Surrounding and Controlling
Underground Toxic Leaks
with
Double Wall Containment Piping Systems

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Leaks of any kind cannot always be prevented, but they can be contained. Because underground pipe leaks can take years to make themselves known, the choices and expenses of containing a toxic leak present a challenge to public and private decision makers. It is sometimes difficult to create a sense of urgency, yet toxic leaks can lead to problems requiring urgent solutions. Therefore, it is important to identify risks and incorporate an overall risk controls methodology.

For underground fluid transferring systems, one of the best proactive ways to achieve peace of mind and ensure compliance with Environmental Protection Agency and the Resource Conservation and Recovery Act (EPA and RCRA) guidelines[*] is to use double wall containment piping systems. The Environmental Protection Agency (EPA) has directed that underground transport of hazardous materials be protected from release into the environment in its 2015 Standard 40 CFR, Part 280 & 281.[†] Companies facing compliance decisions will consider variables such as their fluids' corrosive or hazardous properties and the fluid temperature. Piping system selection is subject to space restrictions, fluid

[*] https://www.epa.gov/rcra/resource-conservation-and-recovery-act-rcra-overview
[†] https://www.gpo.gov/fdsys/pkg/FR-2015-07-15/pdf/2015-15914.pdf

pressure, installation, fittings, documentation requirements, susceptibility to cracking, and more. And of course, cost. There is no one-size-fits-all solution.

Whether installing a new double wall containment piping system or considering altering an existing system, there are several design considerations to address including pipe materials, fluid temperature and pressure, leak detection methods, inspection, and testing requirements.

PIPE MATERIALS

The double wall containment pipe is designed as the name suggests. The carrier or product (inner) pipe that comes in direct contact with the hazardous fluid will be made of various materials depending on the liquid, temperature, pressure and corrosive properties, as would the containment (outer) pipe. Polypropylene can be the least expensive, stainless steel the most, while Fiberglas-Reinforced Plastic (FRP) is lightweight and strong, providing a good ROI for the proper circumstances. The table below compares representative pipe materials and applications.

Stainless Steel Double Wall Containment Pipe

Product Comparison Matrix

Manufacturer	"A"	"B"	"C"
Material (Carrier and Containment Pipe)	Polypropylene	Fiberglass-Reinforced Plastic	Stainless Steel T316
Typical Applications	Drainage applications Chemical resistance Pressurized transfer line Underground installation	Acid Salts Chemical & Industrial process Solvents and caustics	Plant chemical distribution lines Water and wastewater Acid systems Pharmaceutical
Max Pressure (PSI)	150	150	150
Max Temperature (°F)	160	160	700
Sizes Available	1"x3" thru 16"x20"	1"x3" thru 12"x16"	1/2"x2" thru 20"x26"
Internal Corrosive Coating	None	Epoxy	None
External Corrosive Coating	None	Epoxy	None
Wall Thickness	0.280" for 6"X8"	0.170" for 4"-6", 0.220" for 10"-14"	0.28" for 6" , 0.365" for 10" (Schedule 40)

What the table does not convey are the many choices and tradeoffs for specific *combinations* of chemicals, media and fluid temperatures, fluid pressures and system materials, with and without internal and external coatings. Nor can it represent the questions of installation, safety, costs, and ease of use or maintenance. The final cost of the system including pipe materials, leak detection system + design fees + installation, testing, commissioning and documentation may have less to do with the pipe materials themselves than with the final necessary configuration to make sure the fluid leak can be contained.

INSTALLATION

Installation time ranges from almost immediate "plug and play," quick socket fusion installation to multiple-hours as required by on-site welding for some systems. It is important to plan for and include **leak detection, inspection and pressure testing** procedures, **and data capture** options into the installation schedule. The keys to making the right decisions and lowering project risk are: 1) Using a well-designed system as specified by an experienced professional engineer, and 2) Using manufacturers' procedures and trained installers.

- - LEAK DETECTION

The automatic leak detection system can be located between the inner and outer pipe and at the lowest point of the system to detect the leak and report it. The leak can also be detected and observed manually through multiple inspection ports located at the lowest level of the pipe system or at a collection double containment sump. To be truly proactive and safe, and because electronic, machine-reliant systems can fail, there should be some level of frequent *visual* inspections for leaks in any system design that would be following each state's Department of Toxic Substance Control regulations‡ if it is a U.S. installation.

- - INSPECTION AND PRESSURE TESTING

A complete pipe inspection should be performed before starting pressure testing for both the carrier and containment system including welds, joints, cracks, slopes, etc. After a comprehensive visual inspection is completed, a pressure test can be started as follows:

Carrier Pipe — Once the carrier pipe is installed it is essential to certify the pipe and to confirm that the system can handle the design pressure. Certification is as follows: For a gravity flow system, most of the plumbing codes require a working head pressure test for 15 minutes. Other engineered systems may require certifying the system at a higher-pressure rating, which will allow more flexibility to inspect the pipe in the future with a higher-pressure media, especially when there is suspicion of a leak that the camera cannot

‡ https://www.epa.gov/home/health-and-environmental-agencies-us-states-and-territories

locate visually. Choosing the correct pipe material will determine the system's ability to handle higher pressure testing.

Containment Pipe — When the carrier pipe has passed the pressure testing as well as an inspection by a certified professional, the containment pipe can be closed and tested. Usually, the containment pipe will require a lower pressure rating test than the carrier pipe, and in some systems, the containment pipe would be tested when the carrier pipe is charged.

- - DATA CAPTURE

Robust, trusted software systems are crucial to inform decision makers of ongoing and comparative fluid management statistics that are used for both internal and compliance reporting.

UNDER GROUND OR ABOVE GROUND INSTALLATION

Under ground and above ground containment piping systems each have their pros and cons.

Under Ground Installation: The positive aspect to underground installation is that the chemical transfer system can rely on gravity flow in some applications, so that pump and installation costs are avoided. The problem with under ground double-walled containment piping systems is that they can hide a slow leak in an elongated system for a long time. It may take time for a leak to develop and then find its way to the end of the piping system or lowest point. It can also be a challenge to pinpoint a particularly small leak's location especially when a camera inspection cannot find it. Additionally, an automatic leak detection system may not differentiate between a dangerous toxic leak and a harmless condensation between the inner and outer pipes. Condensation could cause a false alarm. Frequent manual inspection and testing can preclude a false reading, averting unnecessary stress and expense.

Above Ground Installation: Above ground systems make leak detection simpler, if only because manual observation is straightforward. Meanwhile, a toxic leak in an above ground system—especially above a building complex—can enter the public water system through roof drain or site water runoff. When an above ground system is still the preferred option, precautions such as a secondary containment pipe or containment pit would be required to prevent accidental damage to the physical plant and danger to the employees. An inspection leg with a sampling port can be added to the pipe system and used to collect the fluid leak from the containment system.

RISK MANAGEMENT

Surrounding and controlling toxic underground leaks hinges on an entity's commitment to a risk management process. Risk management is multi-faceted requiring simultaneous attention to identifying, analyzing, monitoring, planning, and responding.

Risk Management Process

Negligence and ignorance are expensive, not only in monetary fines that can run in the millions of dollars, but also and more importantly in health problems, equipment damage, lost production, cost of re-building, environmental issues, employee or community medical costs, and the entity's reputation being marred. For this reason, risk control methodologies that proactively accept statistical realities are critical when the possibility of toxic leaks is high.

Stainless steel piping and fittings are the most expensive, but may be the only options that contain leaks when operating and testing a pipe under high pressure. Polypropylene is adequate in some applications. FRP is the best choice elsewhere. But because new materials and science are continually advancing, an annual system review—at a minimum—is prudent. Quarterly and monthly evaluations are recommended. Daily inspection is the best defense against failures.

CONCLUSION

Today's marketplace demands responsibility and responsiveness, but more importantly, the world's populations seek a sense of *proactive* attention to containing and thus preventing toxic fluids from infiltrating the land. Double wall containment piping systems, correctly researched, properly installed, and professionally attended both automatically and manually will help avert future crises, disease, and death. The component choices are many but can be compared objectively with the help of a professional engineer or certificated professional.

The World Health Organization (updated July 2017 statistics) estimates 844 million people lack even a basic drinking-water service, including 159 million people who are dependent on surface water.[§] While episodes of contamination have occurred in the United States, "the drinking water quality in the U.S. is good."[**] The pharmaceutical industry could be considered fortunate in having an abundance of engineers, suppliers, and designers to discover the best, most effective, least risk, double walled containment systems for surrounding and controlling underground toxic pipe leaks.

[§] http://www.who.int/mediacentre/factsheets/fs391/en/
[**] https://en.wikipedia.org/wiki/Drinking_water_supply_and_sanitation_in_the_United_States

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