GUIDELINE FOR THE SAFE USE AND HANDLING OF STYRENE BASED RESINS IN CURED-IN-PLACE PIPE (CIPP)

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Disclaimer

This document presents a state-of-the-art guideline for the safe use and handling of styrene based resins in the CIPP pipeline rehabilitation industry. Following this guideline does not guarantee that environmental damage, property damage, personal injury, or other damage or injury will not occur at, on, or near a CIPP installation site. CIPP projects and the associated risks vary tremendously and must be evaluated on a case-by-case basis. Some project circumstances may pose environmental risks completely unassociated with styrene. In addition, downstream sewers and receiving waters are variable, not only from place to place but also from time to time, and the discharge of steam exhaust, cure water and condensates must be thoroughly evaluated for each installation. This document is not intended as a substitute for professional advice pertaining to the use and handling of styrene based resins, and it is recommended that a professional be consulted for such purposes. NASSCO makes no warranty of any kind whatsoever, whether express or implied, with respect to the guidelines set forth in this document. NASSCO disclaims any and all liability, including but not limited to property damage, personal injury, or any other manner of damage or injury arising out of the use of this document or the use and handling of styrene based resins in the CIPP pipeline rehabilitation industry.

EXECUTIVE SUMMARY

Styrene based resin systems, as they are currently used in cured-in-place pipe (CIPP) rehabilitation systems, produce a safe and environmentally sound solution to the challenges of the need for restoring the nation's failing infrastructure. While styrene is currently rated by the Department of Health and Human Services (HHS) as reasonably anticipated to be a carcinogen (see 2011 HHS Ruling at the end of this Executive Summary), a study carried out by the ECETOC (European Centre for Econtoxicology and Toxicology of Chemicals) concluded that "the carcinogenic potential of styrene, if one exists at all, is rated so low that occupational or environmental exposure to styrene is unlikely to present any carcinogenic hazard to man." However, as with most chemical emissions, exposure level is a key component when considering styrene's effects on humans.

The risk associated with styrene's use in CIPP is minimal and well within the Clean Water Acts' original intent of keeping the environment as free as is practical of chemical pollutants. CIPP installation sites managed with good housekeeping practices should present little opportunity for human health and/or environmental risks.

Although styrene occurs naturally in many foods such as cinnamon, coffee, and strawberries, styrene derived from petroleum and natural gas by-products has raised many questions about whether its usage in polyester and vinyl ester resin systems, commonly used in CIPP to rehabilitate piping systems, has the potential to adversely affect human health and/or the environment.

In a study undertaken by the Toronto Works and Emergency Services in 2001, AirZOne, Inc. conducted an investigation of the airborne concentrations of styrene and 24 other VOCs in eight randomly selected residences during the rehabilitation of sewers with CIPP installation. The study also measured ambient air quality, emissions from manholes and occupational exposure from these compounds. Air sampling was executed in three phases, before, during, and after the CIPP's installation. Styrene levels were elevated significantly during the CIPP installation in just two homes where the homes' traps were engineered to be dry in order to simulate a worst case scenario; the levels, although elevated, proved not to be a health concern. Levels measured in these eight homes were 0.1 to 0.2 parts per million (ppm). Styrene emissions from manholes during the CIPP process ranged from 0.16ppm to 3.2ppm. Personal exposure of the installation personnel in the breathing zone ranged from 0.08 to 0.5ppm. Styrene in the breathing zone was well below the industry's voluntary occupational limit of 50ppm for the installation personnel.

Independent, peer reviewed scientific journals have published numerous studies on the fate of styrene and its natural occurrence in the environment. "Biodegradation of Styrene in Samples of Natural Environments" by Min Hong Fu and Martin Alexander of Cornell University concluded that styrene will be rapidly destroyed by biodegradation in most environments having oxygen; although the rates may be slow at low concentrations in lake waters and in environments at low pH. "Desorption and Biodegradation of Sorbed Styrene in Soil and Aquifer Solids" by Min Hong Fu, Hilary Mayton, and Martin Alexander of Cornell University, concluded that being broken down by microbes is a major fate mechanism by which styrene is destroyed in soils. The "Ecotoxicity Hazard Assessment of Styrene" by J.R. Cushman concluded that styrene was shown to be moderately toxic to fathead minnows, daphnids, and amphipods. It was further shown to be highly toxic to green algae, and slightly toxic to earthworms. There was no indication of a concern for chronic toxicity based on these studies. Styrene's potential impact on aquatic and soil environments, it was concluded, is significantly mitigated by the rapid rate at which it evaporates and biodegrades in the environment. And finally, Martin Alexander, in his "The Environmental Fate of Styrene", concluded that transport of styrene in nature is "very limited" because of its volatility from soils and surface waters, its rapid destruction in air, and its biodegradation in soils and surface and ground waters.

Recent studies by Purdue University have raised the question of possible hazards to workers and the public from styrene releases from steam cure CIPP job sites. These studies also found a number of other organic chemicals in the steam exhaust. Although much attention was given to the studies, no evidence was produced regarding the health effects of CIPP steam exhaust on either workers or the public. Because more investigations are required, NASSCO has partnered with respected industry leaders and organizations to facilitate a formal review (Industry Study) of the Purdue and related studies, including additional sampling and analysis of emissions during the field installation of CIPP using the steam cure process. In the interim period, NASSCO made the decision to update this "Styrene Guideline", and then to update it again once the Industry Study is completed.

Because styrene odor can be detected at such low concentrations (0.4 to 0.75ppm, depending on one's ability to detect odors), styrene's odor can be considered a nuisance to those not used to working around it. Some people are offended by this odor and are fearful of it, even though the concentrations they smell present no long-term harm to them. To minimize odor problems during the installation of CIPP, residents/homeowners should be advised to ensure that their sewer traps are in a proper state of repair. In cases of damaged, dry, or non-existent traps, the areas or rooms where floor drains or access to traps are located should be ventilated, if possible, by leaving doors or windows open to the outside during the CIPP installation process. The resident/homeowner should be further advised that non-repair of the defective trap may cause hazardous sewer gases to enter the home in the future.

The CIPP installation contractor should practice good housekeeping and protect the project site such that any accidental resin spillage can be cleaned up and properly disposed of. Given the nature of these resin systems to resist movement once placed in the tube's fiber matrix, only very small quantities, such as minor dripping or droplets, should be anticipated.

The impact of styrene concentrations in the cure water when discharged directly into a sewer collection system is typically insignificant if proper discharge procedures are utilized. An eight inch pipeline 650 linear feet in length will discharge approximately 1700 gallons of cure water to the receiving sewer. At a typical concentration of 20ppm, the resultant discharge would be less than 0.3 pounds of styrene. A 48-inch pipeline 650 linear feet in length will discharge approximately 61,100 gallons of water to the collection system; which, again, amounts to approximately 10.1 pounds of styrene at a concentration level of 20ppm. Although every situation is different and dependent upon site conditions, the receiving sewer should have adequate flow to properly dilute the discharging cure water. With an adequate dilution factor and the assimilative capabilities of the downstream flows, no harm is thus anticipated to the wastewater treatment works and/or the POTW's discharge requirements from either styrene or the temperature of the cure water/wastewater mix.

Based upon the above given discharge quantities of typical CIPP installations, a CIPP installation contractor discharging these same quantities of cure water to the environment is expected to meet the requirements of the EPA's small quantity generator exemption. In fact, due to the nomadic nature of the installer's discharges, a case could be made that the discharges fall under the category of non-point source contributions. However, although in many instances CIPP cure water can safely be discharged to the environment, cure water should not be discharged to the environment unless the impact on the environment has been assessed and determined to be insignificant, and permission and/or a permit from the local regulatory agency has been issued.

In addition, the installation contractor is advised to consider the negative impacts of the temperature of the cure water at discharge if the receiving drainage conveyance contains aquatic organisms that can be harmed by the possible sudden drop in available oxygen due to the large temperature difference between the cure water and the receiving water body's temperature. Although there is no factual evidence, many believe that fish kills previously reported to be due to discharging CIPP cure water containing styrene to a surface water were actually due to discharging high temperature water. Installation contractors should also be prudent and consider the effects of high temperature water when discharging CIPP cure water into a sanitary sewer a short distance from a wastewater treatment plant. Temperature of the cure water discharge must also be considered when assessing the impact on any receiving waters and/or applying for a permit from the local regulatory agency.

Any time an environmental release of a hazardous substance exceeds its reportable quantity as defined in 40 CFR Part 302, the contractor shall report this release immediately to the National Response Center (NRC). The reportable quantity for styrene per 40 CFR § 302.4 is 1000 pounds or about 2500 pounds of unfilled resin. Quantities below this amount are to be handled by the contractor in an expeditious manner; but do not require reporting.

2011 HHS Ruling

In 2011, the National Toxicology Program's (NTP's) 12th Report on Carcinogens (RoC) was published by the Department of Health and Human Services (HHS). In this report, styrene was listed as reasonably anticipated to be a carcinogen. This report was strongly opposed by those in businesses utilizing resins containing styrene, principally because there did not appear to be convincing evidence to support such a listing.

Because of this opposition, in late 2011 Congress directed HHS to contract with the National Academy of Sciences (NAS) to conduct reviews of the NTP hazard assessment of styrene. The NAS contracted with the National Research Council (NRC) to conduct the review. In 2014, NRC published its report which supported the 12th RoC's listing of styrene as reasonably anticipated to be a carcinogen.

As of December 2017, the effect on the CIPP business has been minimal. There have been new resin container labeling requirements and also the requirement to update Safety Data Sheets (SDS).

INTRODUCTION

Styrene is the ideal monomer used for cross-linking polyester and vinyl ester resins. Although alternative monomers have been extensively investigated and are currently in use in the CIPP industry, none of those monomers have matched the overall performance or cost of styrene. However, the use of styrene free vinyl ester resins has increased principally because of the negative publicity about styrene and styrene's offensive odor and low threshold level of detection by humans.

Over the last 40 years, the increasing awareness of the need to limit the effects of styrene exposure have led the polyester resin processing industry to pursue strategies to reduce exposure in the manufacturing and processing plant environment. Most of the studies undertaken to date have centered on these producers' and users' environments which are dramatically different than the work environment of the CIPP installation contractor. Given the desire to address the rehabilitation industry's need for standards in the proper safe use and handling of styrene based resins for CIPP, in 2008 NASSCO created a styrene task force to review the technical information available from these studies and current CIPP installation practices to produce this Styrene Guideline. This guideline was updated in 2009 and 2017 and will be updated again in 2018 once the Industry Study, referenced in the Executive Summary, is complete. In addition to this guideline, NASSCO has prepared an Inspector Training and Certification Program (ITCP) for CIPP to properly equip owners, project engineers and inspectors with the necessary knowledge to ensure that a proper installation is achieved which minimizes the potential for release of styrene to the environment. An extensive revision of the ITCP training materials was completed in 2017, and further updates may be made in 2018 to include the latest edition of this Styrene Guideline.

Polyester and vinyl ester resin systems have been used for more than 45 years in CIPP. During this timeframe there have been no noted serious consequences reported. There have been a number of incidents where styrene gas has entered a building and caused the residents to evacuate. This is understandable because those not familiar with styrene's smell can be alarmed and panicked by the chemical smell. Although a small percent of the population may be affected by inhaling styrene, such as upper respiratory tract issues, most people in these situations simply need to move to a well ventilated area. (Styrene Safety Data Sheet, ScienceLab.com, 2013). As no definitive document for these resin systems as used in the CIPP industry existed prior to 2008, the unknown gave rise to speculation as to their safety with respect to the workers involved, the general public when the odors enter the structures connected to the piping under rehabilitation, and to the greater downstream and surrounding environment from where the work is taking place.

Styrene is a common chemical compound found where we live and work. Indoor sources of styrene emissions include off-gassing of building materials and consumer products and tobacco smoke. Styrene is emitted from glued carpet, floor waxes and polishes, paints, adhesives, putty, etc.

Styrene is expected to exist solely as a vapor in the ambient atmosphere (Hazardous Substances Data Bank 2008). In its vapor phase it is expected to react rapidly with hydroxyl radicals and with ozone. Half-lives based on these reactions have been estimated to range from 0.5 to 17.0 hours (Luderer et al. 2005). Atmospheric washout, the removal from the atmosphere of gases and sometimes particles by their solution in or attachment to raindrops as they fall, is not expected to be an important process because of these rapid reaction rates and styrene's low vapor pressure. Outdoor air monitoring by the EPA for 259 monitoring sites involving some 8,072 observations in 2007 showed that the mean concentrations for these sites were very low and ranged from 0.028 to 5.74 parts per billion (ppb). The primary sources of styrene in outdoor air include emissions from industrial processes involving styrene and its polymers and copolymers, vehicle emissions, and other combustion processes.

Volatilization and biodegradation are expected to be the major fate and transformation processes in water. Styrene is expected to volatilize rapidly from environmental waters; the extent of volatilization depends on the water depth and turbulence with low volatilization occurring in stagnant, deep water. The estimated volatilization half-life of styrene in a river three feet deep with a current of three feet per second and wind velocity of 9.5 feet per second is roughly three hours. Half-lives have been estimated from one hour for a shallow body of water to 13 days in a lake. Some biological oxygen demand studies have shown styrene to be biodegradable. Cohen et al. 2002 found that styrene generally does not persist in water because of its biodegradability and volatility.

MATERIAL FACTS

Styrene Monomer

Property	Value
Auto-ignition Temperature (in air)	914^{o}F
Boiling Point:	
@14.7 psi (atmospheric pressure)	293^{o}F
Color	Colorless
Corrosivity	Non-corrosive to metals except copper and alloys of copper
Density:	
32^{o}F	7.71 lbs/US Gallon
68^{o}F	7.55 lbs/US Gallon
Solubility: Styrene in Water	
32^{o}F	0.018 gms/100 gmsH_20
104^{o}F	0.040 gms/100 gmsH_20
176^{o}F	0.062 gms/100 gmsH_20
Upper (UEL) and Lower (LEL) Explosive Limits	
UEL	6.1%
LEL	1.1%
By Volume of Air @ 68^{o}F & Atmospheric Pressure	

CIPP INSTALLATION PRACTICES

Good Housekeeping. Many environmental and safety issues can be prevented when good housekeeping is practiced on CIPP installation job sites. One definition of good housekeeping is the general care, cleanliness, orderliness, and maintenance of a business or property. That definition certainly applies to CIPP job sites.

Resins, catalysts and other chemicals must be handled with care to promote a safe working environment and prevent spills. This also applies to other liquids on the job site such as gasoline, diesel fuel, various oils, anti-freeze and other liquids common on construction sites. Spills on the ground, a street, side walk or on personal property must be addressed immediately. However, an additional level of concern is raised should a spill enter a sanitary sewer, storm sewer, culvert or surface water.

Excess resin and CIPP trimmings in a sanitary sewer must be trapped and collected at a downstream manhole and properly disposed of during the entire installation process. Disposal may be as simple as collecting the waste liquid polymer in a container and initiating it with the same initiators used for cure. When the material has polymerized, depending on State and local regulations, it may be disposed of as industrial waste.

When rehabilitating storm sewers or culverts, additional measures must be taken to prevent excess resin, resin residues or other liquids and materials from entering a downstream storm sewer or receiving stream. Floating dikes or other devices should be used at the downstream end of a culvert to prevent excess resin from entering the stream. These devices must be maintained throughout the installation process until the installation is complete, including end trimming. Shavings from cutting devices can cause problems in surface waters, and if the floating dikes are removed prior to trimming the ends of the CIPP, these shavings can enter the water.

Provisions must be made by the contractor in advance for containing any accidental spillage of the resin, and these provisions should be included in the project Safety Plan. Further, if more than 2500 pounds of neat (unfilled) resin (1000 pounds of styrene) is spilled, the spill must be reported to the appropriate local pollution control authorities. Spills less than this “reportable quantity” are to be handled in a responsible manner by the contractor, which is typically as recommended by the resin manufacturer Absorption with an inert material and placing in an appropriate waste disposal container is the industry standard for handling small spills on the ground. Some absorbing agents, such as untreated clays and micas, will cause an exothermic reaction which might ignite the styrene monomer. For this reason, absorbing agents should always be as approved by the resin manufacturer or tested for their effect on the polymerization of the monomer before they are used on larger spills. Claymax®, a loose, vermiculite-like material, has been found to be an effective absorbent. Oil dry, kitty litter and sand also work well. If the spill occurs on a hard surface, the area should be scrubbed with soap and water after the bulk of the spill has been cleaned up by the absorbent material. If the spill gets into a waterway, the spill must be contained using a floating dike similar to those used for oil spills. The resin can then be picked up by vacuuming into a vacuum truck and subsequently placed in an appropriate waste disposal container.

It is recommended that the contractor continually clean the installation site of construction debris and keep tools in their designated storage location. The same is true for equipment items that have been used and are no longer needed to provide for a safe jobsite.

Water Cure.

For CIPP installations using hot water to cure the resin, the cure water must be disposed of once the curing cycle is complete. For most sanitary sewer projects, this usually involves slowly discharging the cure water to the sanitary sewer once the cool down cycle has begun. As stated in the Introduction of this Styrene Guideline, styrene readily dissipates through volatilization and degradation. In order to ensure that the cured CIPP remains tight fitting and dimensionally stable with the release of the cure water, the standard in the industry is to require that the cool down be continued until the temperature of the CIPP is no more than 100^{o}F. During the cool down process, a small hole is typically made in the downstream end to release hot water as cold water is introduced at the other end of the installation. Cure water, once the CIPP temperature reads 100^{o}F, will probably have a temperature around 90^{o}F which has been observed to have a styrene concentration in the range of 20 to 25ppm. Releasing of the cure water in this case directly to the sewer is not a concern due to the benefits of dilution in the downstream wastewater. When large volumes of process water are discharged to an existing, low capacity, smaller sewer, the flow must be regulated or limited by the contractor to provide for sufficient dilution of the cure water. The contractor should survey and/or notify the downstream homeowners of potential odors from residual styrene contained in the cure water.

In cases where an interceptor is rehabilitated immediately upstream of a wastewater treatment plant, the customer may request additional measures to lower the styrene content of the cure water, but this is unusual. Carbon filters and aeration have been used to lower cure water styrene content. When discharging cure water to either a sanitary sewer or directly to a wastewater treatment plant, the temperature of the cure water may be of more concern than the styrene content. Thousands of gallons of high temperature water discharged directly to a wastewater treatment plant could have a disruptive effect on biological treatment processes.

Cure water disposal is an important element in the safe installation of CIPP in all types of pipeline systems. When rehabilitating storm sewers and culverts, cure water disposal requires more thought and analysis. Although in some instances CIPP cure water can safely be discharged to the environment, cure water should not be discharged to the environment unless the impact on the environment has been assessed and determined to be insignificant, and permission and/or a permit, from the local regulatory agency, has been issued. If in doubt, cure water should not be discharged to the environment; it should be properly discharged to an adjacent sanitary sewer or hauled to a sanitary sewer manhole or wastewater treatment plant for disposal. Permission should be obtained, in writing, from the sewer or plant owner before discharging.

Before discharging cure water directly to a surface water course such as a drainage ditch or waterway, the contractor must consider the cure water's elevated temperature. Based upon an exhaustive literature review of the quick volatilization of styrene and its potential to result in any long-term harm to plant and animal life, discharges of cure water having the normal concentration levels of styrene and temperature at cool-down directly to a dry waterway in some cases will pose no harm. Further, while the accepted practice of many CIPP installers is to transport the cure water to the nearest wastewater treatment facility, releases of cure water containing no more than a concentration of 25ppm styrene and a temperature approximately equal to that of the receiving waterway should not create any environmental harm (see note below). However, as stated previously, prior to discharging cure water directly to the environment, an engineering analysis should be undertaken to determine the assimilative capacity of the receiving stream with respect to the temperatures and styrene concentrations anticipated, and permission or a permit from the local regulatory agency must be obtained. If there is any doubt, cure water should be discharged to a sanitary sewer or wastewater treatment plant.

Note: A typical 24-inch diameter culvert 100 linear feet in length will require around 2400 gallons of water to process. If released at 25ppm, the amount of styrene anticipated in its release is approximately 0.5 pounds.

Following are example recommendations for protecting workers and the public in and around CIPP water cure job sites. A detailed safety plan should be submitted, by the contractor, before start of any work on the project.

1. All workers should have proper personal protective equipment (PPE).
2. No worker should enter a job site manhole during curing operations.
3. A perimeter should be maintained around the job site to prevent the public from entering.
4. Job site air monitoring should be conducted and documented for all sensitive locations and for the established preventive perimeter.
5. Define and maintain good housekeeping practices at all times throughout the project period.
6. Do not discharge cure water to the environment without justification (described above).
7. Always keep the public informed and address their questions and concerns.
8. Maintain detailed records of all air monitoring performed on the jobsite.

Steam Cure.

On steam cure CIPP projects, steam is introduced into the pressurized air flow on one end of the installation, and a mixture of mostly hot water vapor, styrene and other chemical byproducts are exhausted on the other end. Steam curing greatly reduces the amount of styrene that will potentially be released into the environment because the quick cross-linking of the resin effectively binds up the styrene to a high degree. Also, large amounts of cure water do not have to be disposed of. A small amount of steam condensate is produced, and this amount can be minimized by maximizing the flow of air through the curing CIPP for the site-specific conditions. This condensate should be cooled and discharged to a sanitary sewer. For storm sewer and culvert projects, the steam condensate should be handled in a similar manner as cure water; steam condensate should either be recycled for future steam cure projects or collected and discharged to a sanitary sewer. Steam condensate should not be discharged to the environment unless the impact on the environment has been assessed and determined to be insignificant, and permission and/or a permit from the local regulatory agency has been issued.

Most of the styrene released using the steam cure method is in the vapor form, principally from the steam exhaust. Although higher levels of styrene can be measured directly in the steam exhaust at the end of the discharge hose, the styrene concentration of the vapor rapidly dissipates as it moves away from the discharge point (distance) and also as it cools (temperature). The styrene concentration in the air is rapidly diluted by the cube of the distance from the source. Also, higher levels of styrene are found in conjunction with heat, so as the air cools, the styrene level decreases. The styrene level decrease may determine the location of the public perimeter to be established

Although any air quality data on CIPP job sites is worthwhile to collect, the important questions are, "What levels of styrene are workers and the public actually exposed to and for how long." No worker, and certainly not anyone from the public, should position their face directly at the opening of the steam exhaust, especially if the exhaust is in a manhole. Safety protocol for CIPP installers using steam cure should prohibit workers from entering job site manholes during steam cure. Past studies collecting 8-hour weighted average styrene concentration for workers on water and steam cure job sites have yielded low styrene concentrations. This is the type of data that is being collected by independent sources prompted by proposals requested by NASSCO for an overall Industry Study, currently underway.

Following are recommendations for protecting workers and the public in and around CIPP steam cure job sites. A detailed safety plan should be submitted, by the contractor, before start of any work on the project.

1. All workers should have proper personal protective equipment (PPE).
2. No worker should enter a job site manhole during steaming operations.
3. No worker should be positioned in the steam exhaust plume without proper PPE.
4. The steam exhaust should be located a minimum of 8 feet above the manhole rim or as dictated by specific site conditions including weather and temperature conditions.
5. Other sources of steam exhaust (loose connections, glands, etc.) should be minimized and/or properly repaired or adjusted.
6. A perimeter should be maintained around the job site to prevent the public from entering.
7. Job site air monitoring should be conducted for sensitive project locations and for the established public perimeter.
8. Maintain good housekeeping practices.
9. Do not discharge steam condensate to the environment without justification (described above).
10. Perform regular boiler maintenance to prevent steam contamination during CIPP curing.
11. Always keep the public informed and address their questions and concerns.

It is anticipated that more recommendations will be provided once the Industry Study is complete.

UV Cure.

Ultra Violet Light (UV) CIPP is installed by pulling the liner into place and then inflating with air. No end product of water or steam condensate is produced requiring disposal and/or monitoring. Once the uncured liner is pulled into the existing pipeline, large volumes of air are pumped through the liner and exhausted to maintain its inflated condition while the light curing equipment is pulled into the center of the liner. During UV curing the resin exotherms resulting in some heat and styrene vapors within the CIPP. Styrene vapors in the pipe exhaust generally are very low but should be measured and documented to verify minimum or no environmental harm.

Following are example recommendations for protecting workers and the public in and around CIPP UV cure job sites. A detailed safety plan should be submitted, by the contractor, before start of any work on the project.

1. All workers should have proper personal protective equipment (PPE).
2. No worker should enter a job site manhole during curing operations without proper PPE.
3. A perimeter should be maintained around the job site to prevent the public from entering.

4. Job site air monitoring should be conducted and documented for all sensitive locations and for the established preventive perimeter.
5. Define and maintain good housekeeping practices at all times throughout the project period.
6. Always keep the public informed and address their questions and concerns.
7. Maintain detailed records of all air monitoring performed on the jobsite

General Curing Recommendations

It is imperative that the manufacturer's recommendations be followed no matter which curing method is being used. Properly installed and cured CIPP releases less styrene to the environment. Thermocouples and/or continuous monitoring sensor systems placed strategically in the liner/host pipe interface are a must. A written cure schedule acknowledging the conditions present in the curing environment and the resin system proposed will lead to a proper cure, a long CIPP design and service life and minimal environmental impact.

Proper planning is also very important when using styrene based resins, especially when heavily occupied buildings are connected to the sewer or sewers being rehabilitated. CIPP installations adjacent to hospitals, for example, must be well managed to prevent styrene from migrating up service laterals and into the hospital buildings. Work around schools can be planned when school is not in session while still coordinating with school officials to monitor the school buildings during CIPP installation. A little common sense can go a long way in preventing unwanted incidents.

SUMMARY

Following proper procedures when installing and curing CIPP minimizes styrene releases to the environment. CIPP should be installed in accordance with the manufacturer's written instructions and cured following the manufacturer's or resin supplier's written cure schedule. Cure water, steam exhausts and condensates and other discharges or emissions to the environment should be properly managed. In addition, good contractor housekeeping on the jobsite is always in order.

Following proper procedures and observing the recommended job site practices discussed in this document attempts to minimize the safety risk to workers and the public, which is NASSCO's key objective in producing this Styrene Guideline. The Contractor's primary responsibility is to provide a safe work-site, including providing a detailed safety plan for both workers and the public.

APPENDIX

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