



PRODUCT BULLETIN

THE Life•line MONITORING SYSTEM AND ITS ABILITY TO MONITOR EMPLOYEES DURING UNDERGROUND CONSTRUCTION & TUNNELING

The Tunnel Safety Orders set forth in the California Code of Regulations¹ (Title 8, Division 1, Chapter 4, Subchapter 20) establish a variety of difficult and expensive provisions which the employer must follow to protect workers during tunneling operations. While the regulations are sensible and do indeed help remedy problems faced during construction, meeting each of the requirements effectively is not an easy task. Yet, failure to meet each requirement can result in accidents and/or expensive FEDOSHA / CALOSHA penalties.

The **Life•line** monitoring system was developed by Safe Environment Engineering to create a means of monitoring employees during tunneling operations, as well as in remote and hazardous locations, and in confined spaces without the need for a one-on-one standby attendant.

To assure that the system met both FEDOSHA and CALOSHA requirements, system development was assisted by Barry White, the former Director of FEDOSHA Safety Standards, whose office wrote the Underground Construction (CFR Part 1926.800) and Permit Required Confined Space Regulations (29 CFR 1910.146).

Mr. White will be available to assist each purchaser of the **Life•line** system to rewrite current procedures to encompass the use of **Life•line**, and to place the system in operation so that it meets all Federal and Local OSHA requirements.

WHAT IS Life•line?

The **Life•line** system consists of a main monitoring center, portable **Life•line** monitors and, as options, remote location satellites, environmental monitors, ventilation control sensors, and a future option of a user location system.

The main monitoring center integrates custom database software with specialized communications and computer hardware which will transmit and display the status of workers monitored by the system.

Through the use of an interactive polling system, each monitored user must respond to a system query by pressing a button on their **Life•line** portable monitor indicating they are alright. Failure to respond to this query within a time interval determined by the relative hazard of the area in which they are working, will cause the system to alarm. An attendant monitoring the system can respond to an alarm condition through an emergency voice channel as well as through immediate access to local fire and rescue services. Users of **Life•line** may also request either voice communication or an alarm condition at any time by depressing the appropriate button on their portable **Life•line** monitor.

The main monitoring center can be as small and mobile as a laptop computer, or integrated as part of a central fixed location monitoring center.

Life•line was designed to be a system that can be customized allowing for extensive versatility in its end configuration. Custom features such as integrating gas detection, specific company or industry jargon within its displays and remote monitoring and/or displaying of specific levels or pressures of various substances are just some of the examples of **Life•line**'s capabilities.

¹ Similar requirements are set forth in the "Tom Carrel Memorial Tunnel and Mine Safety Act of 1972, Labor Code Sections 7950 - 8004. Due to the similarities of the provisions of the Labor Code and the Code of Regulations the relevant Labor Code Sections are footnoted throughout this Bulletin for your additional reference.

COMPLIANCE - CALIFORNIA CODE OF REGULATIONS, TITLE 8, SECTIONS 8400-8568
TUNNEL SAFETY ORDERS

ARTICLE 4. Safety Precautions

Every reasonable precaution shall be taken to insure the safety of the workmen in all cases, whether or not provided under these orders.

The **Life•line** monitoring system provides the most advanced safety precaution available for monitoring the safety and well being of both the worker and work place. **Life•line** provides this capability by bridging a technical gap within the safety and health field through our ability to integrate environmental monitoring, voice communication, and the well-being of employees working in tunnels, confined, remote and/or hazardous locations through a wireless central monitoring console.

'8410(d). At least one man must be on duty outside of all tunnels extending 300 feet or more underground whenever a crew is working underground on operations normal to tunnel driving. His outside duties shall not be such that he would be unable to secure aid for those underground in the case of emergency.

The **Life•line** main monitoring center is equipped with both an audible and visual alarm system which will notify the attendant the moment of an emergency. The significant impact of this alarm condition will keep an attendant from doing anything else but responding to this condition. Additionally, **Life•line's** training will dictate that the attendant shall have no duties other than monitoring the **Life•line** system.

'8410(g). A check list or other method acceptable to the Division shall be provided on the surface to check every man into and out of the tunnel and to identify each man underground.

Each entrant proceeding into tunnel construction work area is required to check-out a portable **Life•line** monitor which he/she will take with him/her to the work location. Before entering the work area, the entrant will check into the system by running an identity card through the system's card reader. Each entrant will then be recorded by name and location on the system's computer. **Life•line's** periodic query of the entrant will verify their check-in status. In case of emergency, the names of the entrants can be immediately displayed on the system's display and/or printed by the system printer.

The **Life•line** system will also provide the option for users to access the system from remote satellite locations. This satellite configuration will allow a user to input his/her work location upon checking out a portable **Life•line** monitor. The user may also gain access to the system for changing his/her work location or to check-out of the system at the completion of his/her duties.

'8410(h). Solitary employment in tunnels, underground chambers, raises, and shafts is prohibited where hazardous conditions exist that would endanger his safety unless he can communicate with others, can be heard, or can be seen.

Life•line does much more than provide a means of communication to the work location, it also continuously monitors the well-being of each entrant.

The main monitoring center will regularly poll each portable **Life•line** monitor for the purpose of uploading its current status. The polling process will utilize technology similar to that used by packet radio (a radio frequency modem).

The portable **Life•line** monitor checks on its user in the tunnel at preset regular time intervals by initiating an audible and visual status query. The audible and visual status query will continue until the acknowledge button is depressed by the entrant.

Failure of the entrant to acknowledge the status query within a preset period of time (as determined by the facility) will trigger an alarm warning tone and visual indicator from within the user's portable **Life•line** monitor. The warning tone and a visual signal will last for approximately 15 seconds to give the user sufficient warning of his/her pending alarm condition. Failure of the user to respond to both of these conditions will put the portable **Life•line** monitor into an alarm state and simultaneously cause an alarm condition at the main monitoring center.

Reacting To An Alarm

When an alarm is initiated by a user's portable **Life•line** monitor, a computer screen at the main monitoring center will display the user's name and work location as a flashing emergency identifier. Both a system alarm horn and strobe light will alert the system attendant monitoring the system.

Communication Features²

The system attendant will then have the option of either opening a voice channel to the entrant in alarm to inquire as to his/her condition, and/or immediately dispatching a rescue team to the entrant's location. Should the entrant need help, a "help-request" switch can be depressed on the portable **Life•line** monitor. In this mode of operation, an alarm request is transmitted back to the main monitoring center where the attendant can open a voice channel to the entrant.

If the user is incapacitated in either alarm condition, the system attendant at the main monitoring center can control the microphone of the portable **Life•line** monitor which is in alarm. In this condition, the attendant will be able to listen to the entrant without the need for user intervention.

In addition to the alarm request capability of the system, the entrant may also request voice communications. Emergency voice communications are established by the entrant by simply depressing a blue square voice request button on the top of his portable **Life•line** monitor.

Following any alarm condition where multiple entrants were evacuated from a common work location, the portable **Life•line** monitor will continue its status query to ensure the safety of all workers after the evacuation, i.e., the system will take attendance.

ARTICLE 7. First Aid

‣ 8420 *Care of the Injured.*

One of the most compelling features of **Life•line** is the ability of the attendant at the main monitoring center to identify an emergency and immediately summon rescue and/or other emergency services. A remote display can be located at various locations to inform groups such as fire and rescue of the entrant's location in the event of an emergency.

Life•line's voice communication feature will allow for communications between the entrant and any attending rescue team.

ARTICLE 8. Tunnel Classifications

‣ 8424 *Dangerous or Poisonous Gases.* and ‣ 8425. *Operation of Gassy and Extrahazardous Tunnels.*

The utilization of periodic and continuous gas monitoring systems are set forth in Sections 8424 and 8425³ described. **Life•line**'s ability to integrate with most any environmental monitor and/or monitoring system will allow for compliance with the Sections with the added benefit complete record-keeping system.

²California Labor Code Section 7963 contained similar communication requirements.

³Similar provisions are set forth in Labor Code Sections 7960-61, 7966-68, 7972, 7979, and 7984-85.

An environmental monitor/gas detection system can be directly integrated with the portable **Life•line** monitor. In many facilities, this interface can be accomplished with the employer's existing portable or fixed gas detection equipment. This integrated system will provide real-time information of gas levels in the environment. These levels will be transmitted to a database contained in the main monitoring center so that exposure limits of the users and or locations may be tracked over time. This exposure information can include Peak, Short Term Exposure Limits and Time Weighted Averages.

The environmental monitor/gas detection module will also interface with the portable **Life•line** monitor's alarm if the environment becomes contaminated or deprived of oxygen. If the gas detection system goes into alarm, an audible and visual alarm signal will be produced by the portable **Life•line** monitor. Both the alarm condition and concentration levels will be transmitted back to the main monitoring center where the concentration levels, affected entrants, and work location will be displayed on the system's computer screen. If there are other workers in the affected area, an evacuation alarm will be automatically initiated on all of those users' portable **Life•line** monitors.

ARTICLE 12. Ventilation and Dust Control

The Standards concerning ventilation requirements are as follows⁴:

† 8437 (a). *Ventilation - Fresh air shall be delivered in adequate quantities to all underground work areas. The supply shall be at least sufficient to prevent dangerous or harmful accumulation of dusts, fumes, vapors or gases, and shall not be less than 200 cubic feet per minute for each man underground. The lineal velocity of the air flow in the tunnel bore shall not be less than 60 feet per minute in those tunnels where blasting or rock drilling is conducted or where there are other conditions that are likely to produce dusts, fumes, vapors or gases in harmful quantities.*

† 8437 (b). *The main ventilation system shall be so arranged that the air flow can be reversed from the surface if a fire or some other emergency makes this advisable.*

† 8437 (e). *Where flammable gas or air contaminants have been encountered, adequate ventilation shall be maintained to keep the gas or vapor concentrations within safe limits as provided by Safety Order 8424 and the Threshold Limit Values.*

The **Life•line** system will integrate with the facility's and/or work area ventilation system. In the event of failure of the ventilation system, the main monitoring center will transmit an evacuation alarm to entrants working in the affected area. The ventilation "off" or "stop" buttons will be defeated by **Life•line** until such time as all entrants have left the area that the ventilation system supports, and either logged off the system or changed their work location.

One **Life•line** custom option is the ability to monitor and control air flow, velocity, direction, and pressure. **Life•line** portable monitors can be configured to upload specific air data through the use of integral sail and differential pressure switches, as well as magnahelic and air pressure transducers. This information, along with the regular status and system information, can be printed in an end-user's definable report format. As with our ventilation option alarm, threshold levels can be set for automatic evacuation alarming of entrants in the event of an emergency.

ARTICLE 19. Hoisting and Shafts

† 8498. *Hoisting Signals*

† 8498 (a). *Every shaft or incline shall be provided with an efficient means of interchanging distinct and definite signals between the top of the shaft and the lowest level and any intermediate level from which hoisting is being done.*

⁴Labor Code Sections 7974 and 7982 contain Similar requirements.

† 8498 (c). *Signals to hoist engineer shall be given only by persons authorized to do so.*

Life•line's voice communication feature can be established by the hoist engineer or any other authorized person to allow for clear, concise and effective communications during the hoist procedure. The utilization of voice communications during the hoisting procedure will minimize any potential danger compared to other signaling methods which can rely on the interpretation of bell and horns.

In order to help ensure that only authorized persons are used for hoist engineers, all communications are monitored and controlled by the system attendant at the main monitoring console. Additionally, during the log-on process the **Life•line** system will check its databases against predefined training or authorization levels for the person wishing to use the system. Any contradiction between training and authorization levels will be displayed to the attendant and the user will be refused system access.

THE **Life•line** MONITORING SYSTEM AND ITS ABILITY TO MONITOR EMPLOYEES IN HAZARDOUS AND/OR REMOTE LOCATIONS

Many individuals employed by municipalities, utilities and refineries are required to work in locations where they must work alone and at some distance from assistance. If they should have an emergency such as a fall, a heart attack, or some danger that develops in the environment, communication is often dependent upon a radio in a vehicle which may not be easily reached.

The **Life•line** system's ability to regularly poll the worker can maintain a level of safety and security by providing continuous monitoring of employees in these hazardous or remote locations.

THE **Life•line** MONITORING SYSTEM AND ITS USE DURING CONFINED SPACE ENTRY NEW OSHA REGULATION

On January 14, 1993, OSHA published a long-awaited final rule on entry into confined spaces (CFR Part 1910.146). The new Regulations require that the employer "Provide at least one attendant outside the permit space into which entry is authorized for the duration of entry operations." American industry will be critically affected by the new Regulations due to the huge number of confined spaces requiring entry during plant maintenance and operations. The cost impact on industry of providing additional employees to provide non-productive stand-by presence will result in a substantial cost increase when confined space work is required.

The **Life•line** alternative to the use of an attendant at each confined space entry is now available. Knowing that computer/radio entry monitoring was near development, OSHA specifically permitted the use of such a system in its final rule:

Attendants may be assigned to monitor more than one permit space provided the duties described in paragraph (i) of this section can be effectively performed for each permit space that is monitored. Likewise, attendants may be stationed at any location outside the permit space to be monitored as long as the duties described in paragraph (i) of this section can be effectively performed for each permit space that is monitored.

CFR Part 1910.146 (i) lists the ten duties of the attendant -- duties that must be accomplished regardless of whether there is one attendant for each entry, or one attendant monitoring two to one hundred entrants with the **Life•line** system.

Use of the **Life•line** system permits one attendant to safely perform all ten duties for a multiple number of entrants at the same time.

TRAINING AND MAINTENANCE

The **Life•line** technology is supported by a detailed program of user training in the operation and maintenance of the system and the requirements for safe confined space entry. We provide a program of monthly service and recertification, as well as on-call maintenance and on-line software diagnostics.

ADDITIONAL INFORMATION

Each **Life•line** system is available in a range of capacities from a minimum of no less than two, to a maximum of over one hundred monitored employees. The cost of the system is a function of the number of employees to be monitored. A system lease program is also available.

For additional information on the **Life•line** system, and to arrange for a demonstration of the system, please call Safe Environment Engineering at (805) 295-5500.

Developed by SAFE ENVIRONMENT ENGINEERING
25061 W. Avenue Stanford, Suite 30, Valencia, CA 91355
(661) 295-5500 (661) 294-9246 FAX