HDPE

IT'S NOT JUST A CHOICE. IT'S THE CHOICE FOR MUNICIPAL WATER DISTRIBUTION SYSTEMS

ZERO LEAK. LONGER LASTING. COST-EFFECTIVE. **HDPE PIPING SOLUTIONS.**

TABLE OF CONTENTS

HDPE BRINGS LASTING SOLUTION FOR DULUTH'S WATER-LOSS CHALLENGES

Duluth, Minnesota, had a problem: more than 400 miles of pipe crisscrossing the city were frequently gushing water—forcing the city to pour out money for repairs.

Like many cities, Duluth was using ductile iron for its water mains, which can start to break down as early as 20 years into their promised 100-year life span—especially when installed in corrosive soils.

In 2002, Duluth experienced nearly 200 water main breaks and just as many leaks. In 2021 alone, the city spent roughly $1.6 million fixing more than 103 water main breaks and 88 leaks, which was an improvement to a dire situation.

Literature published by the Ductile Iron Pipe Research Association (DIPRA) states ductile iron pipe has a service life of more than 100 years. Duluth is proof that the claim is, at best, unreliable—especially when you consider that most of the ductile iron pipe coming out of the ground today is 48 years old. Some of Duluth's failing pipe system was only 20 years old, which left the city with the following options:

- Continue patching together corroded pipe.
- Deal with unplanned water shutoffs.
- Manage disruptive and costly repairs.
- Wrestle with increasing water bills and operational and maintenance costs.
- Navigate negative taxpayer and social impacts.

Or the city could face the issue head-on and explore alternative materials like high-density polyethylene (HDPE). Duluth chose the more sustainable path and is transitioning to a 100 percent HDPE conveyance system.

In 2021, city workers replaced miles of corroding iron pipe in Duluth's Morgan Park neighborhood with HDPE; this led to a 47 percent drop in water main breaks from 195 in 2002 to 103 in 2021. "People always ask me, 'how do you fix HDPE if there's a failure?'" said Eric Shaffer, Duluth's chief engineer. "My answer is always the same: if the pipe is installed correctly, you won't experience failures. Duluth laid over 50 miles of HDPE, and failures are very few and far between. We couldn't be happier with the results."

As many municipalities are forced to replace piping through their regions, often due to bursts and breaks, why aren't more municipalities

choosing HDPE over the two legacy pipe systems?

To answer the question, look at the history of the three dominant municipal water pipe materials.

EVOLUTION OF POTABLE WATER PIPES

Ductile iron was first used in water supply networks in 1955. It replaced cast iron pipe, which dominated water conveyance for decades. Although the switch reduced catastrophic circular breaks and corrosion found with cast iron pipe, it did not eliminate these issues. Unfortunately, ductile iron still corrodes and breaks.

Many utilities have since begun opting for lighter, more durable, and noncorrosive materials like PVC and HDPE, which were commercialized in the 1960s. PVC remains the more popular pipe, given its pre-COVID-19 abundance and relative cost advantage.

Tradition and marketing also have a lot to do with PVC's success today. In the mid-1960s, the American Water Works Association published a set of material standards. PVC met them in 1965, and HDPE met the same criteria two years later. While PVC chased the water market, HDPE held the natural gas and oil market. Thus, PVC became the more commonly used pipe for water and HDPE for oil and natural gas.

In short, industries have a habit of adopting and standardizing a particular material. In response, manufacturers market to the industries that demand their materials. So while HDPE has proven itself a superior material for water applications, the industry has been slow to adapt.

With that in mind, let's look at the differences between ductile iron, PVC, and HDPE.

THE BIG THREE:

DUCTILE IRON, PVC, AND HDPE

There are 55,000 municipalities across the country, and they all need to move product like natural gas and water. To do so, they use a wide variety of piping materials. We're covering three of the primary material options:

- Ductile Iron
- PVC
- HDPE

DUCTILE IRON PIPE

Ductile iron pipe (DIP) has been around for decades, and many municipalities still use DIP in their piping systems and infrastructures today.

DIP is a pressure pipe commonly used for potable water and sewage distribution and is a direct descendant of the earlier cast iron pipe. Despite its strength, ductile pipe corrodes internally and externally and declines faster in aggressive environments.

COMMON ISSUES WITH DUCTILE IRON

Ductile iron is strong, but corrosion and tuberculation cause it to deteriorate over time. Worse, the remaining service life cannot be determined from the outside, and the level of tuberculation that may be present on the interior of the pipe cannot be assessed without special equipment. In other words, you might have a problem and not even know it—until the pipe begins to leak.

Here are some common issues:

- Joint separation can occur as a result of ground movement.
- DIP is prone to external corrosion and internal tuberculation.
- DIP is two to four times more expensive than its competitors.
- DIP requires open-cut construction that can be disruptive to communities

POLYVINYL CHLORIDE

Polyvinyl chloride (PVC) is a commonly used polymer for potable water systems. It can withstand significant water pressure; studies, as well as some manufacturers, claim PVC pipe has a service life of more than 100 years.

Life-span estimates vary among sources, and there is consensus that a 100-year lifespan is greatly exaggerated. Typically PVC lasts between 25 and 50 years.

COMMON ISSUES WITH PVC:

Although the PVC pipe industry touts its product as a superior alternative, it is not without limitations. One of the biggest problems is that lead times for PVC pipe are long, and availability is short. Prices have also risen significantly in the past two years. The primary causes include COVID-19-driven demand, catastrophic weather, and logistical challenges that have disrupted the supply chain. Change predictions are not optimistic, and supply shortages are projected to continue for another two to three years.

Here are some common issues:

- Over-insertion or "over-belling" of the spigot into the bell is a common installation defect that leads to PVC pipe failure.
- PVC is brittle and prone to cracking caused by UV exposure, cold temperatures, age, overbending, and chemical exposure.
- Fatigue caused by water surge or water hammer can damage PVC pipe and fittings.
- Failures can be catastrophic and expensive.

HIGH-DENSITY POLYETHYLENE (HDPE)

HDPE pipe has quickly grown in popularity and gained approval in municipalities for its many advantages over legacy pipe material. The landfill, natural gas, geothermal, mining, and oil patch markets have relied on its leak-free, corrosion-resistant, and flexible benefits for years.

The combination of flexibility and leak-free joints allows for unique and cost-effective installation methods. HDPE, known as the trenchless pipe, allows for minimum surface and environmental disruptions using trenchless installation techniques. It is maintenance-free and has a longer life cycle than legacy systems. Adopters of HDPE enjoy fewer system main breaks, low water loss rates, and reduced repair costs.

HDPE is a polyethylene thermoplastic made from ethylene, a petroleum byproduct. It's one of the most versatile types of plastic on the market.

THE BENEFITS INCLUDE:

- surge tolerant (both recurring and occasional);
- long-lasting and weather-resistant;
- tough, yet lightweight and flexible;
- resistant to corrosion, chlorine, and UV;
- resistant to bacteriological and chemical buildup;
- safe to tap in all conditions and unable to fracture; and
- made with a longer life expectancy than other piping (steel, iron, copper).

THE BENEFITS OF HDPE IN WATER APPLICATIONS:

WHY MUNICIPALITIES TRUST IT OVER PVC AND DUCTILE IRON

A mix of COVID-19-related supply shortages and rising material prices continue to make it challenging and costly to repair aging water systems. However, the choice for dependability should not be left to familiarity. HDPE piping systems have proven economical, durable, and energy efficient and to perform well. So why not upgrade to a material that improves the resiliency of our communities and national infrastructure?

Here are a few reasons industry leaders are turning to HDPE piping solutions.

LEAK-FREE SYSTEM

While ductile iron and PVC have leak rates of 30 percent, HDPE has a failure rating of 1/10,000,000, providing a leak-free operation with little to no maintenance.

HDPE provides a water-tight joining system because it is heat-fused, a process during installation called butt fusion—thus, saving unimaginable amounts of water and related operational or repair costs. The butt fusion process allows for one of the lowest rates of leakages out of all pipe materials.

With traditional PVC or DIP systems, potential leak points can occur at every joint (10–20 feet). To illustrate, consider that a city of 100,000 residents using PVC piping for their potable water supply would lose around 14 percent to leakage—over 12 million gallons yearly. That's 604 million gallons over the life of the distribution system.

In the past 20 years, we've only seen a handful of failures—primarily resulting from untrained or improper fusion techniques, not product deficiencies. To eliminate these risks, ISCO offers a robust training program for all cities and customers.

HDPE's leak-free success is mainly due to the heat fusion process, which eliminates mechanical joints and other failure risks by creating a monolithic leak-free pipeline.

Further, HDPE-fused joints reduce installation time because the pipe can be joined at the surface and lowered into the trench. When properly fused, the joints are as strong in circumferential hoop stress and axial tensile strength as the pipes.

EASY INSTALLATION

Another benefit of HDPE is that it is less expensive and easier to install than most other potable piping systems.

With some initial training, HDPE is significantly easier to install than PVC and ductile iron. After training, many installers never want to return to PVC or ductile iron.

In most cases, HDPE also has a lower installation cost. Trenchless technology is typically 50 percent to 75 percent of the cost of open-cut installations. However, open-cut HDPE project costs are often still required. An added benefit is that operators can fuse pipe above-grade versus in the trench, unlike other systems.

HDPE can be installed with trenchless technologies like directional drilling, pipe bursting, slip lining, and compression fit lining. Thus, installation is safer, more efficient, less environmentally disruptive, and less physically demanding—increasing worker safety, reducing trench excavation, and simplifying installation.

RESPONSIBLE AND SUSTAINABLE INFRASTRUCTURE

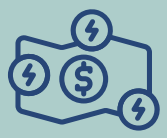
HDPE pipe is the best product for developing sustainable infrastructure. From its low energy cost to produce, ship, and install to its leak-free performance to its corrosion resistance and economic advantages, HDPE pipe is the best choice for performance and versatility compared to other materials.

SHORT-TERM AVAILABILITY

PVC pipe is susceptible to recurring interruptions in its supply chain. The availability of pipe during peak installation seasons is essential for some regions of the country. For example, operators in cold regions have roughly a six-month installation window to install water lines in the ground. Although lead times for HDPE and PVC have both been extended in the wake of recent supply chain disruptions, HDPE is significantly shorter—making timelines more manageable and predictable. This makes HDPE a clear winner in terms of availability.

ENVIRONMENTALLY FRIENDLY

At ISCO, we believe that we have a responsibility to help protect the planet; that's a major reason we advocate for HDPE.



By switching to HDPE, consumers can expect to save up to

65%

on installation costs.

It is the most environmentally friendly plastic on the market. It is recyclable and doesn't give off caustic fumes, and the manufacturing process requires only a fraction of the energy needed to produce some other materials standardized across the industry.

Other environmental benefits of HDPE include the following:

- Energy-efficient manufacturing
- Lightweight design, making it easy and energy-efficient to transport
- Trenchless, low-impact installation process options available, making it ideal for highly congested municipalities and environmentally sensitive areas
- Low-carbon impact

EXTREME SURGE TOLERANCE

Another benefit of HDPE is that it is the most surge and fatigue-resistant of any other water piping material.

An HDPE pipe can handle occasional surges up to two times its working pressure rating and recurring surges up to one-and-a-half times its pressure rating with no risk of stress damage to the pipe.

Additionally, HDPE handles high-flow velocities. The ductile polyethylene material absorbs energy created during a surge event and dissipates the wave quickly when compared to legacy materials. Rigid PVC and DIP pipe amplify the wave, leading to downstream surge impacts.

In other words, HDPE is more resistant to surge and fatigue than any other material used in potable water piping systems.

SIGNIFICANTLY COST-EFFECTIVE LONG-TERM

As we saw in Duluth's case, HDPE holds greater value and is more reliable than ductile iron. But in terms of cost, how does it compare?

Compared to other municipal pipe materials, HDPE has the least expensive life-cycle cost because of its low failure rates and leak-free capabilities.

When making a critical, long-term decision for a municipality, it's important to analyze the "whole life costs" and total cost of ownership, including the following:

- Installation costs for building water infrastructure
- Leakage costs associated with water loss from pipe joints

- Repair costs for necessary infrastructure refurbishments
- Replacement costs in cases where refurbishments require replacement
- Corrosion costs related to pipe failures
- Customer service rebates and penalties as a result of pipe failures

When you consider that HDPE has a well over 100-year service life; does not leak; is tough, flexible, fully restrained, and readily available; and can offer installation methods with little environmental disruption—HDPE consumers will save money throughout the duration of a project.

TOUGH, YET LIGHTWEIGHT AND FLEXIBLE

The beauty of HDPE lies in its strength and flexibility. Unlike brittle PVC and ductile iron, HDPE has an average bend radius of 25 times the outside diameter. Moreover, you can form a radius without using fittings for directional changes. At nearly one-eighth the density of steel, HDPE is also incredibly lightweight, reducing the size of machinery required during installation or transportation, thereby helping reduce the carbon footprint associated with the project.

CORROSION-RESISTANT

Another benefit of HDPE is that it doesn't corrode over time like metallic products; this is essential, especially in potable water applications where internal and external corrosion can occur, common with metal pipe systems.

CHEMICAL-RESISTANT AND STABLE

Because HDPE is resistant to acids, bases, reducing agents, and gentle oxidants, the material mitigates the risk of leaching, ensuring that chemicals do not reach hazardous levels.

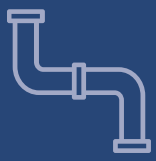
COMMON HDPE MYTHS DEBUNKED

HDPE has been around for 60+ years and taking a stronger hold in the water industry. Improvements in technology, installation methods, jointless systems, durability, and long-term strength are just a few reasons HDPE is gaining market share. As more municipalities adopt HDPE for water transport, several myths about the material need to be addressed.

MYTH 1:

HDPE IS EXPENSIVE

HDPE has historically been more expensive than PVC. Unlike iron and PVC, which have a leak rate of 10 percent to 20 percent and a more limited life span, HDPE offers a 100-year life span without leakage. Moreover, HDPE requires less maintenance and is easier, safer, less disruptive, and faster to install than any other product on the market.



MYTH 2:

HDPE CANNOT BE JOINED TO PVC OR DUCTILE IRON

Municipalities may only be able to replace or manipulate certain sections of pipe at a time—necessitating the joining of different materials. HDPE can be mechanically joined together with both ductile iron and PVC by using fittings and adapters designed for this purpose. The preferred method for joining HDPE to legacy material is to use a mechanical joint or "MJ" adapter.

COMMON HDPE MYTHS DEBUNKED

HDPE has been around for 60+ years and taking a stronger hold in the water industry. Improvements in technology, installation methods, jointless systems, durability, and long-term strength are just a few reasons HDPE is gaining market share. As more municipalities adopt HDPE for water transport, several myths about the material need to be addressed.

MYTH 3:

HDPE needs to be upsized over PVC

Contrary to the myth, there is no real hydraulic need to upsize HDPE. Trenchless technologies like directional drilling, pipe bursting, slip lining, compression fit lining, and open excavation allow technicians to simply replace existing pipe rather than upsize it.

MYTH 4:

HDPE PIPE IS NOT AS DURABLE AS OTHER PIPE MATERIALS

PVC, DIP, and HDPE all resist backfill with comparable success. In other words, all three materials are equally strong. HDPE excels not only because it is strong but also because it is seismically resistant and provides superior longevity, flexibility, and durability. Unlike traditional materials, HDPE withstands aggressive flows, soils, and other unique conditions. It's also ideal for demanding environments that require trenchless installation techniques.

HDPE is equally, if not more, suited than other materials in potable water, sanitary sewer, and stormwater management applications. HDPE pipe has been used for nearly 50 years in the gas industry and more than 40 years in stormwater management systems.

ISCO IS PROUD TO BE THE LARGEST DISTRIBUTOR OF HDPE IN NORTH AMERICA

ISCO Industries is the largest distributor of HDPE pipe in North America. Thanks to our size, inventory, custom fabrication, design support, and fleet of fusion equipment, we can serve your HDPE needs anywhere in the United States and internationally.

There's a reason we're proud to be an HDPE distributor; it is ideal for a wide range of applications, including municipal, industrial, oil and gas, energy, geothermal, landfill, marine, district energy, and more. So what sets HDPE apart from other products?

IN A PHRASE, PEACE OF MIND.

- It's most cost-effective over the life of the project.
- It's easy to install.
- It's durable.
- It reduces system leaks or breaks.
- It's environmentally friendly.

Overall, HDPE performs at a much higher level than its competitors, which is more cost-effective to buy and install; we see no inclination of any of that changing any time soon.

CONTACT:
1-800-345-ISCO (4726)
SEND US A MESSAGE

SOURCES

https://www.laitimes.com/en/article/20wec_29p83.html

https://www.marketdataforecast.com/market-reports/polyvinyl-chloride-market

https://www.argusmedia.com/en/blog/2021/november/11/pvc-prices-at-record-high-analysis-of-key-factors

https://areteindustries.us/hdpe-plastics/#:~:text=HDPE%20plastic%20is%20the%20most,classification%20of%20being%20Eco%2Dfriendly.

https://www.advancedpiping.com.au/blog/benefits-using-hdpe-pipe-civil-infrastructure-projects/

https://pprc.org/2015/p2-rapid/is-high-density-polyethylene-hdpe-a-good-choice-for-potable-water/

https://ukwir.org/long-term-aging-of-polyethylene-pipes

https://www.awwa.org/

https://www.waterrf.org