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# CONTROL OF GAS CHLORINE LEAKS IN WATER TREATMENT

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The US water treatment industry typically uses two techniques for the control of leaks in a gas chlorine disinfection system: scrubbing or containment. The design and technology behind each technique differ substantially. Scrubbing operates on the principle that chlorine gas is removed from an airstream using chemical adsorbents (dry or wet). Containment uses pressure rated vessels to contain leaking chlorine gas. We will further investigate the differences between these technologies and compare their operability.

## SCRUBBING

In wet scrubbing systems, sodium hydroxide solutions are most commonly used for typical scrubbing applications. Chlorine contaminated air is forced though an enclosed tower to which a scrubbing fluid of 18% to 22% sodium hydroxide (NaOH) is injected in a counter flow arrangement. The fluid, now a hypochlorite solution, is collected at the bottom of the tower and neutralized or recycled. This process is complex and requires a complete understanding of the chemical reactions and the safe disposal of the air and liquid phases. Consideration of the following issues is strongly recommended prior to selecting this technology[1)]:

- Once the NaOH solution is saturated with chlorine, chlorine will start venting from the scrubber.
- The adsorption of chlorine into the NaOH solution lowers its pH, reducing its ability to absorb the chlorine.
- The reaction of chlorine with NaOH is exothermic and significant amount of heat is released.
- NaOH is most commonly available as a 50% solution in water that must be diluted because it contains too little water at that concentration to absorb the heat of reaction and to maintain the reaction products in solution and has a high freezing point (approximately 52F).

[1]From "Chlorine Safety Scrubbing Systems, April 2011, Edition 1, published by the World Chlorine Council. Note that wet scrubbing systems are not typically used in the Water Treatment Industry because the capital investment and operational complexity is not justified for treating the rare occurrences of leaks.

Commercially available dry scrubbing systems are designed as a stand-alone enclosure exterior to the chlorine cylinder building. The enclosure contains multiple stages of proprietary media housed in trays that preferentially adsorb chlorine from the air stream. Blowers at the end of the enclosure generate a partial vacuum that draws chlorine contaminated air from a space through the media. The treated air is discharged through a stack. This system would be activated when chlorine gas is sensed in the cylinder storage area, energizing the blower motor and thereby causing a flow of air across the adsorbent media trays. Specifications for a dry scrubber system for treating a leak from a 1-ton chlorine tank are as follows[2)]:

- 19,440 lbs. of media in three trays
- 12'W x 11' D x 19'H enclosure
- Up to 11,000 scfm blower with 75 HP power requirement

**CONTAINMENT**

Containment systems employ a self-contained vessel within which the chlorine gas cylinder (150-lb. or 1-ton) is housed. Accidental leaks are kept within the ASME rated vessel for recycling to the injection system at a normal flow rate. No atmospheric venting occurs because the leaked gas is kept within the containment vessel and therefore keeps our communities safe. This technology offers significant advantages over a scrubbing system:

- It prevents operating personnel from being trapped inside a confined space while handling chlorine gas cylinders.
- It eliminates the construction of a special room that requires the construction of a scrubbing system.
- Simple installation.
- Passive containment means backup power; pumps, blowers and scrubbers are not required. Eliminating the expense of maintaining unnecessary equipment.
- Trapped chlorine is evacuated through automatic chemical sensing shut off valves mounted at the vessel port to the cylinder. There is no waste of chlorine.
- Most cost effective solution to meeting regulatory requirements for the handling of chlorine gas cylinders, especially the Section 112 (r) of the Clean Air Act and Article 80 of the Uniform Fire Code.

**CONCLUSION**

The benefits of using secondary containment for chlorine leak control are apparent when comparing this technology with scrubbing as presented above. Passive secondary containment can satisfactorily address the safety issues engendered by the use of chlorine gas for disinfection while meeting the stringent regulatory codes and keep our communities safe.

[2] From Purafil, Inc., Drawing AOC-1 and general product information contained in their website.