



Confined Space Accidents #2

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Accident #1

Two men were installing piping in an open sump at a gasoline service station. A tank bung was unplugged and left open, allowing gasoline vapors from within the tank to accumulate in the sump. The workers were heating the pipe and fittings with an electric heat gun to set the glue when the vapors ignited. A third worker brought a fire extinguisher over to the sump and put out the flames. One of the men in the sump suffered first degree burns to his face and missed work the following day.

Review

1. Isolation of the confined space from another system (the storage tank) containing a hazardous atmosphere was not performed, allowing vapors to migrate into the work area.
2. The work area (sump) was not monitored for the presence of flammable vapors.
3. Electrical equipment (heat gun) not designed for use in a hazardous atmosphere was used in an area where gasoline (flammable) could accumulate or otherwise be present.

Isolation, monitoring and the use of properly designed electrical equipment are all requirements. Had even one of these requirements been met, the accident would probably not have occurred.

Accident #2

A worker for a firm that was retained to sandblast an underground storage tank turned on an electric vacuum to remove the spent abrasive that had accumulated on the tank bottom. A spark from the vacuum cleaner ignited vapors within the tank. He died later as a result of his burns.

Review

1. Sandblasting is a spark producing operation and should never be performed in a space that contains sufficient flammable residuals that the flammability level within the space can cause a combustible gas indicator to indicate the presence of flammable vapors. This following steps need to be assured A) isolation from an adjacent tanks (through vapor recovery systems, manifolded vent lines, siphon piping, etc.) B) flammable residuals need to be removed to the extent possible (using pumps, manual scraping/shoveling, drying with absorbents and ventilation) C) adequate ventilation of the space needs to be maintained. Ventilation needs to be sufficient to ensure that the rate of air exchange exceeds the rate of flammable vapor generation.
2. The work area (tank) was not monitored for the presence of flammable vapors.
3. Electrical equipment (vacuum cleaner) not designed for use in a hazardous atmosphere was used in an area where flammable vapors could accumulate or otherwise be present.

Accident #3

Two repairmen went to inspect an underground tank for leaks at a remote, isolated farm site. Stored product had been removed from the tank the previous day by another contractor. One of the men entered the tank without respiratory protection or a retrieval harness and without monitoring for vapors as it was assumed that the tank was clean. When he reached the tank bottom, he was overcome by the vapors and collapsed. The other worker realized that he could not retrieve his coworker without help and immediately drove to the nearest farmhouse, nearly a mile away. By the time rescue services arrived at the site, the worker was already dead.



Review

1. It is never prudent to assume that an atmosphere is safe based on the actions of others (assume = ass + u + me). The atmosphere within a confined space must be considered hazardous until proven otherwise. Thus, this was a permit required confined space entry.
2. Confined space regulations require three persons to be present when the confined space contains (or could contain) a hazardous atmosphere.
3. Confined space regulations require a reliable means of communication be available for contacting emergency services.
4. Monitoring of the confined space for oxygen, flammability and toxicity must be performed prior to entry.
5. Entry personnel are required to wear a harness attached to a lifeline for retrieval (non-entry rescue) purposes. The lifeline must be attached to a fixed point outside of the confined space, or, when the depth of the confined space is 5 feet or greater, to a mechanical retrieval device (hoist and tripod).
6. Respirators must be selected and used to protect workers from atmospheric contaminants.
7. Permit-required (those containing or potentially containing hazardous atmospheres) confined spaces must be ventilated prior to entry and continuously throughout entry.

These men were sent to investigate an underground tank for leaks. Now that the tank was empty, if a leak was present, vapors or raw product was free to reenter the tank. Additionally, product clinging to the walls, permeated into rust scale and under overlapping seams can vaporize into the tank displacing oxygen and creating a flammable/toxic atmosphere.

Accident #4

A worker entered a toluene tank to begin cleaning operations without wearing an available respirator that had just been tested moments prior to entry. He quickly was overcome by the vapors in the tank. When firemen arrived on site, they began using an electric saw to widen the opening to allow for entry wearing an SCBA. Sparks from the saw ignited vapors within the tank, resulting in an explosion. The explosion killed the worker in the tank and one of the firemen as well.

Review

1. Monitoring of the confined space for oxygen, flammability and toxicity must be performed prior to entry.
2. Entry personnel are required to wear a harness attached to a lifeline for retrieval (non-entry rescue) purposes. The lifeline must be attached to a fixed point outside of the confined space, or, when the depth of the confined space is 5 feet or greater, to a mechanical retrieval device (hoist and tripod).
3. Respirators must be selected and used to protect workers from atmospheric contaminants.
4. Electrical equipment (saw) not designed for use in a hazardous atmosphere was used in an area where flammable vapors could accumulate or otherwise be present.

Toluene has a permissible exposure limit of 100 ppm, but quickly becomes an imminent danger (IDLH = 500 ppm). Ventilation, if used, was incapable of changing out the air frequently enough to maintain the atmosphere within the acceptable range for breathing without a respirator (it can be presumed that no ventilation was used as the atmosphere reached the flammable range during rescue operations). The removal of the toluene residual (cleaning) is a process that inevitably disturbs the product causing it to emit vapors more rapidly than undisturbed product, warranting the use of a respirator even when initial monitoring shows an acceptable atmospheric concentration. Further, monitoring from the outside



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of a storage vessel provides incomplete information as to the actual atmospheric concentrations that may be encountered within the vessel. The slope and configuration (i.e. baffles, etc.) of the vessel and the ventilation configuration can allow for hot spots in areas that are not monitorable prior to entry. The first duty of the entrant is to assure that there are no localized areas of increased atmospheric concentrations within the confined space prior to initializing work procedures.

Accident #5

A welder was repairing a steel tank. He had just placed his cutting torch inside the tank when the break-time whistle sounded. After taking a 15 minute break, the welder returned to the tank, climbed inside and struck an arc with his cutting torch. The welder was unaware that his cutting torch had leaked acetylene into the tank through the duration of the break. The arc caused ignition of the acetylene gas that had accumulated in the tank and the welder caught fire. He later died as a result of his burns.

Review

1. When the break-time whistle blew, the welder should have secured the cutting torch and shut off the flow of gas from the regulator on the acetylene canister.
2. Cutting and welding are hot work operations that require a fire watch to be present.
3. Cutting and welding operations can emit toxic vapors into the air and require exhaust ventilation, at minimum.

Accident #6

A contract employee was cleaning paint chips out of an 8,000 gallon steel above ground storage tank. He was overcome by the cyclohexanone vapors from the solvent. Two workers attempted to rescue him, but also collapsed. No monitoring of the tank atmosphere was performed prior to entry or subsequent to entry. All three men died.

Review

1. Monitoring of the confined space for oxygen, flammability and toxicity must be performed prior to entry.
2. Entry personnel are required to wear a harness attached to a lifeline for retrieval (non-entry rescue) purposes. The lifeline must be attached to a fixed point outside of the confined space, or, when the depth of the confined space is 5 feet or greater, to a mechanical retrieval device (hoist and tripod).
3. Respirators must be selected and used to protect workers from atmospheric contaminants.
4. Coworkers need to be trained and reminded that entry rescue can only be performed in a higher level of personal protection than that worn by the entrant (if he collapsed, the atmosphere is IDLH and level B PPE is the minimum acceptable level) by properly equipped and trained personnel. About half of all confined space fatalities involve would-be rescuers.
5. Permit-required (those containing or potentially containing hazardous atmospheres) confined spaces must be ventilated prior to entry and continuously throughout entry. The ventilation needs to be capable of changing the air in the confined space often enough that toxic/flammable atmospheric contaminant concentrations will not build to hazardous levels.

Accident #7

Prior to sandblasting a tank, an expanding plug was placed in the product line from the tank interior. While sandblasting the tank, the expanding plug was punctured by the abrasive and deflated, causing it



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to fall from the opening. Accumulated fuel no longer being held back by the plug caused the employee in the tank to be soaked with fuel. Fortunately, no injury resulted.

Review

1. Isolation needs to be accomplished by a secure and reliable means. An inflatable plug may be acceptable under certain conditions. When the operation being conducted has the capability of puncturing the plug, a more durable method needs to be employed.

Accident #8

Two workers were preparing to cut an access entry hole into an underground tank. They had traveled more than 100 miles to the site in a shop truck over mostly secondary roads. Before they began cutting the tank opening, they purged the tank to remove vapors and inserted a combustible gas indicator probe into the fill pipe to measure the flammability of the atmosphere within the tank. The readings on the meter indicated that it was safe to begin cutting the tank. However, the meter had unknowingly been damaged enroute to the job site because it had been free to bounce around in the back of the shop truck. When the electrical saw was turned on, a spark caused an explosion, killing one worker and seriously injuring the other.

Review

1. Sensitive electronic equipment needs to be secured prior to travel.
2. Monitoring equipment requires the use of a daily "bump test" to assure that the monitor is functioning properly. The bump test is accomplished by attaching a tube from a container of calibration gas to the meter and checking to see if the meter detects the calibration gas accurately.
3. Electrical equipment (saw) not designed for use in a hazardous atmosphere was used in an area where flammable vapors could accumulate or otherwise be present.

Accident #9

Two large tanks were being internally coated in preparation for fertilizer storage. A workman was making his way out of the tank after applying the first coat of a rubber-based lining to the tank interior. As he was working his way out, he kicked a mechanics light, causing it to break. The non-explosion proof light ignited solvent vapors. The force of the vapor expansion caused the worker to be ejected from the tank through the manway and into the side of an adjacent tank. He died as a result of his injuries.

Review

1. Electrical equipment (light) not designed for use in a hazardous atmosphere was used in an area where flammable vapors could accumulate or otherwise be present.
2. Permit-required (those containing or potentially containing hazardous atmospheres) confined spaces must be ventilated prior to entry and continuously throughout entry. The ventilation needs to be capable of changing the air in the confined space often enough that toxic/flammable atmospheric contaminant concentrations will not build to hazardous levels.



Accident #10

A four man crew was cutting the top off of a tank at a refinery location. A piece of equipment apparently ignited vapors inside the tank, causing an explosion that killed the three workers that were in the tank.

Review

1. Cutting (hot work) can only be performed in locations that have been made safe by either eliminating flammability/combustibility hazards or protecting them.
2. The atmosphere within the tank had reached the flammable range. Entry into and hot work on (even the outside of) the tank were prohibited conditions.
3. Monitoring was inadequate to warn of the flammable vapor accumulation.
4. Permit-required (those containing or potentially containing hazardous atmospheres) confined spaces must be ventilated prior to entry and continuously throughout entry. The ventilation needs to be capable of changing the air in the confined space often enough that toxic/flammable atmospheric contaminant concentrations will not build to hazardous levels.

The use of respirators can give a false sense of security. When wearing the respirator, your senses (smell) are incapable of telling you that a hazardous situation is developing. Thus, you are even more dependant upon your monitoring instruments to alert you. Note: this is not an endorsement of using your nose as a means for alerting you to hazards. Many hazards are incapable of being reliably detected by the nose and others are already very toxic before the nose will detect them.

Accident #11

A worker was cleaning out an underground storage tank. After the tank was scrubbed and prior to being filled with sand, the workman used a ladder to climb down into the tank carrying an electric lamp and an electric saw connected to a power supply with an extension cord. Vapors in the tank ignited causing the worker to suffer second and third degree burns to 86 percent of his body.

Review

1. Electrical equipment (light and saw) not designed for use in a hazardous atmosphere was used in an area where flammable vapors could accumulate or otherwise be present.
2. Confined space regulations require three persons to be present when the confined space contains (or could contain) a hazardous atmosphere.
3. Confined space regulations require a reliable means of communication be available for contacting emergency services.
4. Monitoring of the confined space for oxygen, flammability and toxicity must be performed prior to entry.
5. Entry personnel are required to wear a harness attached to a lifeline for retrieval (non-entry rescue) purposes. The lifeline must be attached to a fixed point outside of the confined space, or, when the depth of the confined space is 5 feet or greater, to a mechanical retrieval device (hoist and tripod).
6. Respirators must be selected and used to protect workers from atmospheric contaminants.
7. Permit-required (those containing or potentially containing hazardous atmospheres) confined spaces must be ventilated prior to entry and continuously throughout entry.

There was no information available about the victim's condition. However, it is extremely rare for



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someone suffering this level of burning to survive.

Accident #12

A plumber was attempting to warm a confined space in which he intended to work. He placed his lighted cutting torch in the vaulted area and closed the opening. When he returned to the vault, he noticed that the torch was no longer lit and, after entering the vault, attempted to relight the torch. The torch had used up the available oxygen in the space, causing it to extinguish, and filled the space with acetylene. When the plumber reopened the space, oxygen was again introduced and the ignition caused the acetylene vapors to ignite. The plumber was blown out the opening and burned over 65% of his body. He died about a week later.

Review

1. Tools are only to be used for their intended purpose.
2. Cutting and welding are hot work operations that require a fire watch to be present.
3. Cutting and welding operations can emit toxic vapors into the air and require exhaust ventilation, at minimum.
4. The vault was a confined space and all of the requirements of a confined space program should have been implemented (monitoring, ventilation, personnel, training, etc.).