

**SAMPLING AND ANALYSIS PLAN
REDLANDS SHOOTING PARK/
SANTA ANA RIVER BED
REDLANDS, CALIFORNIA**

Prepared for:

Bear Valley Mutual Water Company

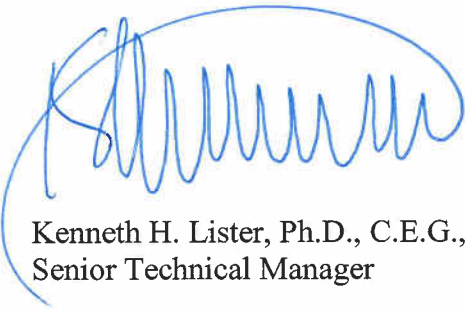
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This Sampling and Analysis Plan dated October 2011, describing proposed sampling in the Santa Ana River related to the Redlands Shooting Park in Redlands, California, was prepared and reviewed by the following:



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DISCLAIMER

This Sampling and Analysis Plan was prepared for the Bear Valley Mutual Water Company with specific application to investigation activities in the Santa Ana River bed in the vicinity of the Redlands Shooting Park, Redlands, California. This plan has been prepared in accordance with the care and skill generally exercised by reputable professionals, under similar circumstances, in this or similar localities. No other warranty, either expressed or implied, is made as to the professional advice presented herein.

1 INTRODUCTION

SCS Engineers (SCS) was retained by the Bear Valley Mutual Water Company to prepare a Sampling and Analysis Plan (SAP) for investigation in the Santa Ana River bed in the vicinity of the Redlands Shooting Park (RSP), Redlands, California. The purpose of the proposed investigation is to assess the extent of impacts resulting from target shooting. Based on the materials associated with target shooting at the RSP, contaminants of potential concern (COPCs) are lead, arsenic, antimony, and polyaromatic hydrocarbons (PAHs). A site map showing the general location of the RSP is provided as **Figure 1**. This SAP has been prepared to meet requirements set out in an October 5, 2011 letter from the United States Environmental Protection Agency (US EPA).

Contact persons for the proposed project are as follows:

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2 ENVIRONMENTAL SETTING AND BACKGROUND INFORMATION

LOCATION AND SITE HISTORY

The RSP occupies an area of approximately 35.4 acres at 2125 North Orange Street in Redlands, California (**Figure 2**). The RSP is bounded on the west by Texas Street, on the south by agricultural land and Beazer Park, on the east by Orange Street, and on the north by the Santa Ana River bed.

Reportedly, the subject site location has been a shooting range since the 1960s. The RSP was incorporated in 1989 and has apparently been the location of recreational trap and skeet shooting since at least that time. During the course of these activities, lead shot and fragments of clay targets have been deposited at the site and within the Santa Ana River bed located directly adjacent to and north of the RSP. US EPA personnel have stated that visual observations indicate that lead shot has been found in the river bed at least one half mile downstream from the RSP. The objective of the proposed investigation is to assess the nature and extent of the COPCs associated with shot and clay targets in the river bed..

TOPOGRAPHY

According to the U.S. Geological Survey (USGS), Redlands, California 7.5-minute topographic map (1967, photorevised 1980), the RSP and the adjacent portion of the river bed is located at an elevation of approximately 1,280 feet above mean sea level. The Santa Ana River bed in this area slopes to the west at approximately 635 feet per mile.

GEOLOGY

The area to be investigated is located in the eastern portion of the Transverse Ranges Geomorphic Province of California. The surficial units in the area of the RSP consist of Quaternary age alluvium made up principally of sand and gravel with some silt (USGS, 2003). Based on information from other nearby sites, the thickness of the Quaternary alluvium is estimated to be greater than 700 feet (SCS, 2008).

The surficial alluvium at the RSP and to the north is very young and portions of the river bed are actively reworked during seasonal inundation. To the south of the RSP is a terrace, the surficial unit of which consists of older Holocene age alluvium. The underlying units in the area range from late Pliocene to early Pleistocene age and are also alluvial. Basement rocks in this area consist of granitic and metamorphic rocks of Mesozoic age. The region is cut by a number of generally northwest-southeast trending faults including the San Andreas, approximately 2.5 miles northeast of the RSP, and the Banning, approximately 3 miles southwest.

GROUNDWATER

Alluvial deposits underlying the site are water-bearing and are capable of yielding large volumes of water. Recent groundwater levels from a well located approximately 0.5 miles west-southwest of the center of the RSP, and that is monitored by the USGS, have been greater than 160 feet below ground surface (bgs). Based on nearby sites and topography, groundwater flow is westerly. The groundwater gradient at the California Street Landfill, located approximately 1.5 miles west, was measured at approximately 0.009 feet per foot to the west-southwest in May 2011; depth to groundwater at this site was 183 to 218 feet bgs at that time (GeoLogic Associates, 2011). General groundwater quality in the area is expected to be good, however regional impacts due to volatile organic compounds and perchlorate have been noted.

PREVIOUS INVESTIGATIONS

Besides the visual survey of the river bed by US EPA personnel mentioned above, no other hazardous material investigations are known to have occurred in the immediate vicinity of the RSP.

3 PROJECT OBJECTIVES

OVERALL OBJECTIVES

As indicated above, the purpose of the proposed soil investigation is to assess the extent of impacts by COPCs related to target shooting at the RSP. The investigation will focus on the area of the Santa Ana River bed between Orange Street on the east and the I-210 Freeway crossing on the west (**Figure 2**).

Field and laboratory analyses will focus on those potentially hazardous substances that are found in the lead shot and clay targets that are likely to have been used at the RSP. As described in the following section, which details the proposed investigation, soil samples, collected at several depths at each location, will initially be field screened for lead, arsenic, and antimony using an x-ray fluorescence (XRF) unit. In assessing the vertical extent of impacts, the investigation will focus on the upper 4 feet of soil. Because metals tend to be concentrated in the finer soil fractions, samples will be sieved prior to field screening. Following field screening, selected samples will be analyzed in an off-site laboratory for total lead, antimony, and arsenic using EPA Method 6010B, and for PAHs using EPA Method 8310. Based on total metals results, extracts of selected representative samples will be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP).

DATA QUALITY OBJECTIVES

Soil samples will be collected in accordance with the US EPA SW-846. Laboratories performing analyses will be certified by the State of California to conduct the requested analysis. Target laboratory detection limits, as well as other data quality indicators (including precision, accuracy, completeness, representativeness, and comparability), data validation, and data management, are described in the Quality Assurance Project Plan attached as **Appendix A**.

4 PROPOSED SAMPLING AND ANALYSIS

OVERVIEW

The scope of work for the investigation includes the following:

- Collection of soil samples at 40 locations from depths of 0 to 0.5, and approximately 1, 2, 3, and 4 feet bgs, or to refusal, and field screening analysis for lead, arsenic, and antimony using field XRF instrumentation. Collection and field screening of 5 background soil samples outside of the investigation area (upstream).
- Laboratory confirmation of total antimony, arsenic, and lead concentrations for selected representative samples using EPA Method 6010B at a rate of 10 to 20 percent of investigation area samples collected. Laboratory confirmation of these metals for all background samples

- Laboratory analysis of arsenic and/or lead extract concentrations for selected samples, based on the results of analysis for total concentrations of lead and/or arsenic, using TCLP. (Note that antimony does not have a TCLP limit, therefore TCLP analysis of samples for antimony will not be conducted.) Samples analyzed in the laboratory that contain total arsenic or lead concentrations (in mg/kg) greater than 20 times the RCRA maximum concentration for toxicity characteristic (which is 5mg/l for both arsenic and lead) will be selectively analyzed using the TCLP. Thus, representative samples with total lead or arsenic concentration greater than 100 mg/kg or more will be selected for TCLP analysis.
- Laboratory analysis of selected investigation area and all background samples for PAHs using EPA Method 8310.

These criteria are summarized in **Table 1**.

As required by law, SCS will contact Underground Service Alert prior to conducting field investigation activities to identify any buried subsurface utilities that may be present. Boring locations will be surveyed in the field using a Global Positioning System (GPS) device.

FIELD AND ANALYTICAL PROCEDURES

Soil samples will be collected from 40 locations. At each location a hand auger will be used to access sample points at 0 to 0.5, and approximately 1, 2, 3, and 4 feet bgs, or to depth of auger refusal. In addition, background soil samples will be collected from five locations upstream of the RSP. Proposed soil boring locations are shown on **Figure 3**, however these locations may be adjusted based on field indications. Specific sampling locations will be chosen based on visual indications of the presence of shot and/or clay target fragments, and the availability of fine-grain sediments. Because lead shot is expected to accumulate in topographically low spots in the river bed, these locations will be preferentially sampled. Due to the presence of abundant cobbles, up to 1-foot or more in dimension, some portions of the river bed will be necessarily excluded from sampling. All sample locations will be surveyed using a GPS instrument. Sample locations will also be identified on daily field sheets and on field sketch maps. Sample locations will be documented photographically.

As indicated, soil borings will be advanced using a hand auger. Discrete soil samples will be collected either in stainless steel tubes using a drive sampler or (since gravelly soil may prevent drive sampling) directly from the cutting head of the hand auger into glass jars, as practicable. Samples collected in tubes will have both ends covered with Teflon sheeting and plastic end caps. Samples collected in glass jars will be sealed with Teflon lined screw caps. A solvent-free label noting the date of collection, sample number, and project number will be affixed to each sample.

At each sample depth two co-located samples will be collected, one of which will be used to prepare a sample for field screening for metals and the other will be sent to the off-site laboratory for possible analysis for PAHs. Standard chain-of-custody procedures will be followed. Soil from the intervals sampled will be identified in the field using the Unified Soils Classification

System and boring logs will be prepared. All field work will be under the direct supervision of a California professional geologist or engineer.

Standard three-stage decontamination procedures (consisting of potable water/lab-grade detergent wash, potable water rinse, deionized water rinse) will be used for all sampling equipment between each sampling depth. New latex or nitrile gloves will be used and frequently replaced in the handling of all soil samples. Cuttings will be used to backfill borings. The volume and concentration of the decontamination water will be sufficiently low to allow disposal at the site.

Field screening analysis for metals using an XRF unit will be conducted at a central location. Sample preparation will involve initially passing a subsample through a 10 mesh screen (openings approximately 2 millimeters or 0.0787 inches) to remove coarse particles and debris, weighing the sample, and then screening with a 60 mesh screen (openings approximately 0.25 millimeters or 0.0098 inches). Material passing the 60 mesh screen will be dried on a burner and then packed into a plastic sample holder (cup) that has a sheet of polypropylene film on one side (supplied by the manufacturer of the XRF unit). The cup will be labeled and analyzed by the XRF unit. Sample analytical results will be recorded on XRF data sheets. Details of sample preparation and instrument calibration are contained in **Appendix B**.

Laboratory analysis will be conducted on selected soil samples at a state-certified laboratory. Samples will be selected, at a rate of 10 to 20 percent of the total. For metals analysis, sample selection will be based on the results of field screening (samples with high and low XRF results will be selected). For PAHs, samples will be selected based on visual indications (discolored soil, clay target fragments). Selected samples will be analyzed for total lead, arsenic, and antimony using EPA Method 6010B and for PAHs using EPA Method 8310. Based on the concentrations of total lead and arsenic, selected samples will be analyzed for leachable lead and/or arsenic using TCLP procedures. All field screening XRF analyses will be run in duplicate on each sample. Duplicate (co-located) samples will be analyzed in the laboratory at a rate of approximately 10 percent of primary samples. Field and laboratory quality assurance and quality control procedures are described in the Quality Assurance Project Plan in **Appendix A**.

REPORTING

Following sampling and receipt of analytical results, a report will be prepared that includes a discussion of field activities, a description of methodology, illustrative figures, a summary of analytical results, and conclusions and recommendations. Boring logs, daily field activities sheets, chain-of-custody forms, analytical results, and other supporting documentation will be appended.

5 HEALTH AND SAFETY

Personnel involved in the investigation will adhere to proper health and safety protocols as described in a Health and Safety Plan prepared for this project included as **Appendix C**. Field personnel will have certification of having completed a 40-hour Health and Safety course and annual refreshers.

An SCS representative will serve as Health and Safety Officer. This person will be responsible for monitoring potentially hazardous situations during investigation activities and will ensure that all personnel know the potential physical and chemical hazards, and are trained in the proper use of personal protective equipment. Although it is anticipated that Level D will be the highest level of personal protective equipment necessary, Level C protective equipment will be available during site activities. Based on the nature of the site, SCS does not anticipate that upgrading to Level C will be required.

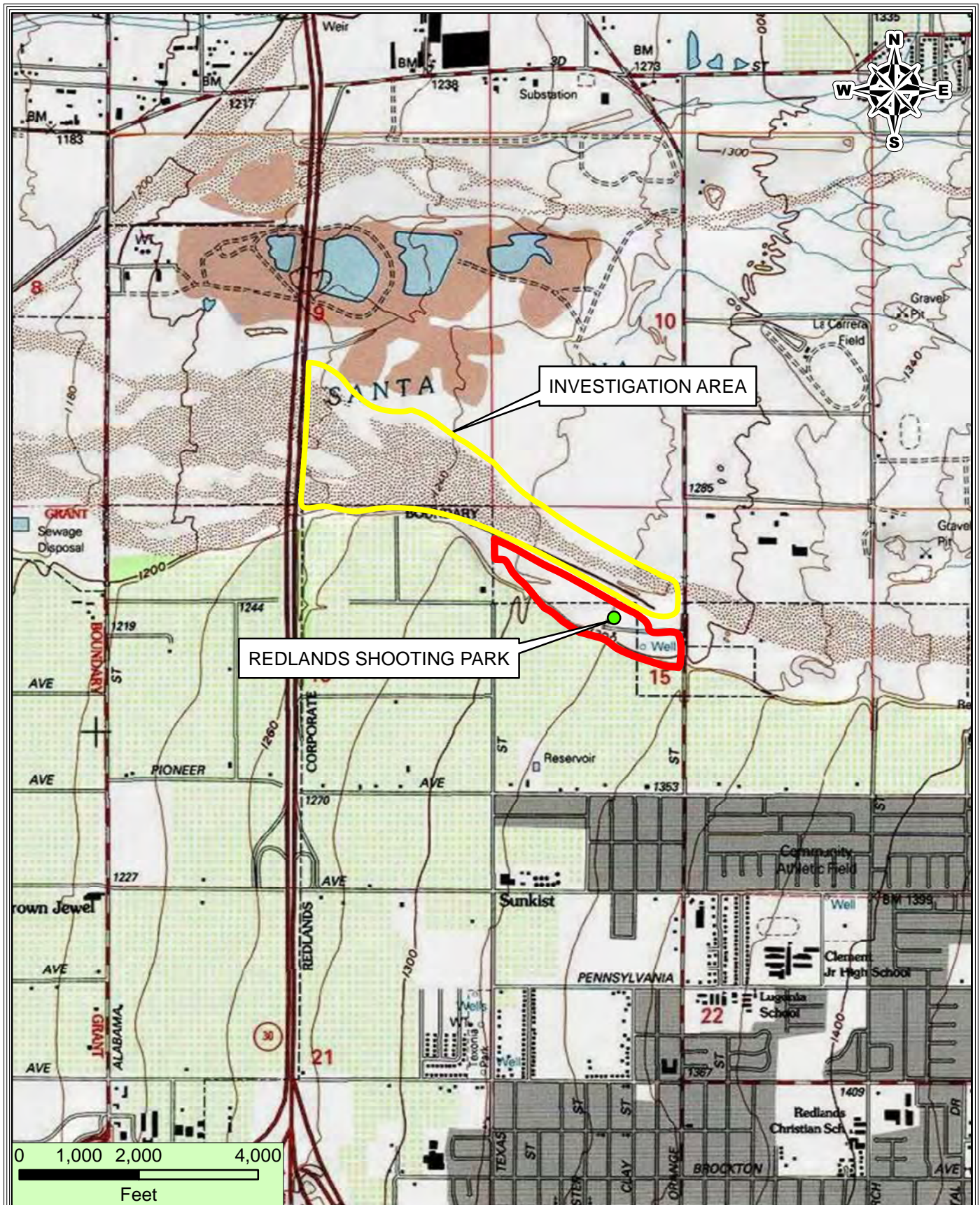
6 REFERENCES

Geologic Associates. 2011 (July). *Second Quarter (Spring) 2011 Water Quality Monitoring Report, California Street Landfill, Redlands, California.*

SCS Engineers. 2008 (September 19; revised September 16, 2009). *Gas Monitoring and Control Program, California Street Landfill, San Bernardino County, California.*

US Geological Survey. 2003. *Geologic Map of the Redlands 7.5' Quadrangle, San Bernardino and Riverside Counties, California*, Open File Report 03-302.

FIGURES 1 - 2



SOURCE: 7.5 MINUTE TOPOGRAPHIC MAP
UNITED STATES GEOLOGICAL SURVEY
REDLANDS, CA, PHOTOREVISED 1980

SCS ENGINEERS

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PROJECT NO:

01211289.00

DRAWN BY:

A. STODDARD

APPROVED BY:

K. LISTER

SITE:

REDLANDS SHOOTING PARK
REDLANDS, CALIFORNIA

TITLE:

MAP OF
REDLANDS
SHOOTING
PARK
AREA

FIGURE

1

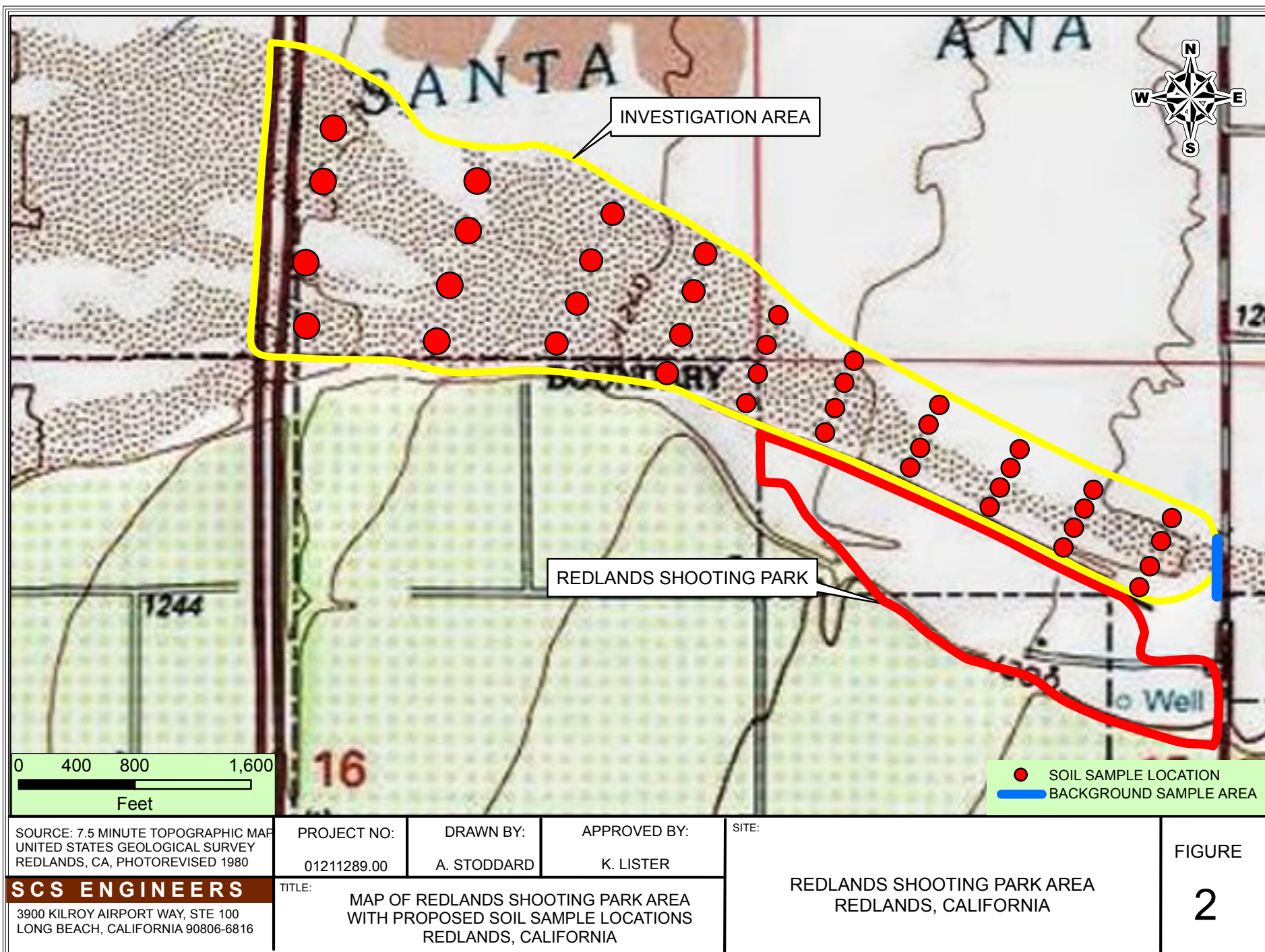


TABLE 1

**TABLE 1. SUMMARY OF SAMPLING AND ANALYSIS PLAN
REDLANDS SHOOTING PARK/SANTA ANA RIVER BED, REDLANDS, CA**

Soil Sample Depth (feet bgs)	Number of Samples	Number for XRF Screening	Number for Lab Analysis: Pb, As, Sb	Number for Lab Analysis: PAHs	Number for Lab Analysis: TCLP (Pb and/or As)
0 to 0.5	40	40	4 to 8	4 to 8	Based on total Pb/As concentration **
1	40 *	40 *	10 to 20% samples collected	10 to 20% samples collected	Based on total Pb/As concentration **
2	40 *	40 *	10 to 20% samples collected	10 to 20% samples collected	Based on total Pb/As concentration **
3	40 *	40 *	10 to 20% samples collected	10 to 20% samples collected	Based on total Pb/As concentration **
4	40 *	40 *	10 to 20% samples collected	10 to 20% samples collected	Based on total Pb/As concentration **
Background	5	5	5	5	0
Total Samples	Up to 205	Up to 205	Up to 45	Up to 45	Up to 40

* May be less because samples will be collected to depth of hand auger refusal.

** Analysis for selected samples with total lab Pb and/or As > 100 mg/kg.

APPENDIX A
QUALITY ASSURANCE PROJECT PLAN

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QUALITY ASSURANCE PROJECT PLAN

**REDLANDS SHOOTING PARK/
SANTA ANA RIVER BED
REDLANDS, CALIFORNIA**

Prepared for:

Bear Valley Mutual Water Company

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1 INTRODUCTION AND SITE DESCRIPTION

This Quality Assurance Project Plan (QAPP) has been prepared for the Bear Valley Mutual Water Company to address quality assurance and quality control procedures and methodologies to implement a Sampling and Analysis Plan (SAP) for investigation in the Santa Ana River bed in the vicinity of the Redlands Shooting Park (RSP), Redlands, California. The RSP occupies an area of approximately 35.4 acres at 2125 North Orange Street in Redlands, California. The RSP is bounded on the west by Texas Street, on the south by agricultural land and Beazer Park, on the east by Orange Street, and on the north by the Santa Ana River bed.

The purpose of the investigation is to assess the extent of impacts resulting from target shooting. Based on the materials used in with target shooting at the RSP, contaminants of potential concern (COPCs) are lead, arsenic, antimony, and polyaromatic hydrocarbons (PAHs). Soil samples will initially be field screened for lead, arsenic, and antimony using a portable x-ray fluorescence (XRF) unit. Selected samples will then be analyzed in an off-site laboratory for total lead, antimony, and arsenic using EPA Method 6010B, and for PAHs using EPA Method 8310. Based on total metals results, extracts of selected samples will be analyzed using the Toxicity Characteristic Leaching Procedure (TCLP).

2 PROJECT ORGANIZATION AND RESPONSIBILITIES

Compliance with the QAPP is the responsibility of SCS Engineers (SCS) including the project manager (PM) and field personnel.

The PM responsibilities include:

- Providing the field personnel with a copy of the QAPP.
- Coordinating with laboratory regarding the project data quality requirements.
- Checking chain-of-custodies (COCs) and field logs to verify sample collection.
- Reviewing field and laboratory data to determine if data quality objectives were met.
- Preparing a summary of quality assurance/quality control (QA/QC) data.
- Reviewing data validation information.
- Taking corrective actions as required.

The responsibilities of the field personnel are:

- Reviewing, understanding, and implementing the QAPP.
- Maintaining logs of daily activities.
- Maintaining control of samples until they are appropriately released.
- Notifying the PM if there are problems or deviations from the QAPP.

3 DATA QUALITY OBJECTIVES

Soil samples will be collected in accordance with the US EPA SW-846. Laboratories performing analyses will be certified by the State of California to conduct the requested analysis. A summary of the analyses of samples, including methods, preservatives and holding times, is

provided in **Table A1**. A summary of the laboratory methods, COPCs, and detection limits are provided in **Table A2**.

The data generated as part of the investigation will be used to determine if the goals of the project have been achieved. Precision, accuracy, completeness, representativeness, and comparability typify the data quality.

Precision is the degree of agreement between independent measurements. Precision can be evaluated through the use of duplicate samples. Precision between duplicate samples can vary due to the inherent heterogeneity of soil. If duplicate samples exceed a relative percent difference (RPD) of 30, data will be qualified as described in the applicable validation section. RPD will be calculated as follows:

$$\%RPD = 200 * (X_2 - X_1) / (X_2 + X_1)$$

Where: X_1 is the larger of the two observed values
 X_2 is the smaller of the two observed values

Accuracy is the degree of agreement of a measured value with true or expected value. Accuracy can be measured using percent recovery data in the laboratory using spiked concentrations. Accuracy is a statistical measurement of correctness and includes components of random error and systematic error. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard.

Accuracy of laboratory analyses will be assessed by laboratory control samples, surrogate standards, matrix spikes, and initial and continuing calibrations of instruments. Laboratory accuracy is expressed as the percent recovery (%R). Accuracy limits are statistically generated by the laboratory or required by specified EPA methods. If the percent recovery is determined to be outside the acceptance criteria, data will be qualified as described in the applicable validation procedure. The calculation of percent recovery is provided below:

$$\%RPD = 100 * (X_s - X) / T$$

Where: X_s is the measured value of the spiked sample
 X is the measured value of the unspiked sample
 T is the true value of the spike solution added

Completeness is the percent of measurements made which are judged to be valid. Completeness can be measured by dividing the number of samples that are judged to be valid by the total number of samples. The goal is for 90% of the measurements to be valid and acceptable.

Representativeness is the degree to which the sample data represents the characteristics of a population. Representativeness is a qualitative parameter that addresses the design of the sampling program. An example of representativeness is to evaluate if the number and locations of samples are sufficient for the purposes of the investigation.

Comparability is a qualitative parameter that evaluates the confidence with which one data set can be compared to another. Comparability can be enhanced by using standard analytical methods performed by certified laboratories.

4 QUALITY ASSURANCE/QUALITY CONTROL SAMPLES AND PROCEDURES

The QA/QC samples will be collected, stored and transported under appropriate COCs procedures and documentation. The COC forms will be included with the samples submitted for laboratory analysis.

The following QA/QC samples will be collected:

- **Temperature Blanks** samples will be included with every cooler that contains samples that require preservation at 4 degrees Celsius. The samples must be preserved at 4 degrees Celsius plus or minus two degrees Celsius.
- **Duplicate or co-located samples** will be collected at a ratio of 1:10 of soil matrix samples collected (10% of soil samples).

Daily information regarding sample collection will be recorded in field sheets. Sample types, soil descriptions, sample identification numbers, and collection times will be recorded on the COCs and/or field sheets.

5 LABORATORY QA/QC PROCEDURES

Laboratory QA/QC procedures will include the following:

- Laboratory analyses will be performed with the required holding time for all samples,
- Appropriate minimum reporting limits (RLs) will be used for each analysis,
- Site specific matrix spikes will be used for all analyses,
- A state-certified testing laboratory will conduct the specified analysis,
- The laboratory will report QA/QC information including;
 - Method blank data,
 - Collection date, preparation date, analysis date, Surrogate recovery and acceptance limits, matrix spike and matrix spike duplicate recovery and acceptance limits, and laboratory sample recovery and acceptance limits, and
 - Signed laboratory reports will include the sample designation or locations, date of sample collection, matrix of sample, analysis laboratory analytical method employed, dilution factor, and the minimum detection limits (MDLs).

6 UTILITY CLEARANCE

As required by law, Underground Service Alert (USA) will be contacted at least 48 hours in advance of performing any field work. USA will mark and identify all the known locations of subsurface utilities in the proposed area of investigation .

7 SOIL SAMPLING

The planned project includes the sampling and analysis of soil as described in the Sampling and Analysis Plan (SAP), and includes specified frequencies and locations of samples to be collected. Some or all of the soil samples will be screened in the field for lead, arsenic, and antimony using a portable X-ray fluorescence (XRF) unit. Ten to twenty percent of the soil samples will be submitted to the laboratory for analysis of lead, arsenic, and antimony by EPA Method 6010B and PAHs by EPA Method 8310. Depending on the initial results, selected samples may be further analyzed for soluble lead and arsenic concentrations using the Toxicity Characteristic Leaching Procedure (TCLP).

8 EQUIPMENT DECONTAMINATION

Sampling equipment that comes into contact with soil will be decontaminated by using a solution of Liquinox detergent and tap water, followed by one potable water, and one deionized water rinses. The equipment will be stored on plastic sheeting or other appropriate surface in order to prevent equipment from coming into contact with the ground. If sampling equipment is to be stored for more than a few hours, and there is a potential for airborne contaminants, the equipment will be covered as well. Generally, equipment will be allowed to air dry prior to being reused. Decontamination solutions and rinse water will be appropriately disposed.

9 SAMPLE CONTAINERS AND PRESERVATION

At each sample depth, two co-located samples will be collected, one of which will be used to prepare a sample for XRF field screening for metals and the other will be sent to the off-site laboratory for possible analysis for PAHs. Soil samples will be collected in laboratory provided pre-cleaned glass jars or decontaminated stainless steel sleeves. After the sample containers are filled with soil, samples for laboratory analysis will be capped, sealed, labeled, and placed into in coolers chilled with ice or Blue ice. Samples for field screening for metals will be immediately prepared and screened using the XRF, as outlined in **Appendix B**.

10 SAMPLE PACKAGING AND SHIPMENT

Following collection and labeling, soil samples for laboratory analysis will be placed in a cooler for transport. The following protocol will be followed for sample packaging:

- Prior to placing into coolers, screw caps or end caps will be checked for tightness.
- Ice or Blue ice will be placed in the cooler to keep samples chilled during storage and transport to the analytical laboratory.
- The COC form will be placed in a water-resistant plastic bag and taped to the inside of the cooler.

A temperature blank consisting of a 40-milliliter glass vial of deionized or tap water will be included in each cooler sent to the laboratory. Samples will be hand delivered or shipped by a commercial carrier to the laboratory.

1.1 DETECTION LIMITS

The laboratory detection limits or practical quantitation limits for the chemical compounds to be analyzed are provided in **Table A2**.

1.2 CHAIN OF CUSTODY

During sampling, samples will be logged on standard COC forms. All COC forms will include the specific testing parameters and specific samples to be tested in general accordance with EPA SW-846 protocol (as appropriate), as well as turnaround time for the laboratory to submit test results.

1.3 DOCUMENTATION

Documentation will include field sheets, boring logs, COC forms, photographs, and results of any QA/QC audits.

1.4 REVISIONS TO THE QAPP

Depending on the conditions encountered in the field, modifications to the sampling and quality assurance protocol as described in this QAPP may be deemed necessary. If any modifications to the QAPP are made, they will be documented in the report of investigation.

TABLE A1.
Summary of Analyses
Redlands Shooting Park/Santa Ana River Bed
Redlands, California

ANALYTE	METHOD	CONTAINER	PRESERVATIVE	HOLDING TIME
SOIL ANALYSES				
Antimony, arsenic and lead by XRF	For Screening Purposes only	Chemplex Sampling Cup	None	180 days
CAM Title 22 Metals	EPA 6010B/7000CAM	glass jar or stainless steel	4° C	180 days
Polycyclic Aromatic Hydrocarbons (PAHs)	EPA Method 8310	glass jar or stainless steel	4° C	7 days for extraction, 40 days for analysis

TABLE A2.
List of Methods, COPCs, and Reporting Limits
Redlands Shooting Park/Santa Ana River Bed
Redlands, California

Metals		
Method	COPC	Reporting Limit (mg/kg)
EPA 6010B	Arsenic	1.0
	Antimony	1.0
	Lead	2.5

Organic Compounds		
Method	COPC	Reporting Limit (µg/kg)
EPA 8310	Polycyclic Aromatic Hydrocarbons (PAHs)	10

APPENDIX B

X-RAY FLUORESCENCE STANDARD OPERATING PROCEDURE

XRF SAMPLE PREPARATION AND ANALYSIS

Samples will be prepared in the field prior to XRF screening level analysis to minimize the effects of moisture and particle size variations. Procedures for sample preparation are as follows:

- Collect soil samples in brass sleeves or glass jars using hand equipment as specified in the workplan.
- Dry any soil samples that are moist using a portable burner.
- Once sample is dry, sieve with #10 (2mm) mesh to separate out large particles.
- Sieve soil through #60 (250um) mesh.
- After soil has passed through #60 mesh, place the sample in a sample cup (see below).

To assemble a sample cup: 1) place a circle of mylar film on top of an XRF sample cup. The window goes on the end of the cup with the indented ring. 2) Secure the film with the collar. The flange inside the collar faces down and snaps into the indented ring of the cup. Inspect the installed film window for continuity and smooth, taut appearance. 3) Set the cup, window-side down, on a flat surface. Fill it with at least three grams of the prepared sample (no more than half-full). Take care that there are no voids or layering. 4) Placing the cup film-side down on a flat surface, tamp the sample into the cup. 5) Fill the cup with polyester fiber stuffing to prevent sample movement. Use aquarium filter or pillow filling as stuffing. A small supply of stuffing comes with the bulk sample kit. 6) Fasten the cap on the cup.

Procedures for sample analysis are as follows:

- Once the cup is assembled, place it in the receptacle of the sample test platform. Attach the XRF to the test stand. Make sure no one is in the pathway of the radiation source.
- Push the safety slide out from under the shutter release. If the slide is still engaged you cannot press in the shutter release and the instrument will not fit on the test platform correctly.
- Place the XRF on the test platform so that the window of the XRF is over the sample cup, squeeze the shutter release, and firmly press the instrument flat against the surface of the test guard. If the shutter release is not completely pressed, the plunger will not depress. If the plunger is not fully depressed, the window is not fully open and the XRF cannot measure accurately. The back of the unit must be flush with the test guard. The shutter release does not need to be held continuously during the measurement. Hold the XRF tightly against the test guard to maintain the reading. Once the XRF is lifted the plunger will fall back and the shutter will close; this will end the reading. In the event that the plunger sticks in the open position simply push it down.

- Watch the display screen results to decide when the test has reached the desired level of accuracy. A typical screening test will last 30-60 *source* seconds.
- Record the result.
- Repeat the analysis steps with the same sample and record the result (duplicate analysis).

XRF QUALITY ASSURANCE

Energy Calibration Check

To determine whether the XRF is operating within resolution and stability tolerances, an energy calibration check should be run. The energy calibration check determines whether the characteristic x-ray lines are shifting, which would indicate drift within the instrument. This check also serves as a gain check in the event that ambient temperatures are fluctuating greatly (> 10 to 20deg.F). Generally, this is run at the beginning of each working day, after the batteries are changed or the instrument is shut off, at the end of each working day, and at any other time when the instrument operator believes that drift is occurring during analysis.

Calibration Verification Checks

A calibration verification check sample is used to check the accuracy of the instrument and to assess the stability and consistency of the analysis for the analytes of interest. A check sample should be analyzed at the beginning of each working day, during active sample analyses, and at the end of each working day. The frequency of calibration checks during active analysis will depend on the data quality objectives of the project. The check samples used will contain the analytes of interest. These will verify the accuracy of the instrument. The measured value for each target analyte should be within +/-20 percent (%D) of the true value for the calibration verification check to be acceptable. If a measured value falls outside this range, then the check sample should be reanalyzed. If the value continues to fall outside the acceptance range, the instrument should be re-calibrated, and the batch of samples analyzed before the unacceptable calibration verification check must be reanalyzed.

Placing the Sample in an XRF Sample Cup

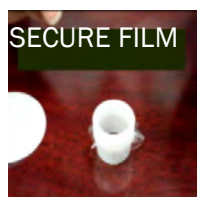
Note The sample container should be a sample cup of a type that can be filled from the rear; that is, the side opposite the window (e.g. Thermo NITON Part Number 187-466). Thermo recommends using a 1/4 mil Polypropelene film (e.g. Thermo NITON Part Number 187-461). A supply of cups and films are included.



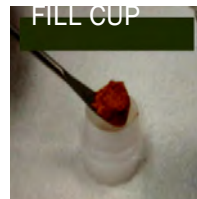
The container used to hold the sample will affect the accuracy of the measurement. Use a container with as thin-walled a window as is convenient and use the same kind of container and window for each sample. Consistency and careful attention to detail are keys to accurate measurement.



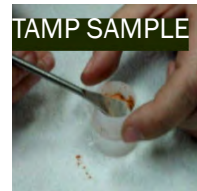
Place a circle of polypropelene film on top of an XRF sample cup. This film goes on the end of the cup with the indented ring. Thermo recommends preparing the cup ahead of time, if possible.



Secure the film with the collar. The flange inside the collar faces down and snaps into the indented ring of the cup. Inspect the installed film window for continuity and smooth, taut appearance.



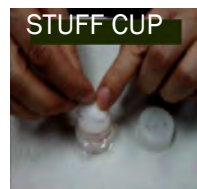
Set the cup on a flat surface film-window-side down. Fill it with at least five grams of the prepared sample, making sure that no voids or uneven layers.



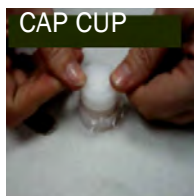
Lightly tamp the sample into the cup. The end of the pestle makes a convenient tamper.



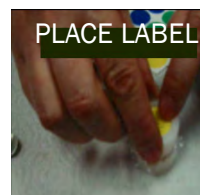
Place a filter-paper disk on the sample after tamping it.



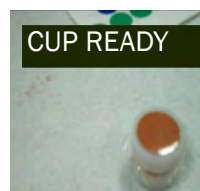
Fill the rest of the cup with polyester fiber stuffing to prevent sample movement. Use aquarium filter or pillow filling as stuffing. A small supply of stuffing comes with your bulk sample kit.



Cap the cup.



Place a label on the cup. Using a pen with indelible ink, write identifying information on the cup. Keep a record of the sample designation, the site and location, the date of the sample, and any other relevant comments.



Cup is ready for testing.

Preparing Liquids and Sludge

Liquids

Fill an XRF sample cup with the liquid to be tested (do not pad the sample with cotton). The cup must be full so it is best if some liquid is allowed to overflow when the cap is put on.

Sludge

Sludge can be placed directly into an XRF cup for screening. This is considered in-situ testing because no attempt has been made to prepare the sample. For more accuracy, the sludge can be dried, sieved, and ground.

Prepare in an XRF sample cup and test the same way you would with a soil sample. For risk analysis, it is advisable to use a 60-mesh sieve to isolate and test only fine particles.

APPENDIX C

HEALTH AND SAFETY PLAN

HEALTH AND SAFETY PLAN FOR LEVEL D TASKS

1 GENERAL PROJECT SITE INFORMATION

Job #: 01211289.00

Site Address: Redlands Shooting Park/Santa Ana River Bed, 2125 N Orange Street, Redlands, California

Client Contact Information:

Mike Huffstutler, General Manager
Bear Valley Mutual Water Company
101 East Olive Avenue
Redlands, CA 92373
(909) 793-4901

Scope of Work (List Job Tasks):

1. Locate utilities/boring clearance
2. Set up work zones
3. Demarcate boring locations
4. Drill soil locations with hand equipment
5. Soil sampling
6. Field Screening with XRF analyzer
7. Submit samples for analysis

Note that the shooting range must be closed during time of sampling in the down range area.

ONSITE ORGANIZATION AND COORDINATION

Project or Site Team Leader:	Kenneth Lister
Primary H&S Representative:	Gary Pons
Onsite Safety Representative (HSO):	Aaron Garret/Justin Rauzon/ Jeffery Sieg
Client Representative:	Mike Huffstutler
Project Director:	Kevin Green

2 EMERGENCY CONTACT AND NOTIFICATION INFORMATION

Nearest Hospital Address (attach directions and map):

Redlands Community Hospital
Fern Ave and Terracina Blvd, Redlands,
(909) 335-5500

Police:	911
Fire :	911
Ambulance:	911
Describe Client Emergency Notification System (if available)	N/A

Describe Emergency Procedures and medical care

Employees may respond to low danger emergencies, such as administration of first aid or fighting small fires (with fire extinguishers). All employees will evacuate from the danger area when an emergency not listed above occurs and will not assist in handling the emergency. Should outside medical or other emergency assistance be required, personnel will notify the HSO of the nature of the emergency and a call will be made to 911 and SCS Engineers at (562) 426-9544. If the injury or illness appears to be relatively minor, the affected person or persons may be driven to the emergency room of the nearest hospital.

1. Head **east** on **Orange St**

0.2 mi

2. Turn right to stay on **Orange St**

2.2 mi

3. Continue onto **Cajon St**

0.4 mi

4. Turn right onto **W Fern Ave**

1.7 mi

5. Turn right onto **Terracina Blvd**

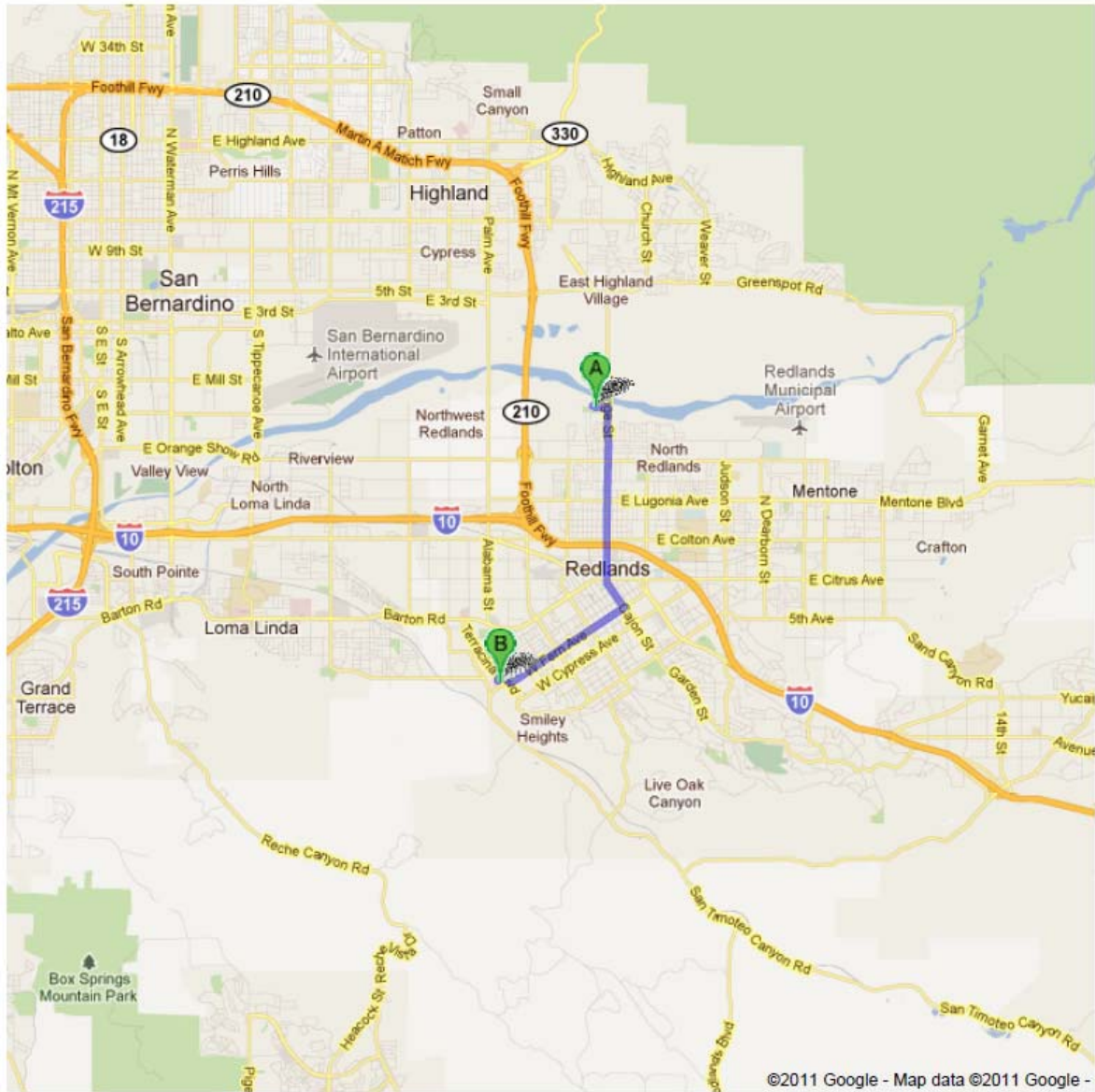
0.1 mi

6. Take the 1st left onto **Circle Dr**

Destination will be on the left

0.1 mi

Redlands Community Hospital
Redlands, California
(909) 335-5500



3 JOB TASK SAFETY ANALYSIS AND PPE ASSESSMENT (JTSA)

Job Task Step	Potential Environmental and Personnel Hazards	Critical Actions	PPE Required
1. Locate utilities/ boring clearance	Tripping Vehicular contact	Be aware of surroundings	Head: Hardhat Body: Safety vest Foot: Steel-toe boots Hand: None Respiratory: None Hearing: None Eye/Face: None
2. Setup work zone	Tripping Vehicular contact	Be aware of surroundings	Head: Hardhat Body: Safety vest Foot: Steel-toe boots Hand: None Respiratory: None Hearing: None Eye/Face: None
3. Demarcate Boring Locations	Tripping Vehicular contact	Be aware of surroundings	Head: None Body: Safety vest Foot: None Hand: None Respiratory: None Hearing: None Eye/Face: None
4. Drilling soil locations using hand equipment (See Appendix C1)	Tripping, lifting, flying particulates,	<ul style="list-style-type: none"> • Use proper equipment • Use proper lifting techniques • Be aware of surroundings 	Head: Hardhat Body: Safety vest Foot: Steel-toe boots Hand: Nitrile gloves Respiratory: None Hearing: Ear Plugs Eye/Face: Safety Glasses

Job Task Step	Potential Environmental and Personnel Hazards	Critical Actions	PPE Required
5. Soil Sampling (See Appendix C1)	Tripping, lifting, flying particulates,	<ul style="list-style-type: none"> • Use proper equipment • Use proper lifting techniques • Be aware of surroundings 	Head: Hardhat Body: Safety vest Foot: Steel-toe boots Hand: Nitrile gloves Respiratory: None Hearing: Ear Plugs Eye/Face: Safety Glasses
6. XRF Field Screening	Radiation from analyzer	<ul style="list-style-type: none"> • Be aware of beam emitted from XRF 	Head: Hardhat Body: Safety vest Foot: Steel-toe boots Hand: Nitrile gloves Respiratory: None Hearing: Ear Plugs Eye/Face: Safety Glasses
7. Submit samples for analysis	Slip/trip, vehicular contact, overextension	<ul style="list-style-type: none"> • Be aware of surroundings • Use proper tools • Use proper lifting techniques 	Head: Hardhat Body: Safety vest Foot: Steel-toe boots Hand: Nitrile gloves Respiratory: None Hearing: None Eye/Face: Safety Glasses

4 BIOLOGICAL HAZARDS

BIOLOGICAL HAZARDS: The following hazards could be potentially encountered while performing the operation and maintenance functions of project:

Hantavirus – Infection typically occurs by the inhalation of tiny airborne droplets of fresh or dried rodent excretions. Transmission to humans may also occur through direct contact with rodents or rodent-contaminated materials, and ingestion of contaminated food or water is also a possible route of transmission. Sweeping or “shaking out” rodent contaminated materials should be avoided unless performed using respiratory protection.

Lyme Disease – A tick-borne bacteria that causes a range of debilitating symptoms (i.e., flu-like discomfort, joint pain, fatigue, headache, lack of concentration, facial paralysis). Main item to look for would be a bulls-eye rash from tick bite. Avoid areas known to have ticks.

Africanized Honey Bees – Aggressive and unpredictable, responds quickly and stings in large numbers, senses threats from people or animals 50 feet or more from nest, sense vibrations from power equipment 100 feet or more from nest, swarm frequently to establish new nests, pursues an enemy 3 miles or more, nest in small cavities and sheltered areas. Avoid areas known to contain bees.

Snakes – Rattle snakes, vipers and coral snakes are poisonous. Not all rattle snakes give an audible warning before striking. Extra caution should be taken if tools or other materials are dropped in highly vegetated areas, around rocks, stockpiles of pipe, etc., or when walking through highly vegetated areas where visibility (of the ground) is limited. The most active time for rattlesnakes is in the morning, late afternoon and early evening, however, an encounter could happen at any time of the day. Walking loudly, shuffling feet, making noise, etc. while working is recommended. Boots that reach mid calf or snake guards are recommended and all personnel should have leather work gloves.

Rodents, poisonous insects, snakes and/or plants are a natural part of any ecosystem and are sometimes difficult to eliminate or avoid on some sites because the sites are typically rural and remote. Employees should be aware of the potential for encountering these types of animals/plants. Where possible, nesting places should be removed and or limited. If several infestations are present, remedies should be discussed with your supervisor and the Client. Refer to SOP-21 attached to this document for precautions and treatment for biological hazards.

5 PHYSICAL HAZARDS

SHOOTING RANGE: Sampling will not be conducted within 1,000 feet of the shooting range when it is active.

LIP, TRIP, AND FALL HAZARDS: Personnel will be reminded daily to maintain sure footing on all surfaces. Use of hand rails when climbing stairs will be enforced and handrails will remain secure until the support structure itself is removed and lowered to ground level.

Work surfaces of unknown or suspect integrity will be strengthened or overlain with a work platform capable of supporting all personnel and equipment in use in that area.

In order to minimize tripping hazards caused by drilling and site investigation, related equipment (augers, rod, drums, buckets, etc.) will be removed daily from the work areas and stockpiled in appropriately designated storage areas. The superintendent will enforce this “house cleaning” effort at the end of each day.

HEAD, EYE, AND BACK INJURIES: Personnel will be trained in and required to use proper lifting techniques when lifting heavy objects. Protective eyewear will be used when there is an imminent danger to the eyes or head during specific work activities. **Hardhats will be used during all site investigation work.**

HEAVY EQUIPMENT AND TRAFFIC: Work zones will be determined in a pre-construction meeting prior to the start of work on-site if heavy equipment use is planned.

The use of heavy equipment on site presents a potential for injury to personnel. Site activities will include the use of a direct-push drill rig and SCS vehicle. The only vehicle that will move frequently will be the drilling rig. Unauthorized non-essential personnel – that is, the public and service station personnel – will be excluded from the work zone. As the various borings and wells are drilled the active work zone will move. Access to work zones will be limited by use of traffic barricades and cones, and caution tape. Areas no longer within the active work zone will be opened as much as possible to allow traffic and normal operation of the service station.

While approaching heavy equipment during operation, will observe the following protocols:

1. Make eye contact with the operator.
2. Signal the operator to cease heavy equipment activity.
3. Approach the equipment and inform the operator of intentions.

Only qualified personnel, as determined by the Site Superintendent, will operate heavy equipment. Those crew members directly involved with spotting for the operator will be the only personnel allowed within the operating radius of the heavy equipment. All other personnel will remain a safe distance away from these operations. Vehicles will yield to all bikes, pedestrians, and railroad crossings.

Only equipment that is in safe working order will be used. To maintain this policy, all equipment brought onto the project site will be inspected for structural integrity, smooth operational performance, and proper functioning of all critical safety devices in accordance with the manufacturer's specifications. A qualified equipment operator will perform this inspection. Equipment not conforming to the operational and safety requirements during this inspection will not be put into service until all necessary repairs are made to the satisfaction of the inspection group. Only qualified operators with the equipment will be permitted to operate equipment.

Investigation derived waste (IDW), if any, will be stored in 55-gallon drums on-site in a location agreed during the pre-construction meeting. The IDW drums will be labeled with the date generated and indicate that analysis of the contents is pending. The drums will be stored on-site until the IDW can be characterized and the drums appropriately removed for off-site disposal or recycling.

ELECTRICAL HAZARDS: Overhead power lines, downed electrical wires, and buried cables all pose a danger of shock or electrocution if workers contact, sever them or come in close proximity during site operations. In order to prevent accidents caused by electric shock, the site personnel will inspect all electrical connections (if required) on a daily basis. They will shut down and lock out any equipment that is found to have frayed wiring or loose connections until a qualified electrician can be contacted and repairs effected. Electrical equipment will be de-energized and tested by an electrician before any electrical work is done. All equipment will be properly grounded prior to and during all work. Underground Service Alert will be notified at least two (2) working days prior to site investigation activities in any area.

In addition, all drilling activities will be conducted in accordance with Cal OSHA provisions for preventing accidents due to proximity to overhead high-voltage power lines. No high voltage overhead power lines are located in or near the proposed work zone on the Property. Electrical Safety Order 2946 (California Code of Regulations Title 8) outlines the requirements for prevention of accidents due to proximity to overhead lines. Personnel must be guarded against the danger of accidental contact with overhead lines. With certain exceptions, work done over live (power on) overhead lines is against the law.

NOISE: Prolonged exposure to loud noise may result in permanent hearing loss. As a result, hearing protection devices will be used as appropriate for field activities conducted on the Property. Historical noise monitoring data collected during work using heavy equipment have shown noise levels exceeding the PEL of 90 dBA (decibels on the A-weighted scale).

Note that if workers are subjected to an 8-hour time-weighted average sound level exceeding 90 dBA, or its equivalent, suitable engineering controls and/or protection must be utilized. In addition, whenever employee noise exposures equal or exceed an 8-hour, time-weighted average sound level of 85 dBA (OSHA Action Level) implementation of the Hearing Conservation Program where annual audiometric testing is required. Personnel will be restricted from high noise exposure should a standard threshold shift be detected during the audiometric testing.

SCS employees, contractors, and subcontractors who enter noisy environments will use ear plugs or ear muffs, even when their cumulative exposure for the day probably will not exceed the OSHA limit. These devices can diminish the actual exposure level by over 10 dBA. Ear plugs must be inserted into the ear canal with care, and muffs must fit tightly around the ear. Employees should seek guidance from the HSO when they suspect that excessive noise exposures are possible.

HEAT-RELATED ILLNESSES: With the possible combination of ambient factors such as high air temperature, high relative humidity, low air movement, high radiant heat, and protective clothing, the potential for heat stress is of concern. The potential exists for heat cramps, heat exhaustion, and heat stroke.

Heat cramps are the result of electrolyte imbalances in the muscles causing involuntary spasms. Intake of electrolyte-containing fluids during extreme heat conditions should reduce the probability of heat cramps.

Heat exhaustion is caused by dehydration and electrolyte imbalances. It is characterized by headache, nausea, and fatigue. The skin is often wet and clammy. Victims should retire to a cooler environment and slowly drink cool fluids.

Heat stroke is a life-threatening situation where the body's ability to cool itself fails. Heat stroke is characterized by hot, dry skin; red, blotchy complexion; mental confusion or unconsciousness; rapid pulse; and rapid breathing. Victims of heat stroke must be cooled immediately and medical attention must be sought.

In order to minimize the potential for heat stress and heat stroke, rest breaks will be taken at 2-hour intervals during level D work activities and at ½-hour intervals upon PPE upgrade (see Table 1 below). In accordance with *the Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (NIOSH, October 1985)*, heat stress monitoring will be implemented beginning at 70°F if Level C apparel utilizing “impermeable” clothing is required.

- **Visual Observations.** The HSO will monitor field personnel through visual observations of breathing rate and redness of skin. If the HSO suspects heat stress, further personnel monitoring will be initiated.
- **Heart Rate.** Count the radial pulse during a 30-second period as early as possible in the rest period. If it exceeds 110 beats per minute, shorten the next work cycle by one-third and keep the rest period the same. Repeat the procedure each rest period, shortening the work cycle as needed by one-third.
- **Oral Temperature.** Use a clinical thermometer (3 minutes under the tongue) or similar instrument to measure the oral temperature at the end of the work period (before drinking). If it exceeds 99.6°F, shorten the next work cycle by one-third without changing the rest period. Repeat this procedure each rest period. **DO NOT** permit a worker to wear a semi-permeable or impermeable garment when his/her temperature exceeds 100.6° F.

Table 1. Summary of Work/Rest Periods Based on Temperature (Level D)

Temperature (degrees F)	Work (minutes)	Rest (minutes)
75 to 80	120	15
80 to 85	90	15
85 to 90	60	15
90 to 95+	30	15

Workers will be encouraged to increase consumption of water and electrolyte-containing beverages such as Gatorade during warm weather. Water and electrolyte-containing beverages will be provided on-site and will be available for consumption during work breaks.

Please see SOP 25- Avoidance/Prevention of Heat/Cold Stress, and Other Weather-Related Hazards for more information on exposure to hot or cold environments.

6 CHEMICAL AND PHYSICAL AGENT HAZARDS

Table 2. Chemical Hazards and Air Monitoring Plan

Chemical	PEL	TLV	IDLH	Monitoring equipment	Action Levels for monitoring equipment	Sample Location ID and Frequency	Procedures when Action Levels Exceeded
Lead	0.050 mg/m ³ (TWA)		100 mg/m ³	Visual	Visible airborne dust	NA	Stop work if wind causes visible airborne dust to drift out of the immediate work (sampling) area
Arsenic	0.50 mg/m ³ (TWA)		50 mg/m ³				
Antimony	0.50 mg/m ³ (TWA)		80 mg/m ³				
Poly aromatic Hydrocarbons	0.20 mg/m ³		80 mg/m ³				

7 SITE SECURITY AND CONTROL, DECONTAMINATION AND DISPOSAL MEASURES

SITE SECURITY AND CONTROL MEASURES

- Sign in with Onsite Safety Representative when entering the work area.
- Use of cones during work in commercial parking lots/driveways.

DECONTAMINATION PROCEDURES

- Equipment decontamination procedures will be conducted by SCS.
- Used PPE and other waste will be bagged and removed from the Property to be disposed of.

8 APPLICABLE STANDARD OPERATING PROCEDURES (SOP) AND PROGRAMS

- SOP 24 – Safe Procedures for Avoidance of Slips, Trips, and Fall
- SOP 21 – Safe Procedures for Biological Hazards

SOP 24

AVOIDANCE OF SLIPS, TRIPS, AND FALLS

PURPOSE

This section describes ways to avoid and prevent accidents involving slipping, tripping, and falling in the workplace. These hazards have caused more injuries at SCS than any other contributing factor. With most of the suggestions provided below, common sense dictates safe practice. This discussion applies to all field employees in OM&M, Construction, Energy, and Engineering, and all office personnel.

HAZARDS FROM SLIPPING

Slipping occurs when there is not enough friction or traction between feet and ground surface. The most common causes of slipping are:

- Wet surfaces.
- Worn shoe soles.
- Spills.
- Weather (hazards from ice and snow).
- Wet surfaces.

To avoid slipping on wet surfaces:

- Avoid (take detours around) the area of a floor that is wet. Standing water could also indicate or camouflage a missing drain or cover.
- For areas that are always wet, maintain proper drainage, or use a doormat to create slip-free transition areas between wet and dry surfaces. If possible, use non-skid strips, mats, gratings, and gritty floor coatings for these areas.
- For temporarily wet surfaces, dry surfaces when possible by mopping or cleaning one side of the space at a time, so people passing through the room will have a dry area on which to walk. Post warning signs for passersby to make them aware of wet areas.
- Walk with feet pointed outward, shorten strides to keep a center of balance, and wear slip-resistant footwear. This footwear usually has soft rubber soles and heels, with rubber cleats for traction.
- Remember that wet shoes on dry floors can be just as slippery as dry shoes on a wet surface.

Worn Shoe Soles and Inclement Weather

Only shoes with good soles and holes that provide traction and ankle support should be worn. When ordering boots for fieldwork, sole patterns that give slip resistance appropriate for job tasks should be selected. Overshoes or shoe overlays provide proper traction in icy or snowy conditions, whose hazards can best be observed by wearing sunglasses. Work in snow and ice should be performed slowly, taking care while exiting vehicles to hold on to the vehicles for support.

Spills

To avoid slipping, spills should be cleaned up immediately and the floor dried. If cleaning is not immediately possible, warning signs should be posted to draw attention to the spill area to warn people of the hazard. Walking surfaces and work areas should be well lit. If machinery leaks, a drip pan should be used to collect fluids, or absorbents to clean the walking surface. Suitable agents for cleaning grease and oil spills should also be used.

Other Hazards

Rugs secured to the floor or made with skid-resistant backing are optimal. When these types of rugs are not available, removing rugs also removes dangers from slipping. Debris, including dust particles, pencil shavings, or pieces of paper should likewise be removed. If irregular surfaces caused by loose gravel or sloping are encountered, employees should slow down and pay attention to the placement of their feet, and look for obstructions and holes.

In addition to these hazards, walking from one type of surface, such as from carpets to marble floors or grass to gravel surfaces, can shorten the length of steps. Employees should adjust their steps and adapt balance until they can regain equilibrium and feel stable on the new surface. Slip-resistant shoes can be beneficial in preventing slips.

HAZARDS FROM TRIPPING

Tripping occurs when feet strike an object that causes the loss of balance. Commonly, this happens from:

- Clutter and uncovered cables.
- Uneven walking surfaces.
- A hole or stump in the ground.
- Obstructed views of the walking surface.
- Poor lighting.
- Obstacles around corners.

Clutter and Uncovered Cables and Piping

Good housekeeping, which includes keeping floors and walkways free of clutter and obstacles, should regularly be practiced. **Nothing** should be put on walkways to cause an obstruction. Cords or cables should be routed around walkways, if possible, but if not, cables or cords should

be covered and secured with heavy-duty tape or cable covers. Mats, rugs, or carpets should not have curled edges or wrinkles, and should be secured by tacking or taping them down. Warning signs or barriers should be posted around temporary piping laid on walking surfaces, to notify employees of possible tripping hazards posed by piping on the ground. In the office or other storage spaces, personnel should remember to close bottom drawers of file cabinets or tool carts as soon as they are with work.

Uneven Walking Surfaces, and Holes and Stumps in the Ground

To avoid tripping, established walkways should be used as often as possible. Areas for walking can be scanned for obstacles and surface hazards, and footing secured while walking through wet grass, around holes or stumps, or in muddy areas. Canes or long sticks can also be used to identify holes or obstructions in areas with high grass.

If you cannot go around an obstruction, try to step over it (instead of on it). Stumps, logs, rocks, piles of lumber, etc. can be slippery, and they may also contain animals or insects.

Obstructed Views and Poor Lighting

Carrying small loads helps to reduce the risk of obstruction and the dangerous consequences from tripping or falling as described above. If employees are required to enter unlit areas, flashlights can be used and the pace of walking slowed. Sunglasses should be avoided in low-light areas, and, because eyes need time to adjust while personnel go from well-lit areas to dark spaces, this adjustment must be considered. To improve vision, burned-out light bulbs and faulty lighting should be replaced as soon as possible.

Obstacles Around Corners

Personnel in offices or buildings should walk carefully around corners and look for obstacles on the floor. Safety mirrors near corners help to show oncoming traffic or obstacles obscured by corners.

HAZARDS FROM FALLING

Falling from heights can cause serious injury or death. Employees should always use proper ladders and fall protection while working at heights greater than 3 feet (see **SOP 10**). Makeshift ladders or chairs should **never** be used to reach for objects at elevated heights (see **SOP 13**).

Additional Suggestions

To ensure safety on stairs, make sure one hand free is free while climbing, and hold on to the handrail. Each step up or down should be made deliberately, planting your foot firmly before putting weight on it. Carrying large loads that block vision, or heavy items requiring the use of both hands while traveling down or up the stairs, should be avoided. When climbing down from heavy machinery or trucks, the use of the three-point of contact rule (three of your four limbs should be placed on hand or foot rails of machinery or vehicles while exiting: this means one hand and two feet, or two hands and one foot). Walking backwards on a dock is also not advisable.

SOP 21

SAFE PROCEDURES FOR BIOLOGICAL HAZARDS

PURPOSE

The purpose of this section is to assist employees in recognizing natural biological hazards such as plants, animals, and insects. These include spiders, snakes, poisonous plants and vegetation, ticks, and rodent or animal droppings that could contain Hantavirus. The discussion offers guidance on how to avoid exposure to these hazards, as well as recommendations for treating illnesses or injuries associated with these hazards.

SCOPE

This discussion is applicable to all employees who may be exposed to biological hazards while working. Employees involved in field activities should become familiar with the basic natural hazards that can be encountered during investigations or other activities. With this knowledge, employees can better avoid dangerous situations. Examples of potential natural hazards are provided below.

Note that different types of biological hazards exist in different regions of the country. Although the examples provided in this SOP are common, they do not form an exhaustive list of every pest you may encounter.

INSECTS

- **Ticks:** Small arachnids that are larger than mites and come in a variety of forms and sizes. Ticks attach themselves to warm-blooded animals and extract blood from the host. It should be noted that ticks harbor at least two diseases:
 - **Rocky Mountain Spotted Fever** is carried by some ticks and can be fatal. Symptoms can include fever, headache, and chills, experienced a few days after being bitten by a tick. Wood ticks can carry this disease.
 - **Lyme Disease** is usually carried by the small deer tick. It may take as long as 72 hours of feeding to transmit infection, so brief contact with such ticks should not be cause for alarm. Symptoms may include red rash around the point of entry and/or flu-like ailments. Antibiotics are usually effective in relieving symptoms and in preventing progression of the disease to more serious stages. If left untreated for weeks or months, Lyme Disease can cause serious nerve and heart ailments, such as meningitis and myocarditis. Months or years after initial infection, affected people may develop arthritis that can last for years. If you are

concerned about exposure to this disease, you can request that you be tested for this disease through your OHSC.

Ways to protect yourself from ticks:

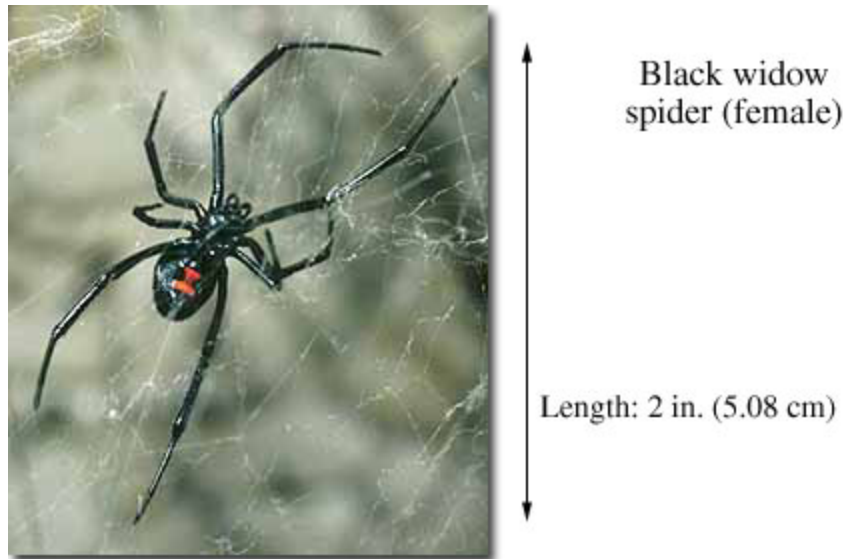
- When in the woods, wear clothing that covers the skin and fits snugly around the wrists, ankles, and waist. In areas known to heavily infested, openings at the pant legs and wrists should be sealed with duct tape. Avoid contact with vegetation such as tall grasses and bushes as ticks may transfer from these locations on to you.
- Wear light-colored clothing to make it easier to spot ticks.
- Use tick repellents (DEET) when working in areas known or suspected to be tick-infested.
- Apply tick repellent to clothing, concentrating on areas most accessible to ticks (for example, shoe tops, socks, and pant cuffs).

After being in a tick-infested area, check closely for any small ticks on the skin (especially the scalp and hair) and clothing. Ticks not completely removed can increase the likelihood of infection. If you find an attached tick, remove it, exercising care not to squeeze the insect's abdomen, since this may cause expulsion of fluids into the wound. The following procedures can be effective in removing ticks:

- Use tweezers to **slowly** pull the tick out of the skin.
 - Grasp the tick as close to the skin as possible before removing.
 - **Do not** attempt to burn the tick off with matches or hot objects.
 - **Do not** attempt other home remedies, such as coating ticks with Vaseline.
 - Contact WorkCare (800.455.6155) if you have difficulty in removing the tick or at the first sign of symptoms.
- **Chiggers:** These are red six-legged mite larva approximately the size of a pinhead. Chiggers suck blood and cause intense itching or irritation. To eliminate chiggers, methods outlined above for protecting against ticks can be effective. Flowers of sulfur (sulfur powder sold in drugstores) are known to be chigger repellent.
 - **Fire Ants:** Any of a genus (*Solenopsis*) of fiercely stinging ants. Fire ants got their name because their sting literally burns like fire. Fire ant venom is much more potent than other insects' venom in that it contains a high concentration of piperidine, an alkaloid compound with a high pH that is 95% insoluble in water. Piperidine is related to piperine, the main active ingredient in black pepper. Fire ant venom also contains a smaller amount of protein than is normally found in stings.

- Do not disturb any ant mounds or nests as the ants will leave the nest or mound and climb up anything they find.
- If fire ants do crawl onto your skin, they first bite with their mandibles in order to anchor for the thrust of the sting. As soon as you feel this pinching sensation, quickly sweep the ants off before they actually sting and you can avoid most of the damage from an ant sting. If you must work in proximity to fire ants, wear rubber boots and gloves powdered with talc.
- Immediately after being stung, wash off the area with alcohol, try not to scratch it so it doesn't get infected. Sometimes a white pustule will form the second day, but it will eventually be resorbed. Apply a hydrocortisone cream to the sting area to reduce inflammation. A thick paste of baking soda and water can also help right after the sting. Careful application of ice will help decrease pain, but can burn the skin if left on too long. If the pustule becomes infected, apply an antibiotic cream and keep the area clean and contact WorkCare (800.455.6155). Antihistamines may help with local reactions: burning and itching.
- If other reactions occur soon after the stings, i.e., difficulty breathing, itchy rash, loss of consciousness, etc., get the person to an emergency room immediately and then contact WorkCare (800.455.6155). About 1% of the population have the potential for serious and dangerous reaction to fire ants. A physician can prescribe a single dose epinephrine auto injector device to carry with you in case of subsequent ant stings and anaphylactic reaction.
- **Bees and Wasps:** Some people are highly allergic to stings from these insects (if so, those people should ask a physician for an emergency sting kit, and carry it at all times). The following are first aid procedures for bee or wasp stings:
 - Remove the stinger by scraping it out with the edge of a knife blade, tweezer tips, or similar device. **Do not** squeeze the stinger.
 - **Do not** use tweezers to grasp the stinger to remove it, as this may inject more poison.
 - Cover the wound, apply a cold pack, and watch for allergic reaction (note: stingers remaining in the body are a problem with respect to bee stings, but not wasp stings).
 - Contact WorkCare (800.455.6155) or seek medical attention if an allergic reaction occurs.
- **Spiders:** Venomous spiders indigenous to the United States include Black Widows and the Brown Recluse:

- **Black Widows** are shiny black spiders with long legs, approximately 2 inches in size. Females have an hourglass-shaped red mark on the underside of their abdomens.



- **Brown Recluses** are brown spiders approximately 1 to 2 inches in size. They have long legs and a distinctive dark brown fiddle-shaped marking on the underside. These spiders produce a dangerous necrotizing agent.



Rule of thumb in relation to spiders: Avoid placing hands in dark holes or spaces. Wear protective gloves when working near such areas. Black widow and brown recluse spiders are usually found in holes or out-of-the-way places. Be alert to spider webs in the field, and try to avoid walking through them. If you think you have been bitten by a venomous spider:

- Remain calm. Too much excitement or movement will increase the flow of venom into the blood.
- Apply a cool, wet cloth to the bite, or cover the bite with a cloth and apply an ice bag to the bite.
- Do not apply a tourniquet. This may cause more harm than benefit.
- Try to positively identify the spider or catch it to confirm its type.

PREVENTION OF INSECT BITES

Insect repellent containing DEET is the most effective insect repellent. It is found in a variety of readily available products. There has been some concern about the negative effects of using this chemical, particularly for children, but none of the “natural plant” products (see below) are likely to be as reliable.

Essential oil of eucalyptus (*Eucalyptus globulus*) is a natural insect repellent. You can make a solution by adding five drops to a cup of water, and then dab it on the skin. Essential oil of citronella discourages insects when placed on exposed skin. A few drops of calendula (*Calendula officinalis*) ointment on the face, arms, and legs may keep insects away. It is also available as a commercially prepared product.

Other recommendations for avoiding insect bites are as follows:

- Apply insect repellent before going into the woods or other areas where you may come into contact with insects. Use insect repellents according to directions, particularly when applying the repellents to children.
- Apply repellents safely. Some insect repellents can only be applied safely to clothing rather than skin.
- Do not apply repellent near mouth, eyes, or openings in the skin. Wash hands following application to avoid accidental ingestion.
- Wash insect repellent off with soap and water after returning indoors.
- Wear light-colored, smooth-finished clothes that cover your body, such as long-sleeved shirts and long pants. Button long sleeves and tuck long pants inside boots. Avoid loose clothes that might entangle a biting or stinging insect.

- Always close vehicle windows when vehicle is parked or while driving through vegetation.
- Avoid flowering plants.
- If you have a severe allergic reaction (anaphylaxis) to insect bites or stings, have someone notify WorkCare (800.455.6155) and carry necessary antidote.
- Avoid swatting at insects or flailing your arms around them. Instead, retreat slowly and calmly when insects act threatening.
- Avoid wearing perfumed lotions, aftershave, or scented hair products during the warmer months.

POISONOUS PLANTS

Poison ivy, poison oak, and poison sumac cause a short-lived but extremely irritating allergic form of contact dermatitis. The leaves, stems, and roots of these plants contain the resin urushiol, even small amounts of which on exposed skin can trigger an inflammatory allergic reaction. Urushiol can be transferred by fingers or animal fur, and can remain on clothing, shoes, and tools for a number of months. Urushiol particles can also travel in the wind when the plant is burned in a fire. Scratching the rash does not spread the poison to other parts of the body, but can prolong discomfort and cause a secondary infection.

The rash from urushiol generally develops within 2 days, peaks after 5 days, and starts to decline after about a week or 10 days. While some people survive exposure without ill effects, complete immunity is unlikely. People who seem immune from poisonous plants at one time and place may find themselves vulnerable in other situations. Of primary concern are:

- **Poison Ivy:** A plant (*Rhus toxicodendron*) characterized by leaves arranged in threes, ranging from less than a foot to 5 feet in height when the plant is free-standing or taller when climbing. Poison ivy has greenish flowers and white berries, and its leaves turn yellow in the fall. When oils from the plant contact skin, they can produce a rash and intense dermal itching.
- **Poison Oak:** Characterized by alternate leaves with three or occasionally five veined, shiny leaflets, poison oak thrives throughout the United States. In autumn, the leaves turn a deep red color. Exposure to the oily sap contained in all parts of the poison oak (roots, stem, leaves, flowers, and the fruit [berries]) may cause skin irritation ranging from mild to severe. Between 50 and 85 percent of the population is allergic to



poison oak, resulting in a more severe reaction when exposed. Primary contamination results from contact with bruised or broken plant parts that release toxicodendrol, an oily resin containing urushiol. Because the lacquer-like resin does not dissolve in water, it is difficult to wash off and its toxicity persists for a long time.

- **Poison Sumac:** A shrub (*Toxicodendron vernix*) characterized by pinnate leaves that have red stems and leaf veins, clusters of greenish yellow flowers that produce ivory-white fruit with a fleshy outer skin, and poisonous oils that irritate the skin.



Treatment for Exposure to Poisonous Plants

If you think you have been exposed to poison ivy, oak, or sumac, wash all exposed areas thoroughly. If you can do this within 5 minutes of contact, you may often avoid allergic reaction.

You can also treat most cases of the rash with applications of calamine lotion, Burrow's Solution, or over-the-counter topical remedies containing antihistamines or hydrocortisone. Cold compresses--15 to 30 minutes several times a day--are useful for itching and blistering; cool showers are also effective. A cortisone shot may relieve the itching, particularly within 24 hours of exposure.

Oral corticosteroids or antihistamines may also relieve the symptoms, but both drugs can have unwanted side effects. If you have complications from a severe case, you may need to see a doctor.

If you do contact any of these poisonous plants, be sure to clean your clothing, tools, or any gear that you may have had with you. Because urushiol can remain on clothing or other items for extended periods of time, touching these items can cause reinfection at a later date.


Prevention of Exposure to Poisonous Plants

The best way to prevent exposure to poisonous plants is to learn to recognize these plants, and avoid contact with them.. Barrier ointments or lotions from outdoor suppliers help if you are working around heavy vegetation.

ANIMALS

- **Rabid Animals:** Some mammals may carry rabies, and rabid animals tend to approach people instead of avoiding them. Beware of nocturnal (night dwelling) animals (such as raccoons or opossums) active during the day.
- **Dogs:** Realize that dogs encountered in the wild tend not to be "man's best friend," even if they look like "Lassie." Two or more dogs together constitute a pack (with a tendency toward fierce behavior), and can pose significant threat. Roaming animals, particularly large dogs that instinctively hunt by sight (such as collies or shepherds),

are cause for concern. Some breeds (cocker spaniels and English Springer spaniels) are notorious for erratic fits of violent behavior. Other dogs are bred as guard dogs or fighting dogs (Dobermans, Rottweilers, Boxers, and Bulldogs). Dogs that are unconfined are more likely to contract rabies. Beware of dogs that foam at the mouth or show their teeth. Upon encountering such a dog, do not make any sudden moves. Do not make direct eye contact with the dog. Back slowly away from the animal, and never turn your back on unknown dogs

- **Alligators-** The American alligator was once very common in rivers, creeks, and backwater sloughs of East and South Texas, Florida, and other southern states. It is not uncommon for alligators to bask along the banks of a pond or stream for extended periods of time. These alligators are usually warming their bodies; they are not actively hunting. Often times a basking alligator may be seen with its mouth open; this is a way to cool its body temperature down, since alligators do not pant or sweat. An approaching human should cause these alligators to retreat into the water. (In some cases, the alligator may be protecting a nest) However, an alligator may be considered a nuisance if it leaves the banks of the water body to spend time near homes, livestock pens, or other structures. Alligators have a natural fear of humans, and usually begin a quick retreat when approached by people.
- 
- **Bears-** Black bears can be found across most of North America, whereas grizzly/brown bears are found only in the northwestern states, Alaska and western Canada. Black bears that reside in the Southwest primarily live in the pine forests and chaparral(brush) zones, and occasionally wander into lower elevations. Black bears should always be considered unpredictable and potentially dangerous. A black bear will usually detect your presence and flee the area before you notice unless the bear has been conditioned to people and their foods.. If you work in bear country, always work in groups and carry a Bear Deterrent Spray.
 - **Cougars (Mountain Lions)-** The cougar, as known as mountain lion, may select a range located anywhere from the shore of the sea up to the higher elevations of mountain slopes, reaching up to elevations up to 11,000 feet in California. The cougars can be found in western states such as California, Oregon, Washington, and Arizona, but can be found in other states. Cougars also. prefers densely forested areas in coastal swamps such as those of southern Florida, and it tends to choose vegetated ridges, rocky cliffs and ledges, and other solid covers in inland areas such as those of the Southwest desert basin and mountain range country.

Prevention of Animal Bites

As a rule of thumb, it is a good idea to carry a large stick for self-defense (the stick can also serve as a hiking aid on some sites). Methods for preventing attack include:

- Do not disturb animals while they are eating, sleeping, or nursing. Animals that have given birth can be very aggressive when protecting their young.
- Do not approach or play with unfamiliar or stray pets.
- Do not run past a dog, because dogs naturally tend to chase and catch things.
- Many animals give warning before they attack. Be aware of unusual noises or growling from animals.
- Firearms should not be carried or used on the job site for protection against animals.

If you see a threatening dog:

- Notify animal control and, if possible, speak with the owners.
- Stay still. Do not run.
- Do not make direct eye contact with or stare at the dog. Staring may be interpreted by the dog as a threat and aggression.
- Do not smile at the dog, since showing your teeth may be taken as an aggressive action by the dog.
- Don't scream. If you say anything, speak calmly and firmly.
- If you fall or are knocked to the ground, curl into a ball with your hands over your head and neck. Protect your face.
- Do not touch wild animals or provoke them to attack.
- Do not handle sick or injured animals.

If you have a close encounter with an alligator:

- Back away slowly. It is extremely rare for wild alligators to chase people, but they can run up to 35 miles per hour for short distances on land. Never make the mistake of thinking that an alligator is slow and lethargic. Alligators are extremely quick and agile and will defend themselves when cornered. A female protecting her nest might charge a person who gets close to the nest, but she would quickly return to the nest after the intruder left.
- If you hear an alligator hiss, it's a warning that you are too close. NEVER feed an alligator.
- Avoid walking near water and streams where alligators may be present. If you walk near the water and an alligator comes straight toward you, run as fast as you can in a straight line, preferably in a path with obstructions that will slow the alligator down.

If it comes out of the water, it is definitely a nuisance alligator that needs to be reported to local animal control. In many cases, these are alligators that have been fed by people or have been allowed to get human food.

- Always seek immediate medical attention even for a small alligator bite, since all bites can result in a serious bacterial infection that may be life-threatening.

If you have a close encounter with a bear during field activities:

- Stop, stay calm and quiet, and make no sudden moves.
- Break eye contact - do not stare in the bear's eyes, as this is a sign of aggression.
- Stand your ground - do not turn your back on the bear - sometimes a bear will bluff charge several times. Have your Bear Deterrent Pepper Spray ready, but do not spray unless you are sure the bear is close enough to spray in the face.
- Look for signs of agitation and aggression - When a bear is standing on its hind legs, it is usually just trying to get a better look and smell of you. When a bear is upset it may have its ears back- it may lower its head and swing it from side to side- it may paw at the ground- it may make huffing or woofing noises- it may snap its teeth- or not show any signs at all, and just drop and charge with no warning.
- Back away slowly, speaking in a calming, monotone voice - you want to show the bear that you are being submissive and want to get out of "its" territory. Do not turn your back and always have your Pepper Power ready.
- If the bear comes at you - spray the Bear Deterrent Pepper Spray aiming for the bear's face or spray a fog out that the bear has to run through to get to you.
- Being close to a sow with cubs is always a dangerous situation.
- Keep a cool head - Try to stay calm, do not yell or scream.
- Some bears, even grizzlies, will climb trees after you. Also a grizzly can reach 10 feet up a tree while standing on the ground.
- Right before a grizzly bear makes contact in a surprise attack at close range (and you don't have pepper spray), roll into a ball or lie face down, try to protect your neck and face, and pray. Don't stick your arm out, kick, scream, or fight. Try to protect the



vulnerable parts of your body while remaining as still as possible, this will actively be helping the bear remove the perceived threat. Surprising a territorial male bear or a sow with cubs will almost always be a threatening situation.

- Some bears, mostly young bears unfamiliar with the dangers of human contact, have been known to actually stalk humans. If you believe this is the situation you are in, and have not just surprised the bear, it is recommended that you defend yourself aggressively.
- If the bear mauls you continuously, despite yourself being passive, you may have to fight back. Try using any available weapon - a knife, rock, fist - and concentrate on hitting the bear's head, eyes and nostrils.

If you encounter a cougar, the following are some safety tips to avoid attack:

- Stand your ground, make eye contact, and back away very slowly; don't bend down, crouch, attempt to hide, turn your back, or run, as these behaviors are likely to trigger an attack. In other words, don't behave like prey.
- Don't corner the cougar – make sure that it has enough room to escape.
- If you have children with you, pick them up but don't bend down to do so.
- Speak firmly in a loud, confident voice.
- Make yourself look larger by raising your arms, opening your jacket, or waving branches or sticks.
- Make noise – clap your hands.
- Throw something at the cougar that you have handy, such as a water bottle (but don't bend down for a stone or other object).



Although an attack is unlikely, if the cougar does follow through, fight back aggressively. Many people have managed to drive attacking cougars away using garden tools, fishing rods, rocks, sticks, other handheld items, and even their own fists. If knocked down, get up and stand up if possible, and continue fighting.

If you need to rescue a trapped or injured animal, get help from Animal Control personnel. If no help is available, wear the heaviest gloves and clothing that you have. Do not move quickly when approaching animals, and talk in a low, gentle voice to reassure them.

SNAKES AND LIZARDS

A bite from a poisonous snake or lizard requires emergency care. If you have been bitten by a snake or lizard that you know or suspect might be poisonous, **call 911 or other emergency services immediately and contact WorkCare (800.455.6155)**. Do not wait for symptoms to develop.

If you are not sure what type of snake or lizard bit you, **call the poison control center immediately (1-800-222-1222)** to help identify the snake or lizard and to determine the next steps to take. Medication to counteract the effects of the poison (antivenin) can save a limb or your life.

It is important to stay calm and lie still as much as possible after a suspected poisonous snake or lizard bite. Vigorous physical activity may increase the flow of venom to the bloodstream.

Poisonous snakes or lizards found in North America include pit vipers (family Crotalidae), such as copperheads, rattlesnakes, and water moccasins (also called the cottonmouth); coral snakes (family Elapidae); and the Gila monster and Mexican beaded lizard:

- The **Northern Copperhead** is characterized by a coppery-red head and an hourglass pattern consisting of dark chestnut crossbands that are wide at the sides and narrow at the center of the back. Small dark spots are frequently present between crossbands, and dark rounded spots exist between the crossbands at the base of the belly. Young Northern Copperheads are paler in color and have bright yellow tail tips. They also have a narrow dark line that extends from both sides of the eye and divides the dark head from the pale mouth. Rocky, wooded hillsides and mountainous areas are typical habitats. Abandoned and rotting slab (the outer strips of logs) or sawdust piles also attract these snakes.

The symptoms reported after a copperhead bite can include: pain and swelling in the area of the bite (swelling may take several hours to develop). The severity of the signs and symptoms developed after a bite varies with the amount of venom injected, size of the snake, age and size of the victim, prior health status of the victim, location of the bite, and the bacteria present in the snakes mouth. *The poison center should be contacted as soon as a suspected bite occurs.*

- The **Timber Rattlesnake** can have either one of two different color patterns:
 - **Yellow phase:** Black or dark brown crossbands on a ground color of yellow, brown, or gray; the crossbands, which may be V-shaped, break up anteriorly to form a row of dark spots down the back, plus a row along each side of the body.
 - **Black phase:** A heavy stippling of black or very dark brown hides much of the



Western diamondback rattlesnake

lighter pigment; completely black specimens are not unusual in the uplands of the Northeast.

Young rattlesnakes are always cross-banded, as in the yellow phase, but with darker colors.

The Timber Rattlesnake is the only rattlesnake in the populous Northeast. Although it is still common in some mountainous regions (for example, the Blue Ridge Mountains), it has almost completely disappeared from many places where it was once abundant (such as the Washington metropolitan area). As its name indicates, this is a snake of timbered terrain, preferring areas of secondary growth where rodents abound.

- The **Mojave Green Rattlesnake** is the most dangerous snake in North America – 30 times more toxic than Western Diamondback and has two types of venom:
 1. Hemotoxin – destroys blood cells and tissue
 2. Neurotoxin – destroys nerve cells and may stop breathing process.

The snake is more aggressive than other rattlesnakes and generally 2 to 5 feet in length with a thick body. The snake can be identified by the diamond pattern on its back fading to a ring pattern at the tail.

Mojave Green Rattlesnake



- The **Western Diamondback Rattlesnake** is the largest western rattlesnake. It has a plump body, a short tail, and a broad, triangular head that is very distinct from the body. This snake can be yellowish gray, pale blue, or pinkish, and has dark diamond shape marks down its back. There is also a rattle at the end of its tail.

The severity of a rattlesnake bite is gauged by how rapidly symptoms develop, which depends on how much poison was injected. Signs and symptoms of a pit viper bite include:

- Immediate and severe burning pain and swelling around the fang marks, usually within 5 minutes. The entire extremity generally swells within eight to 36 hours.

- Purplish discoloration around the bite, usually developing within two to three hours.
 - Numbness and possible blistering around the bite, generally within several hours.
 - Nausea and vomiting.
 - Rapid heartbeat, low blood pressure, weakness, and fainting.
 - Numbness and tingling of the tongue and mouth.
 - Excessive sweating.
 - Fever and chills.
 - Muscular twitching.
 - Convulsions.
 - Dimmed vision.
 - Headache.
- **Coral snakes** are found in tropical regions of North America, and are often confused with nonpoisonous milk snakes because they look similar. The physical characteristics of a coral snake include:



Coral snake



Milk snake

- Red, yellow, and black bands along the length of the body.
- Round pupils and a black nose.
- Fangs: Coral snakes tend to chew on their victims for a few seconds and may leave tooth marks with or without fang marks.
- Length up to 3 feet (0.9 m).

Coral snake venom causes the following signs and symptoms:

- Minor pain may initially be the only symptom.
- Within 90 minutes, a feeling of weakness or numbness may occur in the bitten extremity.

Additional symptoms may appear up to 12 to 24 hours after a bite. Symptoms may include:

- Increased salivation and drooling.
- Drowsiness or euphoria.
- Slurred speech.
- Nausea and vomiting.
- Numbness and tingling (paresthesia).

Symptoms that occur less often are double vision, difficulty breathing, sweating, muscle aches, and confusion. In rare cases, a person may die from a coral snake bite.

- The **cottonmouth** (or water moccasin) is a poisonous snake found in southeastern and south-central North America. Cottonmouths usually leave distinctive double fang marks on the skin, although on rare occasions they may produce one or three puncture marks. The physical characteristics of a water moccasin include:



Cottonmouth (water moccasin)

- Distinctive white coloring inside the mouth.
 - Pitlike depressions behind the nostrils.
 - A triangular head with slit-shaped pupils and fangs.
 - A single row of plates or scales on the undersurface of the snake.
 - Length up to 6 feet (1.8 m).
- The **Gila Monster** is one of only two species of seriously venomous lizards. The Gila monster and the closely related **Mexican beaded lizard** are the only known venomous lizards in the world. These heavy bodied lizards are easily distinguished from non-venomous species by the bead-like surface and yellow or coral colored pattern of their skin. They are described as shy and retiring reptiles, not prone to attacking humans unless they are significantly agitated. Arizona laws protect these fascinating animals from being captured or held in any manner. These large reptiles have a well-deserved reputation for clamping down on a victim with their teeth and not letting go. Most serious bites occur when the Gila monster's lower jaws secure a firm hold on the victim that lasts for several minutes.

The bite is described as extremely painful, although initial pain is generally confined to the area of the bite. Victims may also experience localized swelling, nausea, vomiting, high blood pressure, weakness, faintness, excessive perspiration, chills and fever.

What To Do if Bitten

If you are bitten, it is important to remove the lizard as soon as possible. One of the more practical ways to do this is to pry open the lizard's mouth with a strong stick--but be sure to allow the lizard a solid foothold on the ground while you are trying to pry it off.

The brittle teeth of the gila monster may remain imbedded in the wound and **must be removed by a medical professional**.

- First aid in the field may include
- irrigating the wound with plenty of water
- immobilizing the affected limb at heart level,
- reassuring the patient.

Gila Monster



Mexican Beaded Lizard



Treatment of Snake Bites

If you are bitten by a snake or lizard that you know or suspect is poisonous, **call 911 or other emergency services immediately and contact WorkCare (800.455.6155)**. Do not wait for symptoms to develop. Symptoms may progress rapidly from mild to severe.

Medication (antivenin) to counteract the effects of the poison can save a limb or your life. Antivenin is given as soon as a health professional determines it is needed, usually within the first 4 hours following a bite. Antivenin may be effective up to 24 hours after the bite.

Immediate on-site treatment should not delay transport for emergency evaluation. Remain calm. Lie down and stay as quiet and still as possible after being bitten. Any physical activity may increase the flow of venom through the bloodstream.

If you are not sure which type of snake or lizard bit you, **call a poison control center immediately (1-800-222-1222)** to help identify the reptile and to determine the next steps to take. If signs of shock are present or the bite victim is not breathing, administer CPR.

Remove any jewelry on the bitten limb. The limb might swell, making it more difficult to remove the jewelry after swelling begins.

With a pen, mark the edge of the swelling around the bite every 15 minutes so that the progression of swelling can be evaluated.

Apply a splint to the arm or leg that was bitten to limit motion and the flow of venom into the bloodstream. If possible, keep the bitten area at or slightly lower than the level of the heart.

Drink fluids (not alcohol) in frequent, small amounts unless vomiting occurs. This will help to prevent dehydration and reduce the risk of shock.

Extraction Devices

Extraction devices are designed to remove snake venom with suction if the device is applied within 3 to 5 minutes after a bite. For best results, leave the device on for 30 minutes. When using an extraction device, **do not** cut the skin over the bite. Extraction devices are not likely to be beneficial if they are not placed within 3 to 5 minutes after a bite.

Extraction devices come with different-sized suction cups that attach to the barrel of a syringe. The suction cup is applied over the bite, and the vacuum suction of the syringe draws out fluid and venom. As the fluid and venom fill the syringe, suction is lost. These devices can be emptied and then reapplied during transport to emergency care.

Extraction devices may cause skin and tissue damage at the application site. Treatment may be needed to prevent infection.

Extraction devices are only a temporary first aid measure. Using an extraction device does not guarantee that venom will be removed. A person who has been bitten by a poisonous reptile still requires immediate transport to emergency care. If you were bitten by a known or suspected poisonous snake or lizard, **call 911 or other emergency services immediately**. Medication (antivenin) to counteract the effects of the poison can save a limb or your life.

Prevention of Snake or Lizard Bites

Many snake and lizard bites can be prevented. Find out which local snakes and lizards are common to your area. Learn what they look like, whether they are poisonous, and where you are most likely to encounter them.

If you see a snake or lizard, do not disturb it. Keep in mind that the striking range of a snake is about half its length.

Avoid picking up or handling snakes. Even a severed snakehead can release venom through reflexes for up to an hour after the snake dies.

Watch for snakes around wood or rock piles or caves. Wear protective shoes, boots, and clothing when you are working in areas with these types of hazards.

If you are frequently in an area where there are poisonous snakes, consider carrying an extraction device, an elastic rolled bandage, and splinting materials (such as a SAM splint) in the site's first aid kit. Also carry a cellular phone, if you have one available, to use in the event of an emergency.

ACKNOWLEDGEMENT PAGE

“I have read the attached Health and Safety Plan for 2439-2445 Santa Monica Boulevard, Santa Monica, dated January 2011. I have discussed any questions that I have regarding the materials with the person in charge of site safety for SCS activities on the project, and I understand the requirements.”

Name	Signature	Company	Date

Approved by: _____

Date: _____

Job Task Safety Analysis and PPE Assessment Form: FORM- 08

Job Task Safety Analysis Form			
Task Type: Engineering Services	Task Description Soil Sample Collection with Geoprobe and/or hand auger	Location or Project: VCLP ISRA Activities	
		Date Revised: October 2011	
		Project #/Revision #: 01211289.00	
Analysis Team Member	Position Title	Reviewed by	Position Title
Kevin Green	Project Director	Gary Pons	Health and Safety Director
Ken Lister	Project Manager		
Jeff Seig	Site Team Leader		
Special Training Required:	None		
Applicable SAFE Checklist(s):	ES SAFE Observation Report		

Job Task Step	Potential Environmental and Personal Hazards¹	Critical Actions	PPE Required
1. Review & Sign SSHSP/JTSA	None	None	None
2. Unpack lab equipment, check inventory, review laboratory instructions.	Sample bottles may contain acid preservative. Any free liquid encountered in a cooler should be considered to be an acid.	Check for leaking containers. Ensure you have everything you need to complete the task.	Head: None Body: Hi-vis shirt or vest Foot: Steel-toe boots Hand: Nitrile gloves Respiratory: None Hearing: None Eye/face: Safety glasses
3. Calibrate field sampling equipment.	Radiation hazard	Ensure equipment is clean and probes, meters and instruments are calibrated per manufacture's instructions.	Head: None Body: Hi-vis shirt or vest Foot: Steel-toe boots Hand: Nitrile gloves Respiratory: None Hearing: None Eye/face: Safety glasses
4. Travel to soil sampling location.	Snakes, spiders, ticks; slip/trip hazards; animals	Use snake guards for high grass areas. Only use non-synthetic bug repellants (NO DEET). Use spike overlays for snow or icing conditions, use boots that are slip resistant and provide good ankle support.	Head: Hard hat Body: Hi-vis shirt or vest Foot: Steel-toe boots Hand: Nitrile gloves Respiratory: None Hearing: None Eye/face: Safety glasses

Job Task Step	Potential Environmental and Personal Hazards¹	Critical Actions	PPE Required
5. Observe Geoprobe activities	Getting struck by heavy equipment, steep slopes/ uneven terrain, flying particles and debris/falling objects, slip/trip fall hazards; overhead hazards; high noise; dust	Keep personnel away from heavy equipment when possible. Use of pre-determined hand signals to communicate with ground crew. Watch for uneven surfaces/ trip hazards Use boots that are slip resistant and provide good ankle support Approach excavations from down slope direction	Head: Hard hat Body: Hi-vis shirt or vest Foot: Steel-toe boots Hand: None Respiratory: None Hearing: Earplugs Eye/face: Safety glasses
6. Hand auger at soil sample locations	Overextension, repetitive motion; heat stress; airborne contaminants	Keep arms close to body when hand auguring Take breaks and drink at least 4 cups of water per hour Perform air monitoring to determine if any airborne levels are present.	Head: Hard hat Body: Hi-vis shirt or vest Foot: Steel-toe boots Hand: Leather gloves Respiratory: None, APR available Hearing: None Eye/face: Safety glasses
7. Collect soil samples	Getting struck by heavy equipment, overextension	Keep personnel away from heavy equipment when possible. Keep arms close to body when lifting. Seal sample containers immediately and store properly. Fill out sample log.	Head: Hard hat Body: Hi-vis shirt or vest Foot: Steel-toe boots Hand: Nitrile gloves Respiratory: None Hearing: Ear plugs Eye/face: Safety glasses

Job Task Step	Potential Environmental and Personal Hazards ¹	Critical Actions	PPE Required
8. Label containers and collect samples.	Splash hazard, overextension.	Seal sample containers immediately and store properly. Fill out sample log.	Head: Hard hat Body: Hi-vis shirt or vest Foot: Steel-toe boots Hand: Nitrile gloves Respiratory: None Hearing: None Eye/face: Safety glasses
9. Prepare samples to be shipped to lab.	Take care in handling samples.	Follow proper guidelines for shipping samples.	Head: None Foot: Steel-toe boots Hand: Nitrile gloves Respiratory: None Hearing: None Eye/face: Safety glasses
End of JTSA Form			

¹. See SCS Injury Illness and Prevention Plan Table SOP 4-1 for examples of Environmental Hazards.

² See SCS Injury Illness and Prevention Plan Table SOP 4-2 for examples of Personal Hazards.