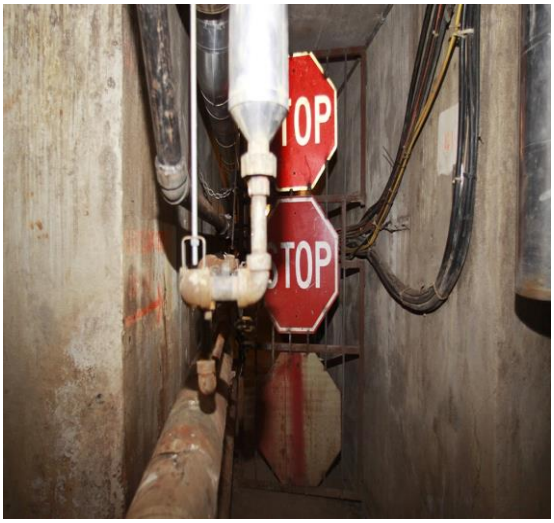
UC Riverside
Utility Tunnel Safety Program

Lead: **Chidozie B. Nzom, Safety Engineer**
Phone: **(951) 827-5118**
E-mail: **chidozie.nzom@ucr.edu**
Team: **General Safety**



Quick Start

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Description

The construction, repair and maintenance of underground tunnels, shafts, chambers, and passageways are essential yet dangerous activities. Working under reduced light conditions, difficult or limited access and egress, with the potential for exposure to air contaminants and the hazards of fire and explosion, workers may face many dangers. Cal/OSHA has Tunnel Safety regulations that ensure safe-work activities when in tunnels. The University of California, Riverside (UCR) EH&S has developed this Utility Tunnel Safety Program to manage the use of and safe work practices, inspection and record keeping of all tunnel systems on campus.

This Utility Tunnel Safety applies to all UCR spaces requiring a tunnel key for entry, and to all persons entering tunnel spaces on behalf of the University of California. This program also applies to any campus utility tunnels, except sections specifically designated as "Confined Spaces". Sections of the tunnels designated as confined spaces, can be entered in accordance with the EH&S Confined Space Entry Program.

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UC Riverside
Utility Tunnel Safety Program

Purpose/Introduction

The University of California, Riverside (UCR) maintains an extensive tunnel system to facilitate the maintenance and repair of campus utility distribution systems. The tunnel system is a critical portion of the University's utility distribution system and must be managed and utilized in a safe manner.

The University of California, Riverside Environmental Health and Safety has developed this program provide procedures for safely working in the UCR tunnel system and sets forth the requirements for all University employees, associated contractors and vendors.

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Applicability/Scope

This Utility Tunnel Safety applies to the University of California, Riverside spaces requiring a tunnel key for entry, and to all persons entering tunnel spaces on behalf of the University of California. Only persons that have written authorization from Facilities Services, Risk Management, EH&S or the Steam Plant may enter the tunnel systems. **UNAUTHORIZED PERSONNEL WILL BE CONSIDERED TRESPASSERS.** This program also applies to any campus underground tunnels, except sections specifically designated as "Confined Spaces". Sections of the tunnels designated as confined spaces, can only be entered in accordance with the EH&S Confined Space Entry Program.

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Roles/Responsibilities

Facilities Services/Steam Plant

Responsible for operation of the steam plant systems and directly control access to the tunnel systems. The Steam Plant Operators shall:

- Approve all access and work conducted in the tunnel systems
- Approve key authorization into the tunnel systems
- Verify training records to ensure potential tunnel entrants are trained and follow the procedures of this program
- Effectively enforce compliance of the tunnel safety procedures
- Notify EH&S when employees enter the tunnel systems if necessary.
- Ensure that the equipment required to enter and work in tunnels are in proper working conditions and made available for use.
- Ensure the Utility Tunnel Safety Work Plan is followed and filled out, including check-in/check-out procedures, wearing appropriate personal protective equipment (PPE), safe work procedures and reporting any safety hazards observed while working in the tunnel.
- Communicate the University Tunnel Safety procedures and requirements to all contractor employees and sub-contractor employees who intends to enter the tunnel systems.
- Establish an Emergency Plan for employees working in tunnels and include its adaptation to specific tunnel systems on campus
- Keep/maintain tunnel safety training and inspection records

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Contractors

Contractors (outside UCR contractors) shall be responsible:

- Communicate the University Tunnel Safety Program to all contractor employees and sub-contractor employees
- Complying with the University Tunnel Safety Program when conducting work in the tunnel systems
- Ensure employees are trained on tunnel entry procedures and safety precautions
- Provide tunnel Rescue Plan for employees working in tunnel systems
- Notify EH&S when employees enter the tunnel systems if necessary.
- Document tunnel entry training and provide Facilities Services/Steam Plant tunnel safety training

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EH&S

- Establish and review the Utility Tunnel Safety Program.
- Assist with training of tunnel entrants when training is requested from EH&S and maintain tunnel safety training records if training is conducted by EH&S.
- Conduct inspections, hazard assessment and periodic audits to ensure employee safety and compliance with this program when necessary
- Advise Facilities Services/Steam Plant staff and University employees on health and safety issues when working in tunnel systems

Authorized Tunnel Entrant

- Complete the Utility Tunnel Safety Work Plan before entry.
- Follow the check-in/check-out procedures and the Utility Tunnel Safety Program requirements.
- Wear appropriate personal protective equipment (PPE)
- Report any safety hazards observed while working in the tunnel to the Facilities Services/Steam Plant Supervisor and/or EH&S if need be.

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Definitions

Authorized Tunnel Entrant
Any individual that has received authorization and training from Facilities Services/Steam Plant, and has legitimate UCR business at the time of entering the tunnel system.

Hot Work Operations
Cutting, welding, brazing, torch soldering, or high speed grinding of materials.

Hot Work Permit
Specific written authorization to perform hot work operations.

Point of Reference (PORs)
A number assigned to a specific location within the tunnels to aide in determining locations.

Steam Plant (Facilities Services)
The Steam Plant is the University unit that is assigned the responsibility for the tunnel system.

Tunnel System
The tunnel system is the underground system connecting buildings and conveying utilities across the UCR campus. Entries into the tunnel systems begin through the access-way that is at each tunnel entry.

Urgent Work
Work that, if not conducted immediately, will result in injury or harm to building users, and/or damage to facilities or equipment.

Utility Tunnel Safety Work Plan
A formal request submitted by University employees to Facilities Services (Steam Plant) for conducting work in the tunnel system. An approved work plan permits the work to be conducted and/or entering the tunnel system.

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Utility Tunnel Safety Procedure

General

Utility Tunnel Safety Work Plan

1. Prior to beginning any work in the tunnel system, an assessment or tunnel evaluation must be conducted by the Supervisor to determine if the work or the conditions in the tunnel could create a potential atmospheric hazard, a potential for entrapment, or create any other safety or health hazard that would either require specialized equipment.

2. The Utility Tunnel Safety Work Plan shall be approved by Steam Plant before entry into the tunnels.

3. Should the scope of work change once in the tunnel, the authorized entrant must notify Steam Plant, stop work, and exit the space. Steam Plant shall re-evaluate the work before re-entry into the tunnel.

4. Prior to any work in the tunnel that will involve modification to the tunnels, the installation of new equipment, shutdown process, conduit, wiring, and piping (including steam, water, sewer, gas, compressed air, etc.) approval must be obtained from Steam Plant before entry into tunnels.

5. Some outside departments, such as EH&S, EH&S Fire Prevention, UCR Police Department, Risk Management, Office of Emergency Management and other

agency services may establish a written request with Steam Plant to enter the tunnels.

6. EH&S, Risk Management, Steam Plant (Facilities Services), UCR Police Department and the Office of Emergency Management may review the Utility Tunnel Work Safety Plan to ensure compliance with Cal OSHA standards and other regulatory bodies.

Open Hatches and Doors

1. All open hatches and doors into the tunnels at ground level will be guarded to prevent falls. Guards used will be placed far enough from the hatch entrance or be of a physically significant nature to warn unsuspecting pedestrians and vehicles. Flashing warning lights will be used if the opening is in a vehicle traffic area.

2. Sufficient measures to prevent unauthorized persons from entering the tunnel system will be taken when the hatches or doors are open.

3. Temporary barriers may be used if the barrier will provide a reasonable physical deterrent to prevent unauthorized persons from entering the tunnel system.

4. Tunnel doors are to be secured at all times. Hatches are to be secured at the end of work. Security is not to be compromised.

5. A safe means of access and egress shall be provided and maintained during work in tunnels.

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Tunnel Access Restriction (Entering and Exiting the tunnels)

1. Steam Plant (Supervisors) will insure they know the locations of their workers and work group or trade within the tunnels and the length of time expected to be in the tunnel system.

2. Only authorized entrants following the procedures outlined in the Utility Tunnel Safety Work Plan shall be allowed into the tunnels. Steam Plant (Facilities Services) will be responsible for authorizing key assignment, check-in and check-out of tunnels to authorized entrants.

3. Students, faculty, staff, the public, and outside contractors, unless performing official business for the University, shall not to be given access to the tunnels.

4. All work performed in the tunnels will be conducted by a minimum team of two employees together. Employees working in the tunnels will move and work in pairs, as a minimum. Work groups larger than two employees are considered to meet the “pairs” requirement as long as the entire group stays within eyesight of each other. Each group must maintain a radio and ability to communicate with Steam Plant.

5. Steam Plant (supervisors) will ensure all Proper Protective Equipment (PPE) and other equipment related to safety is utilized while employees are in the tunnel system. The following list is outlined in the Utility Tunnel Safety Work Plan. *Note: All employees entering the tunnels will have a working flashlight, or other portable light source, for use in case of loss of normal permanent lighting in the tunnels. Employees should be cautioned to wash promptly and thoroughly if exposed to injurious substances in tunnel systems.*

6. At the end of the work shift, supervisors will get positive confirmation of safe exit from the tunnels from each employee working in the tunnels that day. On a monthly basis, the entire roof, walls and ground support system of the tunnel space shall be inspected by a competent person to satisfy **Grounds Control Inspection and records of inspection shall be maintained by Steam Plant.**

7. Any time someone is observed within the tunnels that is not authorized, or is not conforming to the procedures of this program, the University Police Department (UCR PD) and Steam Plant should be notified as soon as possible (827- 5222, or 827- 4174).

Communication

1. Steam Plant and tunnel entrants shall communicate using a working channel if radios are used for work related communications within the tunnels. Communication systems shall be tested upon initial entry of each shift to the tunnel, and as often as necessary at later times, to ensure that they are in working order.

2. When employees are working in tunnels, they must have radio communications with their Steam Plant (supervisor), and the employee must make radio contact when entering and exiting the tunnels. An expected time exit time will be set on the Utility Tunnel Safety Work Plan and if exit confirmation is not received by this time, then Steam Plant (supervisor) will attempt to locate the employee as soon as possible.

3. Any time an employee, or group of employees, is considered “overdue” or missing, appropriate emergency procedures or rescue will be implemented (see Emergency and Rescue Procedures below). Notify EH&S, UCR Police

Department and the Office of Emergency Management on the situation of the entry.

4. Due to the challenges with radio communication to and from the tunnels, and the potential risks involved with working in the tunnels, supervisors must know exactly where their employees are within the tunnels, and insure they have safely exited the tunnels at the end of the work shift.

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Housekeeping and Work Site Responsibility

1. Projects conducted in tunnels are to be cleaned up at the end of each day. Steam Plant employees and Contractors conducting work in the tunnels are responsible for any damage to other systems and tunnel infrastructure during the course of work.

2. No hazards which could cause injury or impede movement and access in the tunnel system will be left adrift in the tunnels.

3. No hazardous materials will be left unattended in the tunnels.

4. Clearly designated and unobstructed walkways with a minimum of 18 inches in width shall be maintained throughout the tunnel. The walkways shall be located on the lighted side of the tunnel unless conditions preclude this.

5. Waste materials for which no underground storage facilities are provided shall be promptly removed from the tunnel. Leaks and spills of flammable or combustible fluids shall be cleaned up immediately.

Ventilation and Heat Stress

1. As many hatches as possible around the work area will be opened to provide as much natural ventilation as possible when working in tunnels. Forced air ventilation will be used whenever possible, and especially in areas with extreme heat stress conditions.

2. In work areas where additional work induced hazards are present, such as hot work (welding, cutting, torch work, or high speed grinding of metal), painting, or using solvents, forced air ventilation is required in addition to natural ventilation specified above. When work induced air hazards are present, continuous air monitoring will be conducted to insure adequate ventilation.

3. The tunnels are typically a very hot and humid work areas and heat stress is a significant risk. New employees should be allowed time to acclimate to their new work environment. During high temperatures, all employees must be given adequate rest periods and supplied with cool water to keep them adequately hydrated. All work should conform to EH&S Heat Stress Program.

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Hot Work in Tunnels

1. Forced air ventilations is required for all hot work in the tunnels. Fans/ventilators shall be used adjacent to the work area. Note: Pressurized sources of oxygen shall not be used for ventilating purposes.

2. Continuous air monitoring shall be conducted throughout the hot work. At a minimum, monitoring will be done for oxygen, flammable gases and vapors, and carbon monoxide.

3. All hot work will conform to the procedures outlined in the EH&S Fire Prevention Hot Work Program, including the use of a hot work permit.

4. Where welding, cutting and other hot work operations are conducted in tunnels, and when such operations may cause fires, suitable shields shall be provided to isolate flammable materials. Appropriate fire extinguishers shall be provided and maintained. Contact EH&S Fire Prevention for more information.

5. No petroleum based product shall be taken into tunnels for illuminating or heating purposes. The use of volatile solvents such as gasoline in tunnels is prohibited.

Atmospheric Testing and Monitoring

Where necessary and/or determined by Facilities Services and EH&S (conducting a hazard assessment), prior to entering the tunnels, the atmosphere of the space will be tested by a qualified person using an instrument approved by EH&S. Tests will be conducted to determine the presence or absence of explosives or flammable gases, oxygen deficiency, or toxic substances.

Where determined, entry into tunnel systems will be prohibited until initial testing of the atmosphere has been done from the outside. The test performed by the qualified person will be documented using the Utility Tunnel Safety Work Plan and will include tests for combustibility, oxygen deficiency, and toxicity as follows:

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Combustibility

1. Prepare instrument (Ventis MX4 Multi-Gas Detector) to test for combustible gases before removing tunnel or manhole cover.

2. All manholes and vaults should be tested prior to opening, if possible. The sampling probe should be inserted through an access hole in the cover and the space will be tested at one-foot intervals to its maximum depth.

3. If an access hole is not available, the cover will be lifted with care sufficiently enough to insert the sampling probe.

4. The manhole or vault will be posted and barricaded to prevent accidental entry.

5. If an explosive atmosphere exists as indicated by the combustible gas analyzer, DO NOT PROCEED. Immediately notify the supervisor, Steam Plant and EH&S.

Oxygen

If after determining that no explosive gases are present, test the tunnel space for oxygen content. The top, middle and bottom thirds of the manhole or vault should be checked using the sampling probe in the same manner as described above.

1. The percentage of oxygen for entry will be no less than 19.5% and no greater than 23.5%. If the level is outside this range, purge and ventilate the space.

Toxic Gases

Test should be conducted for carbon monoxide (CO) and hydrogen sulfide (H2S) gases, in addition to any other toxic material as determined by the qualified person. The reading for H2S must be below 10 ppm and CO below 25 ppm before entry is permitted.

1. If toxic levels are found, employees will not enter the tunnels until purging has been performed.

2. Monitoring of tunnels will be done on a continuous basis.

3. If the percentage of oxygen falls below 19.5% or toxic concentration in the tunnel system cannot be kept within permissible exposure levels as set by CAL- OSHA, approved respiratory protection will be used.

Emergency and Rescue Procedures

1. Rescue measures may be necessary if an employee in the tunnel becomes incapacitated and is unable to exit without assistance. Contact the Steam Plant Supervisor immediately and then the UCR Police Department, the Office of Emergency Management, and EH&S whenever an employee needs rescue from the tunnel.

2. At the first indication of a problem, all employees in the work group should leave the tunnel, assisting each other as needed. When all employees have exited the tunnel, an assessment of the condition of each employee should be made and additional medical assistance sought if necessary.

3. If there is an unsafe condition within the tunnel, do not re-enter the tunnel until other rescue personnel have arrived. The UCR Police Department will contact other rescue agencies, as necessary.

4. Anytime there is a non-worker related emergency in the tunnels, all employees should exit the tunnel by way of the shortest and safest route. In order to insure their ability to exit the tunnels in case of an emergency, at least two exit routes should be planned for every work group. Emergency exit routes should be confirmed as usable prior to any work commences.

5. When making an emergency exit from tunnels, employees should attempt to shut off, or otherwise put their equipment in safe mode, before leaving, if possible.

6. **The Emergency Action Plan shall be posted conspicuously on the safety bulletin board in Steam Plant.** In addition, all entrant employees shall be informed of the emergency action plan, and copies shall be given to the EH&S Fire Prevention. Every entrant employee shall be told what is expected of him/her in cases of emergency.

Signs, Markings and Labels

1. All piping, wiring, utilities and other services running through the tunnels shall be labeled and marked. Markings can follow a color system for identification if necessary. Services that could create a health hazard, such as high voltage electrical or high pressure steam or compressed gas lines, should be marked on the line at set intervals for easy identification.

2. Points of Reference (PORs) and Exits shall be marked. Exits through ground level hatches that may be dangerous to open from inside tunnels such as hatches located in roads or walkways, should be marked with danger signs.

3. Hot Work areas and other areas with work induced hazards shall be marked. Work areas where hot work or other work induced hazards may be present will be posted to warn others entering the work area of the possible hazards.

4. Each tunnel entry will be signed as follows:

> University of California, Riverside
> Utility Tunnel System
>
> **RESTRICTED ACCESS**
> All entrants must be trained and authorized for tunnel entry. Obtain Permission to Enter from Steam Plant
> Radio or Call (951) 827- 4174
>
> **NO TRESPASSING**
> (Entry Without Authorization)

Training

1. All personnel requesting entry are required to be trained in tunnel safety and training will be documented by Steam Plant. All entrants must receive training prior to entry into the tunnel system.

2. The departments whose personnel enter the tunnel systems can request for training on utility tunnel safety by a training provider outside the university, within the department (assuming the trainer is a tunnel safety-skilled person), or by EH&S. Contact EH&S Training Department at 827-2609 to arrange for training to be facilitated by EH&S.

3. Training will consist of a review of the tunnel systems, entry and exit procedures, personal protective equipment, and the hazards associated with the tunnel system.

4. Entrants must sign off the training form to verify the tunnel entry training has been conducted and the entrant is aware of the hazards and the tunnel safety procedures.

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Record Keeping Requirements

Facilities Services/Steam Plant Requirements

1. In conjunction with EH&S, retain records of training which include the attendees name, their employee identification number, and their supervisor's name. EH&S maintains the master training records in the L.M.S. Master Training Record database.

2. All Utility Tunnel Safety Work Plan that are approved shall be maintained and/or retained by Steam Plant.

3. Records of air monitoring tests, gas tests, and air flow measurement if conducted shall be retained by Steam Plant.

4. Records of inspecting the entire roof, walls and ground support system of tunnel systems (Grounds Control Inspection) shall be maintained by Steam Plant

EH&S Requirements

Retain indefinitely the following:

- Records of training provided by EH&S and other entities
- Historical documents and revisions of the Utility Tunnel Safety Program
- Records of periodic inspections, audits, and tunnel hazard assessments conducted by EH&S.

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References

Cal/OSHA

§8403. Tunnel Safety Orders, Scope and Application.
§8404. Tunnel Safety Orders, Permit for Variation for these Orders.
§8410. Tunnel Safety Orders, General Safety Precautions.
§8411. Tunnel Safety Orders, Walkways and Access.
§8414. Tunnel Safety Orders, Personal Protective Equipment.
§8422. Tunnel Safety Orders, Tunnel Classification.
§8424. Tunnel Safety Orders, Airborne Contaminants in Tunnels.

§8425. Tunnel Safety Orders, Operations of Gassy and Extra Hazardous Tunnels.
§8426. Tunnel Safety Orders, Emergency Plan.
§8427. Tunnel Safety Orders, Protection Against Water or Gas.
§8428. Tunnel Safety Orders, Telephone System.
§8430. Tunnel Safety Orders, Rescue Crew and Breathing Apparatus.
§8437. Tunnel Safety Orders, Ventilation and Air Quality.
§8440. Tunnel Safety Orders, Ground Control Inspections.
§8445. Tunnel Safety Orders, Fire Prevention and Control: General.

Fed/OSHA Underground Tunnels Regulations

https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_id=10790&p_table=STANDARDS

EH&S

Chidozie B. Nzom, Safety Engineer
UC Riverside EH&S
Phone: 951- 827-5118
Cell: 951-329- 7729
Email: chidozie.nzom@ucr.edu

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Issued By and Next Review Date

Issue Date:	March 14, 2017
Issued by:	Chidozie B. Nzom, Safety Engineer
Program Review Date:	Five years from issue date

Attachments

Attachment 1 – Utility Tunnel Safety Work Plan

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Attachment 1 – Utility Tunnel Safety Work Plan

I. **Department:**		**Date:**	
II. **Work Order #:**			
III. **Utility Tunnel Location:**			
IV. **Description of Work:**			

V. Required Equipment (Check ALL that apply and describe where indicated):

Tests to be Performed	Acceptable Entry Conditions	ACCEPTABLE?	Test Results #
OXYGEN (% Volume)	20.9% (19.5% to 23.5%)	Yes ☐ No ☐	
FLAMMABILITY (% LEL)	< 10 % of LEL	Yes ☐ No ☐	
CARBON MONOXIDE	< 25 ppm	Yes ☐ No ☐	
HYDROGEN SULFIDE	< 10 ppm	Yes ☐ No ☐	

VI. **Required Equipment (Check ALL that apply and describe where indicated):**

❑ Barricades, Barrier Tape, Fan/Ventilators	❑ First Aid Kit	❑ Fire Extinguisher/Hot Work Permit
❑ Gloves (canvas. Rubber, leather?)	❑ LOTO	❑ Flashlight
❑ Eye Protection (safety glasses; face shield)	❑ GFI Device	❑ Hearing Protection
❑ Body Protection (work coveralls, Tyvek)	❑ Head Protection (hard hat?)	

VII. **Personnel**

Entry Personnel Name(s)	
Attendant Personnel (Name, Department):	

Supervisor Authorizing Entry:		**Date:**	
Certifying Supervisor is responsible for ensuring that all necessary procedures, practices, and equipment for safe entry are in place before and during entry.		Time	

Job Completion:		
Utility Tunnel Space completed and space returned to normal operating mode	❑ Yes	❑ No

Exit Location:	**Exit Time:**

After activity is completed, please send a copy to Steam Plant. EH&S will review completed copies of forms on a quarterly basis.

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EH&S FACT SHEET

Utility Tunnel Safety Program

This fact sheet provides awareness level information of Utility Tunnel Safety and the controls of those hazards in tunnels (Go to the Table Of Content of the Utility Tunnel Safety Program). The program is designed for those who may require access into tunnels or work in tunnels as part of their work activities, and the Department administrators responsible for their training and safe use.

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Does this Utility Tunnel Safety Program apply to my department?

If personnel in your department requires entry into tunnel systems or employees working in tunnels, this Utility Tunnel Safety Program may apply to your department. Contact Steam Plant or EH&S to assist you in your decision.

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Who is responsible for running this Program in my department?

All personnel are responsible for following safe-work practices outlined in this program. Implementation of this program is the responsibility of the Director or head of the Department. This may be delegated to someone designated by the head of the department as the “Utility Tunnel Safety Program Administrator” for the Department.

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As a designated “Utility Tunnel Safety Program Administrator”, what do I have to do?

Become familiar with the Utility Tunnel Safety Program by reading and understanding the requirements of the program including choosing the right tools to work in tunnels, providing training to the Department’s personnel who will be working in tunnels and understanding the inspection and maintenance of the tunnel systems. Once you know what’s required, contact EH&S to arrange for assistance in training when necessary.

Are there “Safe Work Rules” for Utility Tunnel users to follow?

Yes. The work rules are described in the program.

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Who should be trained, and how do we get training?

Cal/OSHA requires that the employer train all authorized entrants on the hazards associated with the tunnel systems. Training requirements are detailed in the program and can be provided at no cost to the Department by EH&S or for cost by outside Vendor.

Who keeps the records of inspections, inventories and training?

Departments must keep records concerning the Utility Tunnel Safety Program’s application to their work activities. This task is the responsibility of the “Utility Tunnel Safety Program Administrator” for the Department. Discuss with your department management who the Program Administrator is in your department. All records must be kept for certain periods of time as outlined in the program by the Department in conjunction with EH&S, and must made available to regulatory agencies such as Cal/OSHA, and EH&S if they request.

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Why do we need an Emergency Action Plan whenever we are working in tunnel systems?

Every employer shall prepare a general plan of action for use in time of emergency. The tunnels are typically a very hot and humid work areas and heat stress is a significant risk that can be fatal. Therefore, when employees are working in tunnels, an emergency action plan to offer immediate assistance and rescue victim out to safety is required by CalOSHA code to ensure the victim's long term wellbeing.

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