TECH TIPS
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MITIGATING THE RISKS OF STYRENE EMISSIONS TO THE ENVIRONMENT FROM THE CURED-IN-PLACE PIPE (CIPP) PROCESS

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Styrene emissions from the CIPP process are a concern when they exceed regulatory levels. NASSCO contracted with the Trenchless Technology Center at Louisiana Tech University (TTC) to delineate styrene levels at various parts of the CIPP process. That study, which should be completed by the end of August 2022, focuses on two areas of study: Styrene accumulation in the back of a refrigerated truck used to store and transport wet-out bags containing a styrenated resin; and emissions from a hot air (steam) cured liner (see Figure 1). Water-cured CIPP liners would have the same emissions in the refrigerated truck but would also have concerns with styrene migrating into the process water, and water running through the cured liner for a period after reinstatement and being emitted into the environment.

There are several techniques for minimizing emissions. Two established processes that may be used to minimize styrene emissions into the environment are the use of Granular Activated Carbon (GAC) towers, and wet scrubbing.

Each of these methods has pluses and minuses. While the GAC process may be used in both water and air cures, the wet scrubbing process may only be used in the hot air cured process.

The GAC method involves a canister of a designed size dependent on the flow and concentration of styrene in the flow. The flow may either be liquid or air. This process can handle effluent from processing the CIPP liner or may also treat the air inside of the refrigerated transport truck prior to opening the truck door at the job site. Once the calculated amount of effluent at the measured styrene concentration has been processed through the GAC cannister, the activated carbon must either be regenerated or replaced.

Figure 1. Emissions from an air cure CIPP Project

The GAC method lends itself to using more than activated carbon alone. Many suppliers of this medium also offer media that contain a combination of ingredients. As an example, one supplier offers a medium that is a combination of activated carbon and potassium permanganate. This combination offers more efficient removal of some types of contaminates.

The design of the unit is more complicated than just designing the cannister size. To maximize carbon life, the effluent passing through the unit should be cooled and dehumidified in the case of air, and should be cooled in the case of a liquid effluent. An engineer familiar with the CIPP process and this treatment method can design an efficient unit. Figure 2 is a simplistic view of the GAC process.

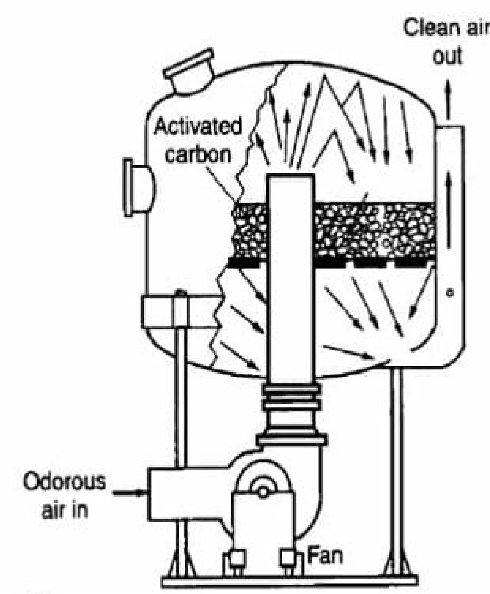

Figure 2. GAC Unit for gaseous effluent

The cost of using the GAC process varies with the amount of effluent to be treated, the concentration of the contaminant in the effluent, and the media used in the unit. Assuming a set of variables, one calculation estimates a cost of slightly less than $14.00 per pound of styrene removed from the effluent stream.

While chemical process methods provide several alternatives for removing styrene from the CIPP process, other alternatives exist. UV light cured processing of CIPP liners has been shown to reduce styrene emissions into the atmosphere and into the process water after the line has been returned to service. The method used by UV light cured processing is the introduction of a specific barrier between the resin-containing layer and either water or air that may meet that liner. Styrene-free resins have been available for several years and have been proven to be a viable alternative to styrenated resins.

A new option is now available for heat cured CIPP liners. This option utilizes similar technology to barrier coatings used by UV cured liners. One of the largest manufacturers of dry tubes used in heat cured CIPP has introduced a polyester felt liner containing a polyamide layer in the barrier coating. Unlike UV light cured liners, these tubes may be inverted in like manner to currently available heat cured bags. Historically, barrier coatings tend to be polyurethane, polyethylene, or polyolefin, all of which are permeable to styrene. The polyamide component, like that used in UV coating's "foils", is impermeable to styrene. This minimizes styrene that may pass through the barrier into the air or water in CIPP heat cures. The degree to which styrene emissions are reduced is currently being determined by contractors using this new tube.

With these existing and newer technologies, styrene emissions into the atmosphere from the CIPP process may be of significantly lower concern.

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