

Culvert repairs pose environmental risks, require safeguards

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A new report recommends that states require standardized testing to safeguard against environmental contamination caused by a widely used method for rehabilitating aging drainage culverts.

Culverts divert stormwater away from roadways and are frequently made of concrete or corrugated metal. These objects are generally out of sight, but across the United States culvert infrastructure is decaying, said Andrew Whelton, an assistant professor in Purdue's Division of Environmental and Ecological Engineering and Lyles School of Civil Engineering.

More than 1 million miles of culverts are in need of repair and state departments of transportation are frequently using a technology called cured in place pipe, or CIPP, to rehabilitate these aging assets. The CIPP method avoids the need for roadway closures and excavation. A wet lining is pulled in place and induced to harden in the field. Some CIPP materials and their installation methods can pose environmental risks, Whelton said.

"State departments of transportation have no standardized product test method that screens out technologies or construction practices that cause environmental damage," Whelton said. "There has been little research into the toxicity of culvert repair technologies, and federal environmental guidelines do not address the issue."

Whelton's research team was funded by the Virginia Department of

Transportation to develop a standardized product test method and examined the environmental impacts of two CIPP installations. The work was conducted with the assistance of the Alabama Department of Transportation.

CIPP is not only used for stormwater culvert repairs, but it also is used by municipalities to rehabilitate sewer pipes and some drinking water pipes.

"There is evidence across the nation that CIPP activities have caused fish kills, negatively affected wastewater treatment plants, and resulted in daycare center, school, and government building evacuations," Whelton said. "All of these incidents were preventable, but many of the infrastructure repair methods used today have not undergone any environmental impact testing."

The Virginia Department of Transportation has taken a leading role to head off potential issues with stormwater pipe replacement in its state. Virginia also has become a resource for other states that are seeking advice.

"Following our first study that reported contaminant release from certain culvert rehabilitation projects, numerous DOTs contacted us," said Bridget Donaldson, a senior research scientist at VDOT and the Virginia Center for Transportation Innovation and Research. "They wanted to share similar findings or request information to develop their own environmental safeguards. This is an issue that needs more attention among municipalities and the transportation community."

Three CIPP processes exist, two involving the generation of a liquid-like waste. Whelton's team studied CIPP projects in Alabama that produced a viscous chemical liquid about the consistency of maple syrup, which remained after curing was completed. This liquid contained chemicals

including acetone, methylene chloride, chloroform, benzene, phthalates, and styrene, some of which are known carcinogens, he said.

Some of these compounds were degradation products of CIPP ingredients.

The research team also discovered that after the contractors completed their work, some of the chemicals leached out of CIPP material and remained in the environment at the Alabama site for one month.

The new report recommends that the Virginia Department of Transportation consider adding additional requirements to its field and lab testing procedures. A newly developed modified toxicity leaching characterization procedure, or mTLC_P, can be used to pre-screen freshly manufactured pipe rehabilitation materials before they are installed. This method has been proposed as a way for agencies to potentially screen out hazardous materials from being used in the field, Whelton said.

He cautioned that the new test method would not address issues caused by the installation process itself. His group also recommends that water quality monitoring be conducted at installation sites before and after culvert repair. Recommended tests include chemical oxygen demand (COD), total organic carbon (TOC), ultraviolet absorbance, water pH and temperature

"Our water quality monitoring recommendations are meant to help VDOT identify if culvert repair has released chemicals into the environment," he said. "These are relatively inexpensive tests. If a problem is found, then the agency can consider ordering a more expansive and detailed investigation."

Research findings also were published in the August issue of the journal *Environmental Science and Technology*, and new findings identified more

than 10 states with environmental incidents – including fish kills – that occurred near or following CIPP activities.

"The industry has primarily focused on testing the environment for styrene near CIPP sites, but we have found a number of other carcinogens and endocrine disrupting chemicals are released," Whelton said. "Our results are relevant to many states, not just Virginia."

VDOT and ALDOT both continue to improve their understanding of the potential impacts of CIPP activities. Both agencies have made changes to their contract requirements to significantly reduce the potential of any environmental impacts from occurring, Whelton said.

The November Virginia DOT report is posted on the Virginia DOT Web site at [www.virginiadot.org/vtrc/main/ ... ports/pdf/15-r11.pdf](http://www.virginiadot.org/vtrc/main/...ports/pdf/15-r11.pdf)

More information: "Impact of Infrastructure Coating Materials on Storm-Water Quality: Review and Experimental Study." *J. Environ. Eng.*, 139(5), 746–756. [DOI: 10.1061/\(ASCE\)EE.1943-7870.0000662](https://doi.org/10.1061/(ASCE)EE.1943-7870.0000662)

"Stormwater Chemical Contamination Caused by Cured-in-Place Pipe (CIPP) Infrastructure Rehabilitation Activities." *Environ. Sci. Technol.*, 2014, 48 (18), pp 10938–10947 [DOI: 10.1021/es5018637](https://doi.org/10.1021/es5018637)

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