

# **Integrated Monitoring Protocol for Cave Entrance Communities and Cave Environments in the Klamath Network**

## **Standard Operating Procedure #1: Training**

**Version 2017Feb10**

Please cite this SOP as:

Krejca, J. K., G. R. Myers III, A. Chung-MacCoubrey, E. C. Dinger, S. Mohren, D. Riggs, D. Sarr, K. Smith, A. Snyder, and S. Thomas. 2017. Standard Operating Procedure 1: Training. Version 2017Feb10. Integrated monitoring protocol for cave entrance communities and cave environments in the Klamath Network. Unpublished National Park Service Report, Klamath Inventory and Monitoring Network, Ashland, Oregon.

To create a new version of this SOP, carefully follow the instructions in SOP #18: Revising the Protocol (<https://irma.nps.gov/DataStore/Reference/Profile/2238840>). Use the Revision History Log below to describe the revisions:

- Populate the top table of the revision history log, providing the previous version date, author of the change, a specific but concise description of the changes made, the footnote number associated with change details, and a new version date.
- In the bottom table, add a footnote and as much text as needed to describe in detail the reasons for and implications of the change.

### Revision History Log

| Previous Version Date | Author of Change | Changes Made | Footnote # | New Version Date |
|-----------------------|------------------|--------------|------------|------------------|
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| Footnote # | Detailed Reasons for and Implications of the Changes |
|------------|------------------------------------------------------|
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## **1 Introduction**

This Standard Operating Procedure (SOP) provides instruction on training field technicians. Seasonal field technicians are usually employed between April and September, although they might be available at other times of the year. These training guidelines can be adjusted to any point on the annual calendar as technicians are needed (SOP #2: Scheduling). General training is provided to all seasonal workers, and specific training tasks applicable to each parameter are described in this SOP. A few key tasks regarding data management and reporting will require additional skills and will be performed by park or Klamath Network (KLMN) staff.

## **2 Qualifications**

The following skills are mandatory in a field technician:

- High level of physical fitness.
- Proven ability to work positively with others in a field setting.
- Familiarity with standardized field data collection.
- Ability to work underground inside constrictive spaces.

## **3 General Training Guidelines**

Ensuring that field crews are adequately trained begins with the selection of qualified individuals with prior knowledge of and experience in cave ecology and monitoring methods. Because it is not always possible to hire the “ideal” individual, a comprehensive training program will be implemented so that crews are familiar with all techniques used in the field and office and are prepared to respond to possible contingencies.

Typically, all seasonal technicians receive training when they are introduced to the park, its facilities, personnel, and the day to day operations. They receive park training in safe caving techniques, radio communication, backcountry travel, minimizing impacts, navigating in the parks (including reading cave maps and using a GPS receiver), and dealing with emergencies. This training is not described in detail in this SOP because it is the standard practice at the park to provide such training to its staff, and each park’s respective staff will be implementing this protocol. Training and practice on an SOP can span roughly 3 to 5 days. It is practical and efficient to teach and practice multiple SOPs at a time given that multiple SOPs are typically implemented during cave visits. Once hired, technicians will be given a description of their role, responsibilities, and expectations, along with a list of required and recommended personal equipment and a copy of the monitoring protocol. Once the crew members arrive at the park, the Project Lead, cave specialist, and Field Lead should review every aspect of the protocol to ensure it is implemented accurately and efficiently. Many of the training elements are best demonstrated in the field. Hands-on training and practice in non-I&M (Inventory and Monitoring) caves is critical and will occur prior to performing I&M cave monitoring. The Field Lead will accompany the new technician(s) to sites during the first week of implementing any new SOP (SOPs are implemented at different times of the year).

Additional tasks, such as tape surveys or setting bolts are required during the initial setup phase of protocol implementation but are not skills required thereafter.

#### **4 Backcountry Rules and Ethics**

Technicians will receive instruction on park-specific backcountry regulations (note that some of these rules may differ between parks). It is the park Field Lead's responsibility to ensure that all crew members understand the rules that they must follow. Technicians will also be trained in safe caving techniques as well as techniques that minimize impacts and disturbance to the cave environments.

#### **5 White Nose Syndrome**

Training will be provided on methods for preventing the spread into park caves of the fungus *Pseudogymnoascus destructans*, the pathogen causing White Nose Syndrome (WNS) in bats. All personnel entering caves will follow the latest park WNS protocol available. Each park's specific WNS protocol will be based on national-level guidance on decontamination, which is found at <https://www.whitenosesyndrome.org/topics/decontamination>. Training will be updated to match national and park protocols, which are changing as WNS spreads across North America. At the time of this writing, park procedures require the use of dedicated field equipment (i.e., gear and clothing used only within the park) or decontaminated equipment from areas not affected by WNS. The latest map of WNS spread may be found at <https://www.whitenosesyndrome.org/resources/map><https://www.whitenosesyndrome.org/resources/map>.

The resource managers of each park have the authority to reschedule or skip certain SOPs if they deem there is a tangible, unmitigated risk during specific times or at specific places for bats (i.e., presence of maternal colonies).

#### **6 First Aid, Safety, and Emergency Procedures**

All Project Leads, Field Leads, technicians, and interns will be working in remote areas; it is therefore essential that everyone, to the extent possible, be prepared for emergency situations. Field crews will receive safety training according to each park's safety program. Caving hazards and mitigation will be discussed using each park's caving Job Hazard Analysis (JHA) as an outline (see JHAs at end of this SOP). The Klamath I&M Network Safety Plan is available as a resource, but when both park and network safety plans/protocols exist, the park safety plan, procedures, and resources should always take precedence. Although providing extensive first aid training is beyond the scope of the training program, we recommend requiring the crew to read and discuss in detail a simple wilderness first aid booklet prior to beginning field work. Crews will also brainstorm potential responses to theoretical emergency situations and have a clear understanding of what to do if they or someone else on the crew becomes seriously injured or missing. Specifically, instruction will be given on whom to contact in the event of an emergency, and whom to contact if field personnel become missing.

#### **7 Data Collection and Entry**

Technicians must be shown how to complete each field datasheet and have an opportunity to practice completing them during training so that questions can be resolved before data collection begins. In

addition, technicians will be trained in data entry according to SOP #13: Data Entry at the onset of the field season. Use of each pertinent database will be demonstrated by entering several example records. Time will be allotted for the field crew to practice data entry and for questions to be answered.

## **8 Data Management**

In addition to collecting and entering data, field crews should be trained on how to manage the data and information they collect. Storage, backup, and delivery methods should be described to ensure that all data products are managed appropriately. Crews should understand how to manage the data while in the field, download the data into the project folder, implement data validation and verification, finalize the data, and submit the data to the Project Lead and Data Manager.

## **9 Monumenting Sites**

After the first year, all caves and sampling locations in the caves should be monumented using methods described in SOP #3: Site Selection and Marking. Crew members should be able to recognize monumented sites, know what to do if a site cannot be found, know how to inspect site markers, and know how to replace site markers that are damaged or missing.

## **10 Task-Specific Training**

All personnel will be trained in the use of equipment, data collection, and other activities required for each of the SOPs to which they are assigned. Each park and the KLMN will maintain staff member(s) who have intimate knowledge of this protocol, can train seasonal workers, and are able to answer questions about this project. Each SOP provides more detail on how to accomplish each task. The requisite knowledge to follow each SOP (beyond the general skills mentioned above) is listed here, organized by SOP.

### **10.1 Water**

The water levels in pools will be measured by staff gauges. In areas where a staff gauge cannot be permanently installed, a permanent ceiling hook will be installed so that the gauge can be removed and later replaced at the same point. Field crews should be trained in the following:

1. Locating off-trail monitoring pools and ceiling hooks for staff gauges.
2. Inserting staff gauges onto ceiling hooks.
3. Measuring water level on staff gauge.
4. Entering data on datasheets and in the database.

**10.2 Climate**

Currently, HOBO Pro-V2 U23-001 data loggers are used to record temperature and relative humidity. Field crews should be familiar with the manufacturer's instructions and trained in the following:

1. Initial setup of the data loggers.
2. Calibration of the data loggers.
3. Changing the battery in the data loggers.
4. Downloading the data loggers while in the field using the data shuttle.
5. Entering data on datasheets and in the database.
6. Storing the downloaded data when back at the office.
7. Using the HOBOWare Pro software to review the data.
8. Converting the data to .txt files.

**10.3 Ice**

Monitoring the ice is performed 4 ways: (1) photomonitoring, (2) plumb bob distance from permanent stations, (3) laser distance meter transects, and (4) laser distance meter perimeter surveys. Each of the quantitative methods (2-4, above) involves tying in to permanent stations in the cave wall that have a known elevation (in feet above mean sea level). Field crews should be trained in the following:

1. Recognizing survey markers or reference stations.
2. Using a plumb bob for vertical alignment.
3. Measuring distance using a survey tape.
4. Using a laser distance meter.
5. Using standard cave survey techniques (sketching not required).
6. Downloading and storing field data.
7. Entering data on datasheets and in the database.
8. Configuring camera and flash settings for low light conditions.

#### **10.4 Visitation**

A combination of ticket sales, cave registers, and infrared trail counters will be used to sample visitor use at each park. The Project Lead and crew members should be knowledgeable about the visitor collection methods being used at the park where they are working. Field crews should be trained in the following:

1. Setting up, downloading, resetting, and calibrating electronic visitation data collection devices. This includes TRAFx infrared trail counters (see SOP #7 for instructions and location of reference manuals).
2. Understanding the design of the cave registers and how to interpret the data collected by them.
3. Entering data on datasheets and in the database.
4. Storing and managing data before and after transfer to the Klamath Network.

#### **10.5 Bats**

This protocol requires monitoring a subset of caves that contain a majority of the known Townsend's Big-eared Bat population at Lava Beds National Monument (LBE), and monitoring the bat population in The Cave (Oregon Caves National Monument and Preserve [ORCA]). Training for this SOP should include surveys in non-I&M caves to provide technicians with practice to develop search images for hibernating bats on cave walls and crevices. Field crews should be trained in the following:

1. Familiarity with bat surveys (at least 1 person) as described in SOP #8: Bats.
2. Ability to count animals and make extrapolations based on area to achieve counts (this is a basic natural resource skill that most technicians will probably possess).
3. Ability to recognize different bat species with on-site training. At a minimum, at least 1 member of the crew should be able to tell the difference between *Myotis* and *Corynorhinus* bat species. These genera are relatively easy to differentiate based on the large difference in ear size.
4. How to enter data on datasheets and in the database.
5. How to document unknown or unidentified species.

**10.6 Cave Entrance Vegetation**

A line-transect point-intercept method and photo monitoring will be used to rapidly assess vegetation at the cave entrance. Field crews should be trained in the following:

1. Ability to distinguish vascular plants, bryophytes, lichens, and plant growth forms as described in SOP #9: Cave Entrance Vegetation.
2. General methods on setting up the plot and measuring the vegetation using a transect and plumb bob.
3. How to enter data on the datasheet and in the database.
4. Methods to document, photograph, and manage unknown species.

**10.7 Scat and Visible Organics**

No special skills beyond the ability to follow a photo key of scat and organic matter is needed for this SOP. Field crews should be trained in the following:

1. General methods to survey for scat and organic matter as described in SOP #10: Scat and Visible Organics.
2. How to enter data on datasheets and in the database.

**10.8 Invertebrates**

This protocol requires the use of bait station methods to attract and identify invertebrate species as described in SOP #11: Invertebrates. Similar to bat survey techniques, training on this SOP should include practice with several invertebrate searches to assist in the development of search images. This practice can occur at non-I&M caves or during bait setup at I&M caves; data should not be officially recorded during practice sessions. Field crews should be trained in the following:

1. Field identification of typical cave invertebrates (at least 1 person).
2. Methods to set up bait stations.
3. How to enter data on datasheets and in the database.
4. How to document, photograph, and manage unknown species

**11 Training Documentation**

A training log book (shown below) should be completed for each field season by the Field Leader. This log book should list the names of each crew member, what training they completed (both tasks and equipment), when they completed the training, and who trained them, according to the following guidelines:

Klamath Inventory and Monitoring Network  
*Training Documentation*

| Name of Training                              | Date       | Description/SOP/Equipment                    | Trainer     |            |           | Employee  |            |           |
|-----------------------------------------------|------------|----------------------------------------------|-------------|------------|-----------|-----------|------------|-----------|
|                                               |            |                                              | Name        | Title      | Signature | Name      | Title      | Signature |
| Example:<br>Pre-season cave protocol training | 04/15/2016 | HOBO data loggers<br>5-Climate; 9-Vegetation | David Riggs | Field Lead |           | Joe Smith | Field Crew |           |
|                                               |            |                                              |             |            |           |           |            |           |
|                                               |            |                                              |             |            |           |           |            |           |
|                                               |            |                                              |             |            |           |           |            |           |
|                                               |            |                                              |             |            |           |           |            |           |
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|                                               |            |                                              |             |            |           |           |            |           |
|                                               |            |                                              |             |            |           |           |            |           |

Name of Training – Course title or topic

Date – Date or range of dates the training occurred

Description/SOP/Equipment– The type of training, related SOPs, specific equipment covered by training (if any)

Trainer Name – The person giving the training (e.g., David Riggs)

Trainer Title – Position of the person giving the training (e.g., Field Lead)

Employee Name – The person receiving the training (e.g., Joe Smith)

Employee Title – The position the person receiving the training performs (e.g., Field Crew)

## 12 Job Hazard Analysis- Caving at Lava Beds National Monument

| Lava Beds National Monument<br>Job Safety Analysis – Caving |                                                                                                                     |                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ACTIVITY                                                    | POTENTIAL HAZARDS                                                                                                   | POTENTIAL RISKS                                                                                                                                                                                                                                      | SAFETY PROCEDURES                                                                                                                                                                                                                                                                                                    |
| Planning                                                    | Lack of leadership/communication                                                                                    | <ul style="list-style-type: none"> <li>▪ Safety or communication issues not addressed</li> <li>▪ No organization in event of crisis</li> <li>▪ No point of contact established</li> <li>▪ Too few people in caving party to ensure safety</li> </ul> | <ul style="list-style-type: none"> <li>▪ Designate a trip leader for each trip. This person is responsible for communicating issues of safety, cave impacts, and trip goals.</li> <li>▪ Ensure that a safety contact knows caving plans and return time</li> <li>▪ Do not cave alone</li> </ul>                      |
|                                                             | Planning trip that exceeds abilities of a team member (physical condition, technical skills, psychological aspects) | <ul style="list-style-type: none"> <li>▪ Injury or exhaustion</li> <li>▪ Team member encounters conditions with which they can't cope</li> <li>▪ Team has to address compromised member</li> </ul>                                                   | <ul style="list-style-type: none"> <li>▪ Discuss trip plans with team members. Make sure each member understands the trip plans and is prepared to meet the challenges of the trip.</li> </ul>                                                                                                                       |
| Equipment Preparation                                       | Not bringing proper/sufficient equipment                                                                            | <ul style="list-style-type: none"> <li>▪ Objectives cannot be achieved</li> <li>▪ Getting stranded or injured</li> <li>▪ Becoming dehydrated or exhausted</li> </ul>                                                                                 | <ul style="list-style-type: none"> <li>▪ Schedule time for sorting equipment and loading cave packs</li> <li>▪ Use a checklist to help remember critical items</li> <li>▪ Consider length of trip to plan for food/water</li> <li>▪ Trip leader will check that all group equipment is properly prepared.</li> </ul> |
|                                                             | Equipment worn, broken or inoperable due to lack of proper maintenance.                                             | <ul style="list-style-type: none"> <li>▪ Objectives cannot be achieved</li> <li>▪ Getting stranded or injured</li> </ul>                                                                                                                             | <ul style="list-style-type: none"> <li>▪ Each member should regularly clean and check caving equipment to ensure it is in proper working order.</li> </ul>                                                                                                                                                           |
|                                                             | Team member does not know how to properly use caving equipment.                                                     | <ul style="list-style-type: none"> <li>▪ Getting stranded or injured</li> <li>▪ Equipment is degraded</li> <li>▪ Cave resources are impacted</li> <li>▪ Objectives cannot be achieved</li> </ul>                                                     | <ul style="list-style-type: none"> <li>▪ Ensure all team members have training in proper usage of each piece of equipment used for their specific trip.</li> </ul>                                                                                                                                                   |

| Lava Beds National Monument<br>Job Safety Analysis – Caving |                                                  |                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------|--------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ACTIVITY                                                    | POTENTIAL HAZARDS                                | POTENTIAL RISKS                                                                                                                                                                             | SAFETY PROCEDURES                                                                                                                                                                                                                                                                            |
| Entering Cave                                               | Entrance Zone Animals                            | <ul style="list-style-type: none"> <li>▪ Injury from animal bites/stings</li> </ul>                                                                                                         | <ul style="list-style-type: none"> <li>▪ Be alert for potentially dangerous animals</li> <li>▪ Watch where you place your feet and hands</li> <li>▪ Give potentially dangerous animals a wide berth</li> </ul>                                                                               |
|                                                             | Stick piles or vegetation                        | <ul style="list-style-type: none"> <li>▪ Falling while on loose stick pile</li> <li>▪ Getting scratched or otherwise injured by sticks or vegetation</li> </ul>                             | <ul style="list-style-type: none"> <li>▪ Avoid walking on loose stick piles</li> <li>▪ Be mindful of vegetation when negotiating cave entrances</li> </ul>                                                                                                                                   |
| Horizontal Caving (general)                                 | Rough, uneven, or slippery cave surfaces and ice | <ul style="list-style-type: none"> <li>▪ Tripping on lava floor features</li> <li>▪ Rolling or spraining ankles on loose rocks</li> <li>▪ Slipping on icy or wet floor features</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Wear sturdy footwear with ankle support and good traction</li> <li>▪ Move cautiously and pay close attention to cave floors and foot placement</li> <li>▪ Wear spikey shoe covers or other traction device if walking extensively on ice</li> </ul> |
|                                                             | Unstable rocks                                   | <ul style="list-style-type: none"> <li>▪ Injury from collapse or shifting of rocks</li> </ul>                                                                                               | <ul style="list-style-type: none"> <li>▪ Be aware of surroundings and use caution in areas of breakdown</li> <li>▪ Inspect hand- and footholds when climbing</li> </ul>                                                                                                                      |
|                                                             | Low ceilings                                     | <ul style="list-style-type: none"> <li>▪ Bumping head on ceiling projections</li> <li>▪ Scraping body against ceiling while crawling</li> <li>▪ Damage to delicate cave features</li> </ul> | <ul style="list-style-type: none"> <li>▪ Wear a proper, certified helmet</li> <li>▪ Move carefully and deliberately when in close proximity to ceilings</li> <li>▪ If necessary, use a spotter to protect team members and cave features</li> </ul>                                          |
|                                                             | Tight constrictions                              | <ul style="list-style-type: none"> <li>▪ Becoming stuck</li> </ul>                                                                                                                          | <ul style="list-style-type: none"> <li>▪ Tight spaces should only be negotiated by experienced cavers that know their limits</li> </ul>                                                                                                                                                      |

| Lava Beds National Monument<br>Job Safety Analysis – Caving |                             |                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ACTIVITY                                                    | POTENTIAL HAZARDS           | POTENTIAL RISKS                                                                                                                                                                                | SAFETY PROCEDURES                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                             | Low light or total darkness | <ul style="list-style-type: none"> <li>▪ Trouble seeing when moving from bright daylight to cave darkness</li> <li>▪ Becoming stranded without light</li> <li>▪ Unable to exit cave</li> </ul> | <ul style="list-style-type: none"> <li>▪ Let eyes adjust in entrance area before proceeding deeper into the cave</li> <li>▪ Use a bright, efficient headlamp</li> <li>▪ Ensure that batteries are fully charged prior to trips</li> <li>▪ Carry a backup headlamp and spare batteries</li> </ul>                                                                                                                        |
|                                                             | Cool, damp conditions       | <ul style="list-style-type: none"> <li>▪ Hypothermia</li> </ul>                                                                                                                                | <ul style="list-style-type: none"> <li>▪ Wear proper clothing, including insulating layers</li> <li>▪ Choose synthetic or wool materials - avoid cotton</li> <li>▪ Pack extra clothing, fleece hat, hand warmers, etc.</li> </ul>                                                                                                                                                                                       |
|                                                             | Non-technical climbs        | <ul style="list-style-type: none"> <li>▪ Trauma or fatality from falling</li> </ul>                                                                                                            | <ul style="list-style-type: none"> <li>▪ Maintain 3 points of contact when climbing</li> <li>▪ Test and inspect hand- and footholds</li> <li>▪ Use chimneying techniques when possible</li> <li>▪ Use handlines when appropriate</li> <li>▪ Utilize a spotter for difficult climbs or unskilled climbers</li> </ul>                                                                                                     |
| Horizontal Caving (cont.)                                   | Exhaustion                  | <ul style="list-style-type: none"> <li>▪ Becoming stuck or stranded</li> <li>▪ Getting injured</li> </ul>                                                                                      | <ul style="list-style-type: none"> <li>▪ Brief team on duration and difficulty of trip</li> <li>▪ Check condition of each team member prior to and during trip</li> <li>▪ Be aware of your own condition and others</li> <li>▪ Take breaks to rest, eat, and drink</li> <li>▪ Tailor group speed to slowest team member</li> <li>▪ If team member becomes overexerted, modify trip plan to achieve safe trip</li> </ul> |

| Lava Beds National Monument<br>Job Safety Analysis – Caving |                                                            |                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------|------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ACTIVITY                                                    | POTENTIAL HAZARDS                                          | POTENTIAL RISKS                                                                                                                                                    | SAFETY PROCEDURES                                                                                                                                                                                                                                                                                                                          |
|                                                             | Pits, ledges, and drop-offs                                | <ul style="list-style-type: none"> <li>▪ Injury or fatality from falling</li> </ul>                                                                                | <ul style="list-style-type: none"> <li>▪ Stay clear of areas with vertical exposure</li> <li>▪ Only experienced vertical cavers with proper gear should be allowed to negotiate vertical drops</li> <li>▪ Properly maintain all vertical hardware, ropes, webbing, etc.</li> <li>▪ Retire and replace vertical gear when needed</li> </ul> |
|                                                             | Areas with high levels of animal feces and guano           | <ul style="list-style-type: none"> <li>▪ Exposure to environmental pathogens (e.g. hantavirus, histoplasmosis)</li> </ul>                                          | <ul style="list-style-type: none"> <li>▪ Avoid traveling on woodrat middens or areas of accumulated guano</li> <li>▪ Avoid stirring up dusty areas</li> <li>▪ Use respirators in hazardous areas</li> </ul>                                                                                                                                |
|                                                             | Multi-level caves or maze caves                            | <ul style="list-style-type: none"> <li>▪ Becoming lost or disoriented</li> </ul>                                                                                   | <ul style="list-style-type: none"> <li>▪ Travel with experienced cavers familiar with the route</li> <li>▪ Carry a cave map and know how to read it</li> </ul>                                                                                                                                                                             |
|                                                             | Dusty areas where fine particulates can become aerosolized | <ul style="list-style-type: none"> <li>▪ Exposure to fine particulates can cause lung irritation</li> <li>▪ Long term exposure can lead to lung disease</li> </ul> | <ul style="list-style-type: none"> <li>▪ Avoid stirring up dust</li> <li>▪ Pick up feet when walking, shuffling kicks up dust</li> <li>▪ Use a dust masks rated for fine particulates for prolonged exposure.</li> <li>▪ Take regular breaks away from dusty areas</li> </ul>                                                              |
|                                                             | Working in close proximity to others                       | <ul style="list-style-type: none"> <li>▪ Bumping into, stepping on or tripping over others</li> <li>▪ Accidentally hitting others with gear</li> </ul>             | <ul style="list-style-type: none"> <li>▪ Be vigilant; remain self-aware, while being conscious of others</li> <li>▪ Move deliberately, and don't operate tools carelessly.</li> <li>▪ Maintain communication</li> </ul>                                                                                                                    |

| <b>Lava Beds National Monument</b><br><b>Job Safety Analysis – Caving</b> |                                         |                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                     |
|---------------------------------------------------------------------------|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>ACTIVITY</b>                                                           | <b>POTENTIAL HAZARDS</b>                | <b>POTENTIAL RISKS</b>                                                                                                          | <b>SAFETY PROCEDURES</b>                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                           | Dehydration and fatigue                 | <ul style="list-style-type: none"> <li>▪ Becoming exhausted</li> <li>▪ Getting injured from lack of focus</li> </ul>            | <ul style="list-style-type: none"> <li>▪ Properly hydrate before entering the cave</li> <li>▪ Bring sufficient water to maintain proper hydration</li> <li>▪ Bring snacks/food if necessary to maintain energy levels</li> </ul>                                                                                                                                                                                    |
|                                                                           | Being unprepared for sickness or injury | <ul style="list-style-type: none"> <li>▪ Minor sickness or injury can escalate in remote or difficult cave locations</li> </ul> | <ul style="list-style-type: none"> <li>▪ Carry a first aid kit for longer trips</li> <li>▪ Have personnel on trip trained in first aid</li> <li>▪ Have a rescue protocol in place for the park</li> </ul>                                                                                                                                                                                                           |
| Horizontal Caving (cont.)                                                 | Overdue party                           | <ul style="list-style-type: none"> <li>▪ Unnecessary rescue efforts initiated</li> </ul>                                        | <ul style="list-style-type: none"> <li>▪ Allow for a reasonable amount of time for the team to accomplish objectives and exit the cave</li> <li>▪ Team should adhere to established schedule</li> </ul>                                                                                                                                                                                                             |
|                                                                           | Rock fall                               | <ul style="list-style-type: none"> <li>▪ Injury or fatality from falling rock</li> </ul>                                        | <ul style="list-style-type: none"> <li>▪ Be aware of other team members' location</li> <li>▪ Position team members where they will not be exposed to rock fall from members above them</li> <li>▪ Move carefully and thoughtfully in areas of potential rock fall</li> <li>▪ If a rock is accidentally knocked down, clearly yell "Rock!" to warn those below</li> <li>▪ Wear a proper, certified helmet</li> </ul> |

### 13 Job Hazard Analysis- Caving at Oregon Caves National Monument and Preserve

| JOB HAZARD ANALYSIS: Horizontal and Non-Technical Vertical Caving |                                                                      |                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Activity                                                          | Hazard                                                               | Hazard Eliminator                                                                                                                                                                                                                                                                                                                                                     |
| 1) Initiation of trip                                             | A) Forgetting appropriate gear needed                                | A) Create and use a gear check list that would include equipment for the task at hand, equipment needed for the specific cave, etc. Inspect and test equipment before using it. Be sure that all equipment is adequate for caving.                                                                                                                                    |
|                                                                   | B) Unprepared / Lost                                                 | B) Before a trip in the cave, obtain and study a cave map with your intended route on it. Identify hazards along the route before initiating the trip. Complete a trip report that includes the cave location and interior destination of trip, directions to the route, accompanying personnel, and the expected time of exiting the cave and arrival at the office. |
| 2) Moving through a cave                                          | A) Low light/poor visibility                                         | A) Use a reliable light that you are familiar with servicing. Insure that your light is bright enough for the conditions in the cave. Carry spare parts, bulbs and batteries. Have a second light mounted on your helmet that is easy to access and turn on. Carry a third light as a backup.                                                                         |
|                                                                   | B) Collapse (entrapment, falls, or being struck)                     | B) Be aware of potential collapse areas and unstable rock. Test areas before moving past or over them. If unsure, assume instability of rocks or sediments.                                                                                                                                                                                                           |
|                                                                   | C) Poor Footing (falls)                                              | C) Be aware of the cave floor in front of you - watch for slick, sloped and unstable areas surfaced by breakdown, flowstone or even bedrock. Maintain three points of contact when climbing or on unsteady surfaces.                                                                                                                                                  |
|                                                                   | D) Low air temperature (hypothermia)                                 | D) Know the temperature and conditions of the cave you are visiting. Bring proper clothing and extra warm clothing, such as pvc suits, synthetic material pants and shirts, and warm hats. Bring adequate food. Consider including heat packs in your cave pack.                                                                                                      |
|                                                                   | E) Poor air quality (CO2)                                            | E) Be aware of feelings of shortness of breath or lethargy in you or your companions. Use a lighter or carbide lamp to test the air quality (this is not known to be a problem in any park caves)                                                                                                                                                                     |
|                                                                   | F) Radon                                                             | F) Document in cave time to asses total exposure. Include in maintained data base on park staff exposure. Avoid breathing dust and stirring-up dust in dry areas of caves. Absolutely no smoking underground. Use radon sensors to monitor actual radon levels in the cave throughout the year.                                                                       |
|                                                                   | G) Exposure to environmental pathogens (Hanta virus, Histoplasmosis) | G) Avoid areas with animal feces and guano, avoid stirring up dust in dry areas of caves. When these hazards cannot be avoided, consider using a respirator for dangerous areas of caves.                                                                                                                                                                             |
|                                                                   | H) Tight constrictions                                               | H) Know your size limits, do not attempt constrictions below those limits. Move through tight areas with other cavers present and not while you are alone. Be particularly careful in vertical slots with poor foot and hand holds or where returning through a constriction will involve upper body muscles.                                                         |
|                                                                   | I) Rock fall                                                         | I) Always wear an approved helmet. Be sure that all trip participants know proper procedures during rock fall. Never be underneath a person that is climbing. Do not look up when someone yells rock.                                                                                                                                                                 |

| <b>JOB HAZARD ANALYSIS: Horizontal and Non-Technical Vertical Caving</b> |                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Activity</b>                                                          | <b>Hazard</b>                               | <b>Hazard Eliminator</b>                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 2) Moving through a cave (cont'd.)                                       | J) Exhaustion / fatigue                     | J) Recommend proper physical conditioning. The group leader should inquire about people with known potentially dangerous physical conditions and treatment needs before entering the cave. Quick energy food should be consumed to keep up with calorie needs. Avoid overexertion. The group should pace itself according to the slowest member. Bring plenty of water and avoid overloading a pack.                                             |
|                                                                          | K) Losing contact with the group            | K) When traveling through passages, maintain contact with the person behind and in front of you. This should be done either visually or through voice contact. Pace yourself to ensure an equal distance between those in front and in back. Alert the next in line when contact is lost for an extended time. Communicate to the person following if the path is not obvious. Do not leave anyone who is not aware of where the group is going. |
|                                                                          | L) Loss of light and hypothermia            | L) Bring at least 3 separate sources of light and additional batteries. Carry an extra layer of wool or hi-tech material, and a balaclava in your helmet liner. A garbage bag, a small piece of foam pad, and chemical heater can be used to create a bivouac in the event of an emergency.                                                                                                                                                      |
| 3) Non-technical climbing underground                                    | A) Falling while climbing                   | A) Assess climbs in comparison to personal ability carefully. Do not hesitate to ask for a hand line or other assistance on a climb. Use "spotters" on tricky climbs. Check hand and foot holds before trusting them during a climb. Use chimneying and other energy saving techniques when possible. Never, never, never take off your helmet. If you are in an area that requires you to remove your helmet, leave and do not continue.        |
|                                                                          | B) Pinch Falls (fall leading to entrapment) | B) Learn to recognize potential pinch falls. Avoid climbs that expose one to pinch falls. Be particularly careful in pinch fall areas with hand and foot holds and consideration of use of handlines and spotters.                                                                                                                                                                                                                               |
| 4) Moving through stream passages                                        | A) Low water temperature                    | A) Proper clothing is mandatory and key. Party members should communicate their comfort level and level of cold to each other frequently and without hesitation. Minimal travel in stream bed is required in ORCA. Wear rubber boots when walking in streams is necessary                                                                                                                                                                        |
|                                                                          | B) Flooding                                 | B) This is not known to be a problem at ORCA. Be aware of rising water and changing conditions while in stream passages. Remain calm. Move quickly and carefully to areas with higher ceilings, preferably where passages lead to upper levels and alternative routes to entrances.                                                                                                                                                              |
| 5) Moving through passages with vertical exposure                        | A) Falls                                    | A) Inspect ropes and slings for wear; replace sooner than you think is absolutely necessary (all fibers in webbing are exposed to abrasion, unlike kernmantle ropes). Inspect teeth of mechanical ascenders for wear; keep a prussik 'quick draw' in case of ascender failure. Cross a drop unsecured only if you are sure that the moves needed are well within your skill level; make sure nobody is below.                                    |
| 6) Exiting the cave                                                      | A) Tripping/ falls                          | A) Watch where you put your feet. The bottom of your shoes will be muddy and not grip as well. Use handrail.                                                                                                                                                                                                                                                                                                                                     |

**14 Job Hazard Analysis- Caving at Oregon Caves National Monument and Preserve**

## REVISION LOG

| Date      | Editor                                     | Description of revision                                                                                     | Version number |
|-----------|--------------------------------------------|-------------------------------------------------------------------------------------------------------------|----------------|
| Unknown   | Unknown                                    | Creation                                                                                                    | 1              |
| 2/11/2014 | Ivan Yates - Biological Science Technician | Edited hazard eliminators to be relevant and succinct. Included the hazard "Losing contact with the group." | 1.1            |