5.4 SOP for Personal Protective Equipment

Proper inspection of PPE features several sequences of inspection depending upon specific articles of PPE and its frequency of use. The different levels of inspection are as follows:

- Inspection and operational testing of equipment received from the factory or distributor.
- Inspection of equipment as it is issued to workers.
- Inspection after use or training and prior to maintenance.
- Periodic inspection of stored equipment.
- Periodic inspection when a question arises concerning the appropriateness of the selected equipment, or when problems with similar equipment arise.

The primary inspection of PPE in use for activities at the site will occur prior to immediate use and will be conducted by the user. This ensures that the specific device or article has been checked-out by the user and that the user is familiar with its use.

5.5 Reassessment of Protection Program

The Level of Protection provided by PPE selection shall be upgraded or downgraded based upon a change in site conditions or findings of investigations. It is expected that the level of PPE will not be downgraded unless quantitative air sampling is completed to support the downgrade. When a significant change occurs, the hazards should be reassessed and the HASP updated. Some indicators of the need for reassessment are:

- Commencement of a new work phase, such as the start of unexpected tank sampling or work that begins on a different portion of the site.
- Change in job tasks during a work phase.
- When temperature extremes or individual medical considerations limit the effectiveness of PPE.

- Contaminants other than those previously identified are encountered
- Change in ambient levels of contaminants.
- Change in work scope which affects the degree of contact with contaminants.

6. FREQUENCY AND TYPES OF AIR MONITORING/SAMPLING

Currently, air monitoring programs are not expected to be utilized at the site. The concentrations of the COCs vary across the site and are unknown. Air monitoring could be conducted to support the downgrade of the use of respiratory protection, however, MGA has elected to conservatively maintain the use of respiratory protection.

7. MEDICAL SURVEILLANCE

Medical monitoring programs are designed to track the physical condition of employees on a regular basis as well as survey pre-employment or baseline conditions prior to potential exposures. The medical surveillance program is a part of each employers Health and Safety program.

Prior to being assigned to a hazardous or a potentially hazardous activity involving exposure to toxic materials employee must receive a pre-assignment or baseline physical. The contents of the physical are to be determined by the employer's medical consultant.

The pre-assignment physical should categorize employees as fit-for-duty and able to wear respiratory protection.

7.1 Exposure/Injury/Medical Support

As a follow-up to an injury or possible exposure above established exposure limits, all employees are entitled to and encouraged to seek medical attention and physical testing. Depending upon the type of exposure, it is critical to perform follow-up testing within 24-48 hours. It will be up to the employer's medical consultant to advise the type of test required to accurately monitor for exposure effects.

8. SITE CONTROL MEASURES

The following section defines measures and procedures for maintaining site control. Site control is an essential component in the implementation of the site health and safety program.

8.1 Site Communications Plan

Successful communications between field teams and contact with personnel in the support zone is essential. The following communications systems will be available during activities at the site.

- Hand Signals
- Verbal
- Honk Vehicle Horn - Evacuate immediately

Signal	Definition
Hands on top of head	Need assistance
Thumbs up	OK/I am all right/I understand
Thumbs down	No/negative
Arms waving upright	Send backup support
Grip partners wrist	Exit area immediately

8.2 Safe Work Practices

The following is a list of standing orders for the duration of the project.

- No smoking, eating, or drinking in areas where there is a potential of cross contamination or risk of fire or explosion.
- No horseplay.
- Implement the communications system.
- Line of sight must be in position.
- Wear the appropriate level of protection as defined in the HASP.
- No unauthorized entry into excavation pits.

9. DECONTAMINATION PLAN

Decontamination involves the orderly controlled removal of contaminants. All site personnel should minimize contact with contaminants in order to minimize the need for extensive decon. Section 5.2 lists the tasks and specific levels of protection required for each task. Consistent with the levels of protection required, decontamination provides a step-by-step orderly removal of contaminants from personnel and equipment. These procedures should be modified to suit site conditions and protective ensembles in use.

9.1 Personnel Decontamination

All workers exposed to site contaminants will be required to enact an orderly removal of contaminated PPE. This can be accomplished through repeated change of disposable garments and or PPE wash at the end of the shift. Workers shall be instructed to the importance of decontamination to prevent cross contamination.

9.2 Sampling Equipment Decontamination

Sampling equipment and heavy equipment may be decontaminated in accordance with procedures as defined in the work plan(s) or as follows:

- Sampling equipment will be rinsed using water and 5% tri- sodium phosphate solution.
- Sampling equipment will be decontaminated between taking samples to prevent cross contamination.

10. EMERGENCY RESPONSE / CONTINGENCY PLAN

This section describes contingencies and emergency planning procedures to be implemented at the Site. This plan is compatible with local, state and federal disaster and emergency management plans as appropriate.

10.1 Pre-Emergency Planning

A field pre-construction / field activities meeting will be conducted at the project site approximately one week prior to implementation of field services. The meeting will include personnel from MGA and the selected contractors. Each of the activities and procedures presented will be reviewed during this meeting.

In addition, tailgate site safety discussions will be held daily. All employees will be trained in and reminded of provisions of the emergency response plan, communication systems, and evacuation routes. Section 3.3 identifies the hazardous conditions associated with specific site activities. The plan will be reviewed and revised if necessary, on a regular basis by the HSO. This will ensure that the plan is adequate and consistent with prevailing site conditions.

10.2 Emergency Recognition/Prevention

Table 3.1 provides a listing of chemical hazards onsite. Additional hazards as a direct result of site activities are listed in section 3.3 as are prevention and control techniques/mechanisms. Personnel will be familiar with techniques of hazard recognition from pre-assignment training and site-specific briefings. The HSO is responsible for ensuring that prevention devices or equipment is available to personnel.

10.3 Evacuation Routes/Procedures

In the event of an emergency that necessitates an evacuation of the site, the following alarm procedures will be implemented:

Evacuation alarm notification should be made using three long blasts on a vehicle horn, supplemented using the hand signals and / or verbal orders. All personnel should evacuate upwind of any activities. Insure that a predetermined location is identified off-site in case of an emergency, so that all personnel can be accounted for. Personnel will remain at that area until the re-entry is authorized.

10.4 Emergency Contact/Notification System

The following list provides names and telephone numbers for emergency contact personnel. In the event of a medical emergency, personnel will take direction from the HSO and notify the appropriate emergency organization. In the event of a fire or spill, the site supervisor will notify the appropriate local, state, and federal agencies.

Organization	Telephone
Ambulance:	911
Police:	911
Fire:	911
Carson Tahoe Regional Healthcare:	775-445-8000
NDEP	775-687-49485
Regional EPA:	415-947-8000
National Response Center:	800-424-8802
Center for Disease Control:	770-448-7100
Chemtrec:	800-424-9300

10.5 Nearest Medical Assistance

A map of the route to the nearest medical facility, Northern Nevada Medical Center, which can provide emergency care for individuals who may experience an injury or exposure on site is provided in Appendix B. The route to the hospital should be verified by the HSO, and should be familiar to all site personnel.

10.6 Emergency Medical Treatment Procedures

Any person who becomes ill or injured in the hazardous material work area must be decontaminated to the maximum extent possible. If the injury or illness is minor, full decontamination should be completed and first aid administered prior to transport. If the patient's condition is serious, at least partial decontamination should be completed (i.e., complete disrobing of the victim and redressing in clean coveralls or wrapping in a blanket.) First aid should be administered while awaiting an ambulance or paramedics. All injuries and illnesses must immediately be reported to the project manager.

10.7 Fire or Explosion

In the event of a fire or explosion, the local fire department should be summoned immediately. Upon their arrival, the project manager or designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on site. If it is safe to do so, site personnel may:

- Use fire fighting equipment available on site to control or extinguish the fire; and,
- Remove or isolate flammable or other hazardous materials, which may sustain a fire.

10.8 Spill or Leaks

In the event of a spill or a leak, site personnel will:

- Inform their supervisor immediately;
- Locate the source of the spillage and stop the flow if it can be done safely; and,
- Begin containment and recovery of the spilled materials.

10.9 Emergency Equipment/Facilities

All emergency equipment will be provided by each contractor schedule for work at the facility and emergency equipment will be located as close as possible to the work area. Additionally, the Area D treatment building will contain emergency equipment for use in the event of site emergencies.

- First aid kit
- Fire extinguisher
- Mobile telephone
- Eye wash

11. SPILL CONTAINMENT PROGRAM

The procedures defined in this section comprise the hazardous material spill containment program in place for activities at the Site.

Where spills, leaks, or ruptures may occur, adequate quantities of spill containment equipment (absorbent, pillows, etc.) will be stationed in the immediate area. The spill containment program must be sufficient to contain small and incidental spills generally associated with routine operation and maintenance activities. All drums and containers used during the spill clean-up shall meet the appropriate DOT, OSHA, and EPA regulations for the waste that they will contain.

- Drums and containers shall be inspected and their integrity assured prior to being moved.
- Operations on site will be organized so as to minimize the amount of drum or container movement.
- Employees involved in the drum or container operations shall be warned of the hazards associated with the containers.
- Drums or containers that cannot be moved without failure, shall be emptied into a sound container.

12. HAZARD COMMUNICATION

In order to comply with 29 CFR 1910.1200, Hazard Communication, the following written Hazard Communication Program has been established. All employees will be briefed on this program, and have a written copy for review.

12.1 Container Labeling

All containers received on site will be inspected to ensure the following: (1) all containers will be clearly labeled as to the contents; (2) the appropriate hazard warnings will be noted; and (3) the name and address of the manufacturer

All secondary containers will be labeled with either an extra copy of the original manufacturer's label or with generic labels, which have a block for identify, and blocks for the hazard warning.

12.2 Material Safety Data Sheets

Copies of the MSDS are provided in Appendix A. Copies of MSDSs for all hazardous chemicals known on site will be maintained in the work area. MSDSs will be available to all employees for review during each work shift.

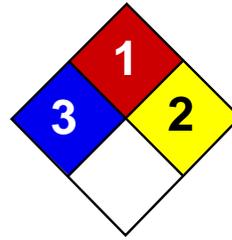
12.3 Employee Training and Information

Prior to starting work, each employee will attend a health and safety orientation and will receive information and training on the following:

- An overview of the requirements contained in the Hazard Communication Standard, 29 CFR 1910.1200;
- Chemicals present in their workplace operations;
- Location and availability of a written hazard program;
- Physical and health effects of the hazardous chemicals;
- Methods and observation techniques used to determine the presence or release of hazardous chemicals;
- How to lessen or prevent exposure to these hazardous chemicals through usage of control/work practices and personal protective equipment;
- Emergency procedures to follow if they are exposed to these chemicals;
- How to read labels and review MSDSs to obtain appropriate hazard information;

APPENDIX A

Material Safety Data Sheets



Health	3
Fire	1
Reactivity	2
Personal Protection	E

Material Safety Data Sheet

Arsenic MSDS

Section 1: Chemical Product and Company Identification

Product Name: Arsenic

Catalog Codes: SLA1006

CAS#: 7440-38-2

RTECS: CG0525000

TSCA: TSCA 8(b) inventory: Arsenic

CI#: Not applicable.

Synonym:

Chemical Name: Arsenic

Chemical Formula: As

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Arsenic	7440-38-2	100

Toxicological Data on Ingredients: Arsenic: ORAL (LD50): Acute: 763 mg/kg [Rat]. 145 mg/kg [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant), of eye contact (irritant).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH. **MUTAGENIC EFFECTS:** Not available.

TERATOGENIC EFFECTS: Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance is toxic to kidneys, lungs, the nervous system, mucous membranes. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:

Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits highly toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.01 from ACGIH (TLV) [United States] [1995] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 74.92 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: Not available.

Melting Point: Sublimation temperature: 615°C (1139°F)

Critical Temperature: Not available.

Specific Gravity: 5.72 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, acids, moisture.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 145 mg/kg [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A1 (Confirmed for human.) by ACGIH. Causes damage to the following organs: kidneys, lungs, the nervous system, mucous membranes.

Other Toxic Effects on Humans:

Very hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Arsenic UNNA: UN1558 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Arsenic California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Arsenic Pennsylvania RTK: Arsenic Massachusetts RTK: Arsenic TSCA 8(b) inventory: Arsenic

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:**WHMIS (Canada):**

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R22- Harmful if swallowed. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 2

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 2

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information**References:**

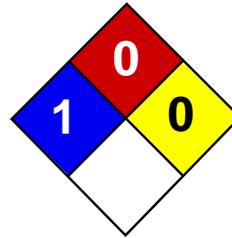
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Liste des produits purs tératogènes, mutagènes, cancérigènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

Other Special Considerations: Not available.

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Health	1
Fire	0
Reactivity	0
Personal Protection	E

Material Safety Data Sheet

Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

CI#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Non-flammable in presence of open flames and sparks, of shocks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.05 (mg/m³) from ACGIH (TLV) [United States] TWA: 0.05 (mg/m³) from OSHA (PEL) [United States] TWA: 0.03 (mg/m³) from NIOSH [United States] TWA: 0.05 (mg/m³) [Canada] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

pH (1% soln/water): Not applicable.

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Can react vigorously with oxidizing materials. Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential: Skin: Lead metal granules or dust: May cause skin irritation by mechanical action. Lead metal foil, shot or sheets: Not likely to cause skin irritation Eyes: Lead metal granules or dust: Can irritate eyes by mechanical action. Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation. Inhalation: In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes. Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungs by mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually absorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, delirium, convulsions/seizures, coma, and death. Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead colic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations**Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information**Federal and State Regulations:**

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Lead California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

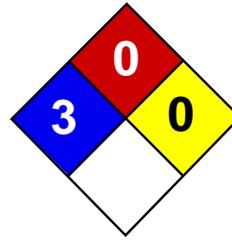
References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

Last Updated: 11/01/2010 12:00 PM

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Health	3
Fire	0
Reactivity	0
Personal Protection	

Material Safety Data Sheet

Mercury MSDS

Section 1: Chemical Product and Company Identification

Product Name: Mercury

Catalog Codes: SLM3505, SLM1363

CAS#: 7439-97-6

RTECS: OV4550000

TSCA: TSCA 8(b) inventory: Mercury

CI#: Not applicable.

Synonym: Quick Silver; Colloidal Mercury; Metallic Mercury; Liquid Silver; Hydragyrum

Chemical Name: Mercury

Chemical Formula: Hg

Contact Information:

Sciencelab.com, Inc.

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:

1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Mercury	7439-97-6	100

Toxicological Data on Ingredients: Mercury LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, permeator). Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

Hazardous in case of skin contact (permeator). **CARCINOGENIC EFFECTS:** Classified A5 (Not suspected for human.) by ACGIH. 3 (Not classifiable for human.) by IARC. **MUTAGENIC EFFECTS:** Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance may be toxic to blood, kidneys, liver, brain, peripheral nervous system, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation.

Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:

When thrown into mercury vapor, boron phosphodiiodide ignites at once. Flame forms with chlorine jet over mercury surface at 200 deg to 300 deg C. Mercury undergoes hazardous reactions in the presence of heat and sparks or ignition.

Special Remarks on Explosion Hazards:

A violent exothermic reaction or possible explosion occurs when mercury comes in contact with lithium and rubidium. CHLORINE DIOXIDE & LIQUID HG, WHEN MIXED, EXPLODE VIOLENTLY. Mercury and Ammonia can produce an

explosive compound. A mixture of the dry carbonyl and oxygen will explode on vigorous shaking with mercury. Methyl azide in the presence of mercury was shown to be potentially explosive.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:

Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, metals.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Do not store above 25°C (77°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.025 from ACGIH (TLV) [United States] SKIN TWA: 0.05 CEIL: 0.1 (mg/m³) from OSHA (PEL) [United States]
Inhalation TWA: 0.025 (mg/m³) [United Kingdom (UK)] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Heavy liquid)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 200.59 g/mole

Color: Silver-white

pH (1% soln/water): Not available.

Boiling Point: 356.73°C (674.1°F)

Melting Point: -38.87°C (-38°F)

Critical Temperature: 1462°C (2663.6°F)

Specific Gravity: 13.55 (Water = 1)

Vapor Pressure: Not available.

Vapor Density: 6.93 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Ground mixtures of sodium carbide and mercury, aluminum, lead, or iron can react vigorously. A violent exothermic reaction or possible explosion occurs when mercury comes in contact with lithium and rubidium. Incompatible with boron diiodophosphide; ethylene oxide; metal oxides, metals(aluminum, potassium, lithium, sodium, rubidium); methyl azide; methylsilane, oxygen; oxidants(bromine, peroxyformic acid, chlorine dioxide, nitric acid, tetracarbonylnickel, nitromethane, silver perchlorate, chlorates, sulfuric acid, nitrates,); tetracarbonylnickel, oxygen, acetylinic compounds, ammonia, ethylene oxide, methylsilane, calcium,

Special Remarks on Corrosivity:

The high mobility and tendency to dispersion exhibited by mercury, and the ease with which it forms alloys (amalgam) with many laboratory and electrical contact metals, can cause severe corrosion problems in laboratories. Special precautions: Mercury can attack copper and copper alloy materials.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A5 (Not suspected for human.) by ACGIH. 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: blood, kidneys, liver, brain, peripheral nervous system, central nervous system (CNS).

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (corrosive, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May affect genetic material. May cause cancer based on animal data. Passes through the placental barrier in animal. May cause adverse reproductive effects(paternal effects- spermatogenesis; effects on fertility - fetotoxicity, post-implantation mortality), and birth defects.

Special Remarks on other Toxic Effects on Humans:

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Mercury UNNA: 2809 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Mercury California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Mercury Connecticut hazardous material survey.: Mercury Illinois toxic substances disclosure to employee act: Mercury Illinois chemical safety act: Mercury New York acutely hazardous substances: Mercury Rhode Island RTK hazardous substances: Mercury Pennsylvania RTK: Mercury Minnesota: Mercury Massachusetts RTK: Mercury New Jersey: Mercury New Jersey spill list: Mercury Louisiana spill reporting: Mercury California Director's List of Hazardous Substances.: Mercury TSCA 8(b) inventory: Mercury SARA 313 toxic chemical notification and release reporting: Mercury CERCLA: Hazardous substances.: Mercury: 1 lbs. (0.4536 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):

R23- Toxic by inhalation. R33- Danger of cumulative effects. R38- Irritating to skin. R41- Risk of serious damage to eyes. R50/53- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S2- Keep out of the

reach of children. S7- Keep container tightly closed. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S39- Wear eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label. S60- This material and its container must be disposed of as hazardous waste. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 0

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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APPENDIX B

Map to Nearest Medical Assistance
