

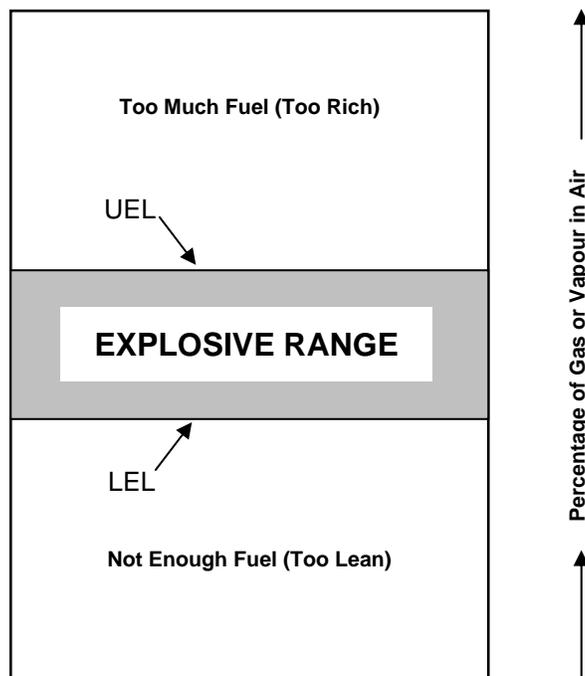
Confined Space Entry Program

Appendix A: - CONFINED SPACE HAZARDS

Combustible Atmospheres:

There are many sources of a combustible atmosphere, but the most common one aboard pilot boats is when a flammable/combustible liquid (such as diesel fuel, WD-40, contact cleaner, paint solvent, etc) becomes vapourized.

An atmosphere becomes combustible when the ratio of oxygen to combustible material in the air is neither too rich nor too lean for combustion to occur. Combustible gases (such as hydrogen and acetylene) or vapours from combustible liquids can accumulate in spaces where there is little or no ventilation. Since many gases and vapours are denser, or heavier than air, they will seek lower levels in a lazarette or other space. Other gases such as hydrogen (which is produced when batteries are charging) and vapours are lighter, or less dense than air. They can rise and develop a combustible atmosphere at the top of a space.



Sources of Ignition:

Welding, burning, soldering and grinding in a confined space are major causes of explosions in areas that contain a combustible atmosphere. All sources of ignition must be carefully controlled. Static electricity can also produce sparks and ignite a combustible atmosphere.

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Toxic Atmospheres:

There are many toxic substances that may be found in confined spaces onboard pilot boats. Many of them are gases or vapours, and they are invisible.

Exhaust emissions from the diesel engines are a toxic cocktail that includes carbon monoxide, carbon dioxide, nitrogen compounds, sulfur compounds and particulate.

Carbon monoxide is very dangerous because of its poor warning properties. Early stages of CO poisoning are nausea and headache. Carbon monoxide is considered very dangerous at 200 ppm in air, and may be fatal at 1000 ppm. 25 ppm is the legal limit of exposure for carbon monoxide. Because carbon monoxide is colorless, odorless and relatively common, any untested atmosphere must be suspect.

Maintenance operations performed in a confined space (for example, welding or brazing, and the use of certain paints and coatings) will very quickly produce a toxic atmosphere that will not be identified by the APA's gas monitor. Such work must be reviewed with the APA's Shore Engineer to ensure that adequate controls are in place.

Asphyxiating Atmospheres:

The normal atmosphere is made up of 20.9% oxygen, 78.1% nitrogen, and 1% argon, with small amounts of various other gases. Reduction of oxygen below the acceptable limit (18%) is very dangerous and can be deadly. Oxygen deficiency in a confined space may be the result of either consumption or displacement.

Oxygen is consumed during the combustion of flammable substances (example: welding, heating, cutting, and brazing). Oxygen is also consumed by some bacterial actions, but that should not be a common concern on pilot boats. Chemical reactions, such as the rusting of a large, exposed surface in a confined space also consume oxygen. The number of people working in a confined space and their physical activity will also influence the oxygen consumption.

The second cause of oxygen deficiency is displacement by another gas. Exhaust gases from the diesel engines, if allowed to leak into lazarettes and other spaces, will displace the oxygen. Many of these gases are colorless and odorless and they may pose an immediate hazard to health. The atmosphere in all confined spaces must be tested before entry to ensure an adequate level of oxygen. Ventilation is always advised.

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Electrical & Mechanical Hazards:

If activation of electrical or mechanical equipment would cause injury, each piece of equipment must be isolated and locked-out (*see SOP – Lock-out*). Energized equipment could also provide a source of ignition for combustibles.