



Communications for Confined Space

Good communications is one of the most important tools to provide worker safety and at the same time improve efficiency. This is especially true in the hazards of confined space entry, where good communications provides protection to employees. There can be *no safety without effective and reliable communications*. Additional benefits in productivity, resulting cost savings, and worker confidence may often be realized with good communications. In some circumstances, communication makes an otherwise impossible task possible. In the highly sophisticated plants of today's world, with their sometimes extremely noisy environments and a variety of identified confined spaces, we must consider how to achieve communications between workers. This is not only necessary from a practical point of view, but in the case of confined spaces, a requirement under the OSHA standard¹.

There are various methods used in achieving communications including hand signals, shouting, rope tugging, and several types of electronic communicators. We shall examine these methods and identify their inherent strengths and weaknesses in use with confined space entry.

Confined Space- an Overview

Lets look at the definition of a confined space as set forth in the OSHA standard¹. It describes "*confined space*", as any space that has limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by the employee. These areas include but are not limited to: underground vaults, tanks, storage bins, vessels, pits or sumps, and silos.

A "*permit required confined space*" is described as those spaces that meet the definition of a "confined space" and has one or more of the following characteristics: (1) Contains or has the potential to contain a hazardous atmosphere. (2) Contains a material that has the potential for engulfing an entrant. (3) Has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section. (4) Contains any other recognized serious safety or health hazards.

If workers are to enter permit required spaces, employers are to develop and implement a written permit space program in accordance with the OSHA standard¹ This document sets forth the practices and procedures to protect employees from the hazards associated with entry into permit required spaces.

Communication Methods

One of requirements of the standard is that all entrants must be able to "communicate with the attendant as necessary to enable the attendant to monitor

entrant status and to enable the attendant to alert entrants of the need to evacuate the space”¹. In short the standard specifies that *clear, continuous communications must exist at all times*. The methods used to achieve this are left up to the individual employer. It is not always a simple task to choose a communication solution that will satisfy OSHA’s requirements¹ to provide effective communications in all anticipated and unanticipated situations, and still be readily accepted by employees. This becomes even more apparent when you consider that in many cases entrants are encumbered with equipment such as self-contained breathing apparatus (SCBA), personal alert and gas detection devices, and safety harness apparatus.

In examining the conventional means of communications used, it is found that many of these have limited application and usefulness. For example, direct voice transmission (talking or shouting) work only in low noise environments and over relatively short distances. Loud hailers can extend the distance to some degree but are cumbersome and not very useful when more than one entrant is involved. Hand signals work only in line-of-sight applications and require constant visual contact between communicants. As soon as a back is turned a vital hand signal will not be seen. Tugging a rope will signal the recipient only if the rope is not snagged and conveys only the very basics of intelligence.

Electronic communications offer better solutions and fall into two main categories: “tethered” and “non-tethered”. Tethered communications require the use of a physical wire or equipment connection between the communicants. Non-tethered communications utilize wireless or radio equipment.

Wireless Communications

Wireless communications that transmit signals through the air via radio frequency waves (i.e. two-way radio) provides unhampered mobility to the user. For this reason it has become the system of choice in many instances. Radio equipment has its own shortcomings however, making its use limited or even unacceptable in many confined space applications.

The most serious problem is maintaining a line-of-sight condition between each radio. When this condition is not met communications may become erratic or worse, entirely missing. Steel, concrete and brick surrounding or in proximity to the radio have a shielding effect. Additional antenna elements installed in strategic locations may alleviate these problems but this becomes expensive and impractical in portable or emergency applications.

Most radio installations are based on a “Simplex” mode of operation where all radios transmit and receive on the same frequency. Transmission is achieved by keying the radio manually or by voice activation. Simplex systems only allow one person at a time to transmit. Once the radio is keyed to transmit, it is incapable of receiving incoming transmissions. Simplex is not suitable for confined space communication as it does not meet OSHA’s requirement¹ for continuous communications.

The use of a “Duplex” system addresses the Simplex problem by having each radio operating on two frequencies simultaneously. In this case transmit and

receive frequencies are open all the time in both directions. Keying the radio to transmit is not necessary as the transmitter is on all the time. This method meets the requirement for continuous communication but tends to use a lot of power. This is an important factor since most systems are battery operated.

Things get more complicated if more than two radios are required and the use of an additional repeater is necessary to accommodate duplex operation. PTT (push-to-talk) or VOX (voice actuated) switches used to switch the radios to transmit are unacceptable since it prevents continuous communications.

In applications that involve potentially volatile explosive atmospheres, intrinsically safe equipment is required. Only one or two radios on the market today meet this approval. Assembling a multi-radio, intrinsically safe duplex system is an attractive solution only if cost is not a consideration.

In summary, wireless communications should not be the system of choice for confined space communications.

Wired Communications

Fortunately there are other solutions available that address these areas of concern. These are defined as tethered or hard-wired systems. Wires are used to interconnect headsets and components to form an intercom between the workers.

The numerous advantages of this system outweigh the disadvantage of a physical interconnection between components. Initial and operating cost is low and non line-of-sight communications is assured. Full duplex lets everyone talk at once and insures that no messages are missed. PTT or VOX controls are not required resulting in complete hands free and intuitive operation. This feature is especially important in emergency situations where one doesn't have to worry or think about what buttons to push.

Wired communications are multi-user and typically allow for up to 10 users. Most systems have immunity from RFI (radio frequency interference). This is often encountered from nearby equipment that generates RF such as arc welders, computers, fluorescent lighting etc. Generally, wired communications do not generate their own RF and do not cause interference to nearby electronics such as PLC, s (Programmable Logic Controllers) found in many pieces of equipment used in industry.

In the event that a confined space rescue becomes necessary, most wired intercom systems provide the privacy needed to prevent monitoring or interference by those not involved with the operation.

Recently the ASTM released recommendations² regarding hard-line communications for confined space and although the standard doesn't preclude the use of other communication systems, it does state the following. "Because of the many unique requirements of permit-required confined space rescue operations and the specific construction and composition of some confined

spaces, hard-line communication systems may be the only type that will meet the requirements of working in these spaces”²

In brief summary this document states the following system requirements: (1) it must be intrinsically safe, (2) have continuous, hands free voice communications, (3) be dedicated and private, (4) not effect readings of other equipment (i.e. gas detectors), (5) if battery operated must have a low battery warning or back up power, (6) accommodate a minimum of three users, (7) allow for communications between all entrants as well as attendant, (8) must work in conjunction with any personal protective equipment used and, (9) must be impervious to the chemicals within the space.

There are several manufactures offering wired communications today which meet the OSHA and ASTM standards. SED Inc.'s Rescom® hardwired system is one such solution that meets the highest of intrinsic safety standards as defined by CSA and UL. It provides communications for up to 10 employees for any distance up to 3 miles. Although 3 miles is a rather long distance, it does indicate the assurance of communications over distances and allows for the pre-wiring of plants or underground tunnels.

Rescom® goes a step further by incorporating the communication wires internally into a tag, or safety rope. This “communication rope” is a high performance Kernmantle rope, which can be used like any other quality safety and rescue rope including high angle rescue (when used with approved accessories). This combination meets OSHA's requirement of providing a means of rescuing entrants from a confined space and eliminates the need for an additional cable. Reduced equipment means improved worker efficiency and greater safety.

The many variables involved in confined space communications appear to make it difficult to decide on a suitable system. In light of the facts reviewed a hardwired product such as the intrinsically safe 'Rescom® system providing clear, uninterrupted continuous communications can be considered a system of choice.

Poor communications in confined space entry can be fatal. It is highly recommended that a product with the highest intrinsic safety rating be chosen so that workers, employees and employers are guaranteed that the correct communications are being used no matter what the emergency. This provides not only for the greatest worker safety but for employer liability protection as well.

1: Occupational Safety and Health Administration (OSHA): Document #29 CFR 1910.146

2: American Society for Testing and Materials (ASTM) Designation: F 1764-97).