

# PFAS in CIPP Resins?

By NASSCO Technical Advisory Council Member Kaleel Rahaim



Kaleel  
Rahaim

By now most of us have heard the term PFAS, but there is still some mystery surrounding these substances, so we would like to explain what PFAS are, why there is so much buzz surrounding them, and what one needs to know about PFAS in cured-in-place pipe (CIPP) resin formulations.

PFAS is the acronym for a diverse group of human made per- and polyfluoroalkyl substances. According to the U.S. Food and Drug Administration, PFAS have been used since the 1940s because of their resistance to grease, water, oil and heat. The special properties of the chemicals make them useful in a vast array of commercial and household products: Teflon pots and pans, stain-proof furniture and carpeting, waterproof clothing and outdoor gear, and more.<sup>1</sup> The concern with PFAS materials is their bioaccumulative effects when found in water.

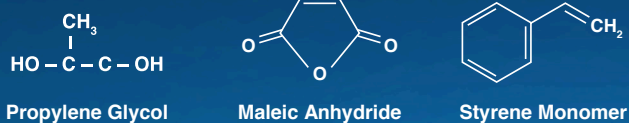
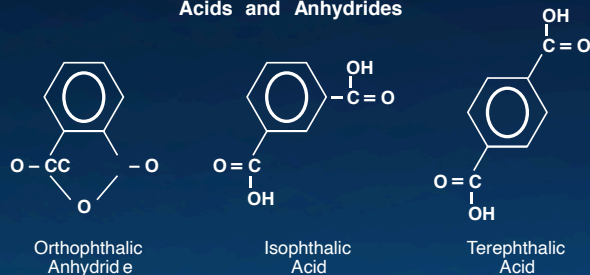
## Resins

Polyester, vinyl ester and epoxy resins are produced for use as the thermoset resins in cured-in-place pipe (CIPP) applications. CIPP is the process of renovating deteriorated underground pipes such

as sewer pipes, stormwater pipes, culverts, drinking water pipes, and industrial pipes.

Polyester resins are manufactured by a process called “condensation polymerization”. Dibasic acids are reacted with glycols to form an “alkyd”. This alkyd is dissolved in a reactive diluent such as styrene monomer. When this mixture is provided with an initiator that forms free radicals, a polymerization process begins that transforms the liquid product to a solid thermoset plastic. Chemical structures for these components are shown as follows:

### Acids and Anhydrides



Other components in smaller quantities include inhibitors, promoters, fillers, viscosity modifiers and initiators. These components, except for fillers, are generally found in levels of 1% by weight or below.

Vinyl ester resins are resins produced by the esterification of an epoxy resin and methacrylic acid or acrylic acid. As with polyester resins, there are no PFAS compounds in any raw material used in the production of a vinyl ester resin.

Epoxy resins are produced with an epichlorhydrin and bisphenol-A. Again there are no PFAS in any component used or as a reaction product in the production of epoxy resins.

For PFAS materials to be present in CIPP resins, they must either enter the process as a component in one of the ingredients or be created by reaction during the process. For them to be created during the process, fluorine must be present in a component used.

All the components listed in the creation of a thermoset polyester, vinyl ester or epoxy resin contain no fluorinated compounds or free fluorine. These resins are PFAS free.

## **Dry Tube**

Several different materials are used to manufacture CIPP heat-cured dry tubes. These typically include a thermoplastic coating, polyester felt fibers, glass fibers, pigments and/or thread. Tubes for various markets and uses may include all of these materials, some of these materials or various combinations of these materials. None of these commonly used materials in CIPP dry tubes have been found to contain PFAS.

## **Summary**

The finished CIPP product is a combination of resin and a dry tube. As discussed in this article, presently neither the resin nor the dry tube contain PFAS materials. Thus, when installing or using heat-cured CIPP manufactured with polyester, vinyl ester or epoxy resin and a dry tube, there is no need to be concerned with PFAS. As the industry innovates with the introduction of new resin and dry tube combinations, PFAS impact on water quality and treatability must be considered. This mindfulness must extend beyond the CIPP industry to any rehabilitation solution that may include PFAS compounds in its formulation.

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<sup>1</sup>McWhirter, Sheri, "State hosts PFAS informational meeting for GT Band; 'forever chemicals' associated with health problems" May 27, 2021