APPLICATION OF CHLORINE CAPPING KITS
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Physical Properties of Chlorine

It is important to understand some of the physical properties of chlorine as these characteristics can influence your approach in capping a leaking cylinder or tonner.

Chlorine is a greenish-yellow gas and if you can see this gas in the chlorine room, then you know you have high concentrations. Normally leaks or releases are very small in terms of amount. Most sensors in chlorine rooms are set at 3 ppm or 5 ppm, so these will activate when the gas is not visible. Chlorine has a very distinctive odour detectable at levels of 0.3 ppm consequently smell is not always a good indicator of the severity of the leak. However, the odour and irritating properties of chlorine do serve as good early warning signals for individuals who may be in the chlorine room at the time of a release. At 5 to 8 ppm, individuals will experience irritation of the eyes, nose and throat making it uncomfortable to remain in the area. The IDLH (Immediately Dangerous to Life or Health) for chlorine is 10 ppm. This is the concentration levels that an individual could be exposed for 30 minutes and still escape without irreversible health effects.

The reactivity of chlorine can be a problem in the case of a release. Chlorine is not a flammable material so there is no need to ground cylinders of tonners. However, it will support combustion and react with organic and inorganic compounds which can results in the evolution of heat. It is very important that other chemicals are not stored in the chlorine room.

Chlorine also reacts with ammonia to produce a white smoke and this is a reliable method for locating any leaks in chlorine system. Avoid the use of Snoop or any other indicator that might container water. Dry chlorine either liquid or gas, at ordinary temperatures does not corrode steel, however reacting with water, chlorine will produce hydrochloric and hypochlorous acids which are corrosive. This can cause corrosion around the leak and increase the severity.

As chlorine gas is heavier than air it will collect and settle in low areas. Ideally, ventilation exhausts should be located near floor to effectively remove the chlorine gas. The rate of release for chlorine gas is difficult to determine since temperature and pressure are important variables. The rate of chlorine gas delivery depends upon the pressure in the container, which in turn is dependent upon the temperature of the liquid chlorine. As the liquid turns to gas, the temperature of the liquid is lowered which then reduces the pressure. The temperature of the liquid is also affected by the transfer of heat from the ambient air to the liquid chlorine through the wall of container.

As a guideline the flow of chlorine gas from a 68 kg cylinder at 18 C will be about 25 kgs in two and a half hours. The flow slows down significantly after five hours and would stop after seventeen hours with a total of 57 kgs released. For a 907 kg tonner, at 18 C, after five hours the release would be 190 kg and the flow would decrease significantly after fifteen hours. The flow would probably stop after fifty-five hours, with 880 kgs released. The movement of this gas will be dependant upon

temperature and wind direction. Chlorine is only slightly soluble in water so there would be little absorption from a cloud of chlorine gas. Chlorine can causes bleach spots on leafy plants.

Finally, chlorine liquid has a high expansion ratio, 1 volume of liquid will vaporize to approximately 460 volumes of the gas. One 68 kg cylinder would completely fill a standard 10 X 10 X 8 foot room with 100% chlorine gas. If a container is leaking liquid, rotate the container so the release is gas. This will reduce the volume of the uncontrolled chlorine as chlorine liquid will leak fifteen times the rate of chlorine gas. When pressurized liquid or gas is released from a container, the resulting drop in temperature and pressure inside the container will decrease which will slow the rate of the leak. Liquid that has escaped will immediately cool to its boiling point, -34 C. Once it comes into contact with any heat source, the air, ground or water, the chlorine will begin to boil. Normally this boiling off-rate will be high initially, but will decline as the heat source is then cooled by the chlorine.

When the Alarm Activates

All chlorine rooms will have sensors and alarms. Then the alarms activate, the concentrations have now reached at least the minimal levels. By the time a response has occurred these levels will have increased if the leak has continued. When approaching the chlorine room, check the wind indicator as this will tell you the direction the chlorine is moving if it has escaped the building from either the ventilation system, inlet safety valve on the chlorinator, or through an open door.

Quickly check through the inspection window to the chlorine room to see if the chlorine is visible. This will give you some idea of how large the leak might be. At this point the recommended equipment is SCBA as the concentrations of chlorine will be unknown. Best practices require that two individuals don SCBA with at least one individual in SCBA as a backup. In applying the capping kits, especially Kit "B" for the tonners, two people are more efficient in handling the equipment.

Responding

The procedures for capping a cylinder or a tonner are very similar and neither procedure is complicated. The Chlorine Institute supplies instruction booklets in the capping kits which are good sources for information. A review of these booklets from time to time will certainly help you to respond should an incident occur.

Once the members from the response team have donned the protective equipment, the first step is to determine the location of the leak. With the ammonia bottle, spray the ammonia vapour around the area of the cylinder and look for the white smoke to form. Avoid spraying liquid, as this could encourage corrosion around the leak. Check the fittings and connections as this is where the majority of the leaks occur.

Cylinders

If the leak is develops around the valve, there are two very simple procedures that will address the majority of these leaks. First open and close the valve stem. It is possible that metal filings or dirt

may be lodged on the valve seat and opening and closing the valve can dislodge the material. Remember that the valve and valve seat are a metal to metal junction and it can be sticky so be firm when tightening the valve. The valve can be opened by striking the chlorine wrench with the heel of the hand, but never use a wrench extension.

The second procedure is to tighten the packing nut. Close the valve and then tighten the packing nut, but do not over tighten as this might bind the valve. This will seal off any leaks that are occurring around the packing.

If the leak is from the valve inlet threads, carefully tighten the valve. However, do not over tighten as the leak could be as a result of corrosion and further damage may occur to the valve or the container. Finally a leak may develop on the inlet threads of the fusible plug. This plug can also be tighten, but again exercise caution.

All of these leaks can be addressed by the "A" kit hood assembly. To start remove the protective housing if it is still in place. If the housing cannot be removed, the newer capping kits have hoods large enough to fit over this housing. Prepare the capping kit by removing the outlet cap on the vent valve and open this valve on the hood. This is to make it easier to apply the hood by not allowing pressure to build up from the escaping chlorine. Next prepare the base assembly by attaching the ramp to the small hook that is between two of the base segments. This will ensure stability and prevent the ramp from sliding while the cylinder is being moved into position. Once the cylinder has been rolled into position, clean the cylinder shoulder with the scraper. Remove any loose paint or dirt that may interfere with a good seal from the hood.

Then place the hood along with the gasket over the leaking valve. The gasket should be clean with no cracks. Now place the yoke on top of the hood with the screws from the yoke aligned with the dimples on top of the hood. Hook the chains to the over the ears of the yoke, ensure that the chains are straight and snug. Begin to hand tighten the screws which will force the hood assembly against the cylinder. However do not over tighten as this may damage the gasket. Close the vent valve and replace the outlet cap. Then test for leaks around the gasket using the ammonia bottle. If a leak persists, hand tighten the screws again.

There is also a clamp for leaks from the fusible plug. If the leak is from the threads, then the plug must be sawed off and flush with the valve surface. Then apply the clamp along with a gasket. By tightening the screw on the clamp pressure is applied to seal the leak. This would be the procedure if the cylinder was going to remain in the system and supply chlorine. However, the risk does increase as the cylinder is no longer able to release pressure should a fire occur. If the cylinder is to be pulled from the system, applying the hood assembly will save time. If the leak is from the fusible material inserted in the plug, the clamp can be applied directly to the plug.

Another device is used for sealing side-wall leaks in cylinders. Should a leak occur, roll the cylinder so the escaping chlorine is gas and not liquid. Clean the area around the leak with the scrapper and check the integrity of the wall around the leak to ensure it is not weak from corrosion. Slip the chain around the cylinder ensuring that the chain is not twisted. Place the cap screw, yoke and gasket over

the leak, and hook the ends of the chain onto the ears of the yoke and cap screw device. Tighten the cap screw but watch for any indication that the cylinder wall is leaking.

Finally should a valve shear off a cylinder, drift pins are available to seal the hole. If possible attempt to apply the hood assembly for added security.

In all cases, once the any of the capping kit equipment has been applied, check for leaks with the ammonia bottle.

Tonners

Leaks involving the valves of the tonners would be similar to those of the cylinders. However, there are two major differences to consider. With the tonner, the leaking valve could be discharging chlorine liquid or chlorine gas. Also the valves do not have a fusible plug, these are now located at both ends of the tonner.

To apply the "B" kit to a leaking valve, first remove the protective housing if it is still in place. With the ammonia bottle determine the source of the leak and if necessary roll to tonner so that the leaking valve is above the secure valve. This will change the release from liquid chlorine to chlorine gas. Again check the valve by opening and closing it firmly and tighten the packing nut. If these two activities do not terminate the leak, prepare the hood assembly. Remove the outlet cap on the vent valve and open the valve. Check the gasket for cracks or dirt, and if none exist, attach the gasket to the hood assembly. Clean around the valve with the scraper and then place the hood assembly over the leaking valve. Adjust the screws on the bar assembly so that the device can be inserted behind the chime of the tonner. Try to keep the bar in a vertical position as this will help to make any adjustments to the bar much easier. Align the bar assembly so that a cap screw is directly over the hood assembly and tighten the jack screws so that the bar assembly fits tightly inside the chime.

Begin to tighten the cap screw which will force the hood assembly against the tonner. Tighten only enough to stop the leak, since over tightening can split the gasket. If a seal cannot be obtained, other gaskets are available which can be used in combination with the hood assembly to seal the leak. Close the vent valve on the hood and test with the ammonia bottle to ensure there is no leak.

If the leak is occurring from a fusible plug, again rotate the tonner so the leaking plug is at the highest point. If the leak is from the fusible metal, slip the small yoke with the stud over the head of the plug. Cover the leaking area with a gasket and tighten the stud, which will force the gasket against the leak.

If the leak is from the inlet threads of the fusible plug, proceed with the small yoke and stud from the previous procedure. Once this is in place, scrape around the plug to remove any lose paint or dirt and prepare the small hood assembly. Place the gasket on the hood and then put the hood over the yoke and stud so that the stud extends out of the hood. Slip a gasket over the stud and then screw the cap nut onto the stud. Slowly tighten the cap nut, just enough to seal the leak and test with the ammonia bottle. Over tightening the cap nut could pull the fusible plug out of the tonner if the threads of the fusible plug are corroded.

If a fusible plug should pull out or a valve break off, drive pins can be inserted.

The final device is for sealing a leak on the side-wall of the container. This device and the procedure for applying it are very similar to the procedure for the cylinder. Refer to the cylinder section, but the concern in applying these devices is the strength of the surrounding wall. Discontinue tightening if there is evidence that the wall is weakening.

Training

The procedures for using both the "A" kit for cylinder leaks and the "B" kit for tonner leaks are very simple. Often it is the stress of wearing the personal protective equipment and the unfamiliarity of the kits which complicates a response to a leak. Regular training with the SCBA and a review of the equipment in the kits will allow responders to feel more comfortable in an emergency situation.

In addition, the kits should be inspected at least annually to ensure the equipment is clean and none of the parts are missing.

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