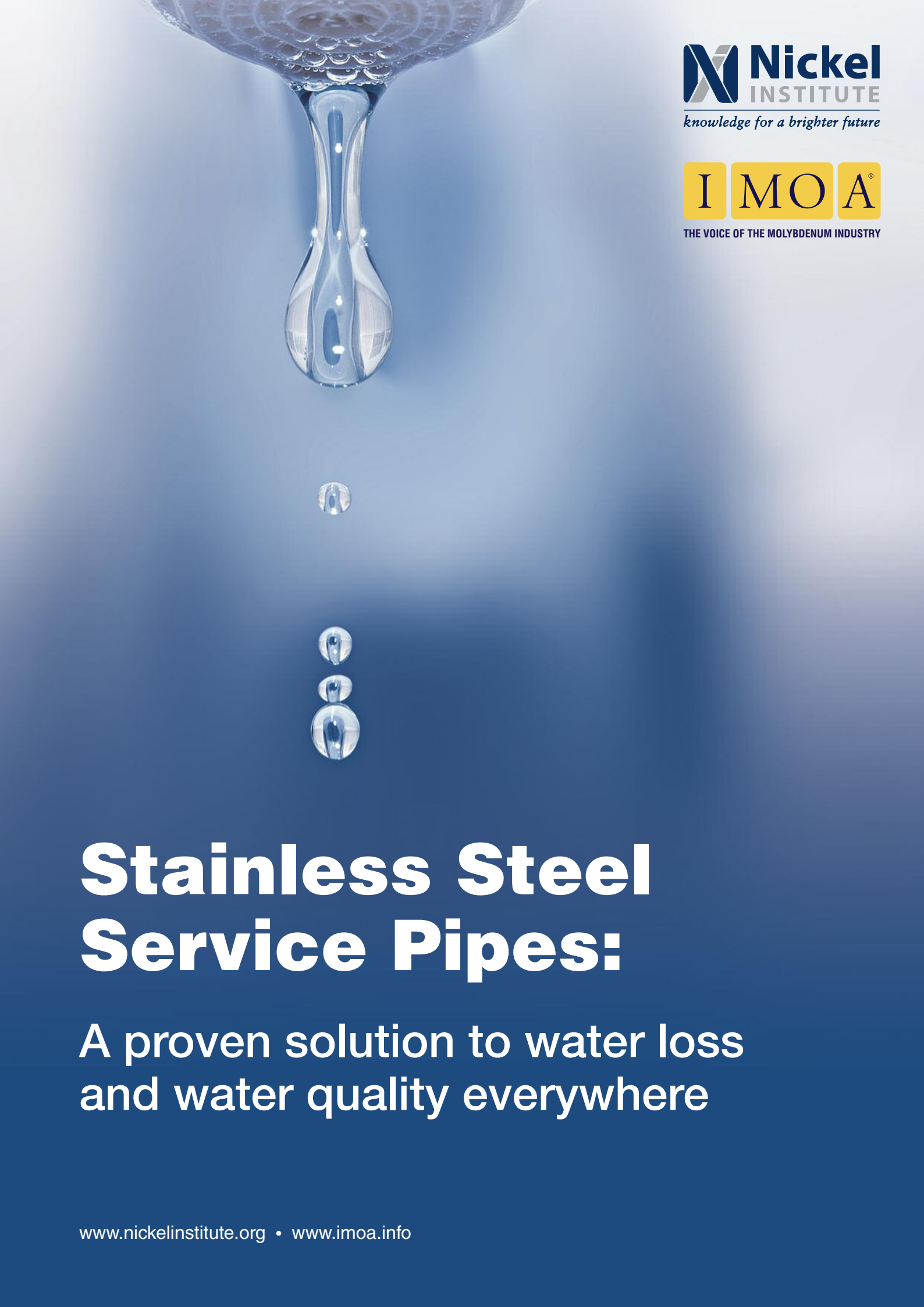

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THE VOICE OF THE MOLYBDENUM INDUSTRY

Stainless Steel Service Pipes:

A proven solution to water loss and water quality everywhere

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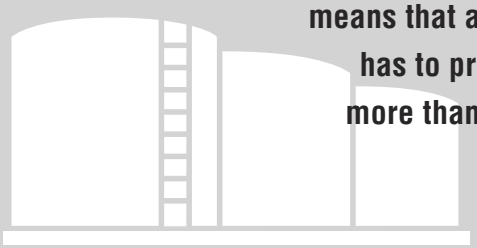
Time to address a global issue

Water leakage is a global problem which is quickly escalating to a crisis in many parts of the world. Some cities are now perilously close to running out of water.

As much as 95% of all leaks occur in the service pipe connecting the mains to the customer. This water loss constitutes the majority of Non-Revenue Water (NRW) – water that leaves the treatment plant but is not billed to consumers.

According the World Bank, more than 25% of all water produced by utilities never reaches their customers. This means utilities, on average, need one-third more processing infrastructure than would be required with zero leakage. This includes more water treatment, more pumping stations, more chemicals, more electricity and, critically, more water to meet their service obligations. This burden of cost and waste can be solved by stopping the leaks, and particularly by preventing the leaks from recurring.

In some cities, NRW is as high as **70%** (OECD)



A water loss of 25% means that an authority has to produce **1/3** more than necessary

By 2030, it is predicted that water demand will exceed supply by 40% (2030 Water Resources Group, 2009). If we are to reduce this looming shortage, water losses on this scale are simply not sustainable – things need to change before it is too late.

"It will become increasingly important to develop and implement innovative long-term strategies for making sure we have enough water when and where we need it" *(White House Water Summit)*

In developing countries, about 45 million cubic meters of water are lost every day through water leakage – enough for nearly 200 million people (World Bank)

The total cost of NRW to water utilities is an estimated $14 billion per year (World Bank)

Flexible solution

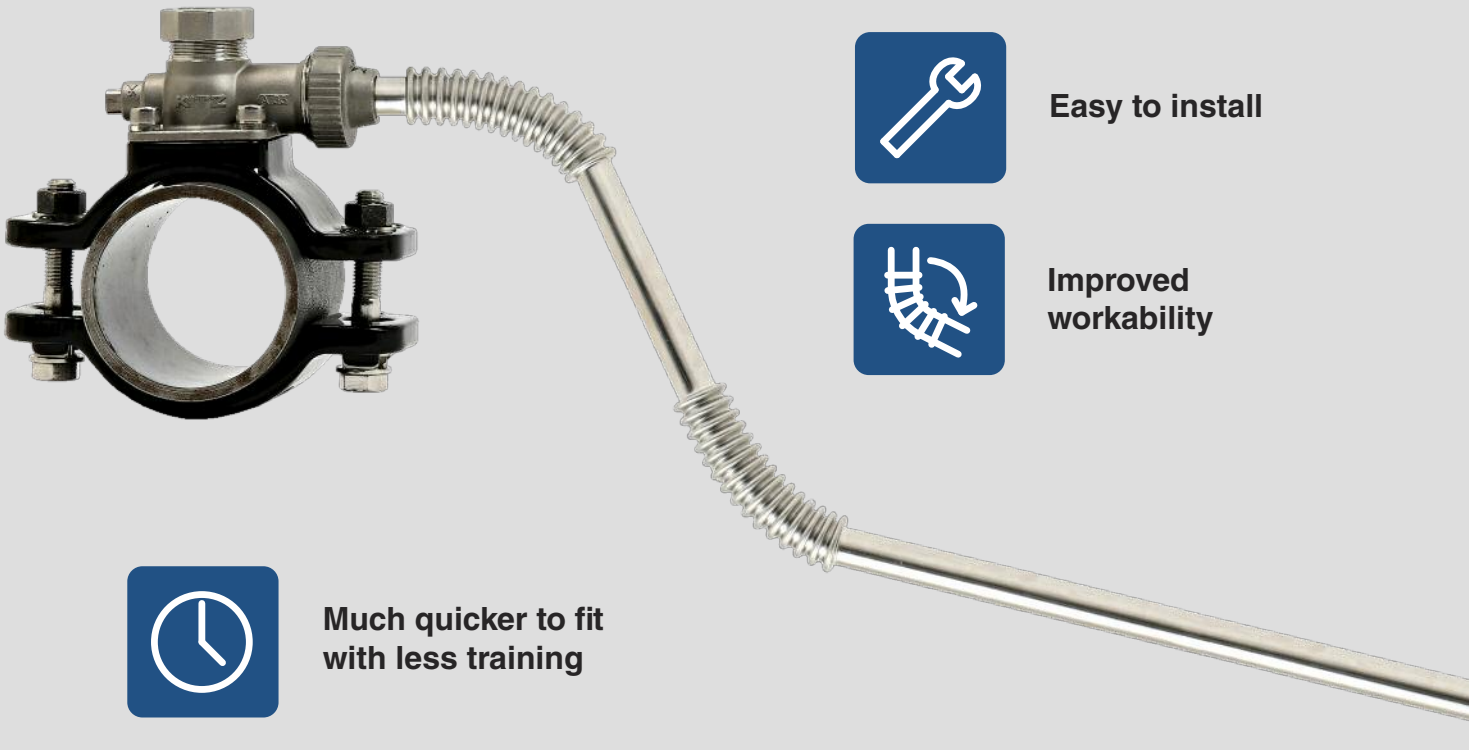
Service pipes, the main source of water leaks, are usually made from plastic, galvanized steel, copper or, historically, lead. They are vulnerable to damage from corrosion, earth movement, seismic events and extremes of temperature, particularly at piping joints.

Type 316 stainless steel provides a hygienic, corrosion resistant and long-lasting solution of 100 years or more. It is used to manufacture partially corrugated piping. It is flexible, resistant to seismic shocks and eliminates the need for most fittings and elbows, making it easy to install.

The corrugated system minimizes potential leakage, substantially reducing repair cases and the resources needed for their detection.

Pipe replacement has been shown to offer the most significant benefit in overcoming water loss, as part of an overall water loss strategy as demonstrated in Taipei.

Benefits of flexible stainless steel piping:



Easy to install

Improved workability

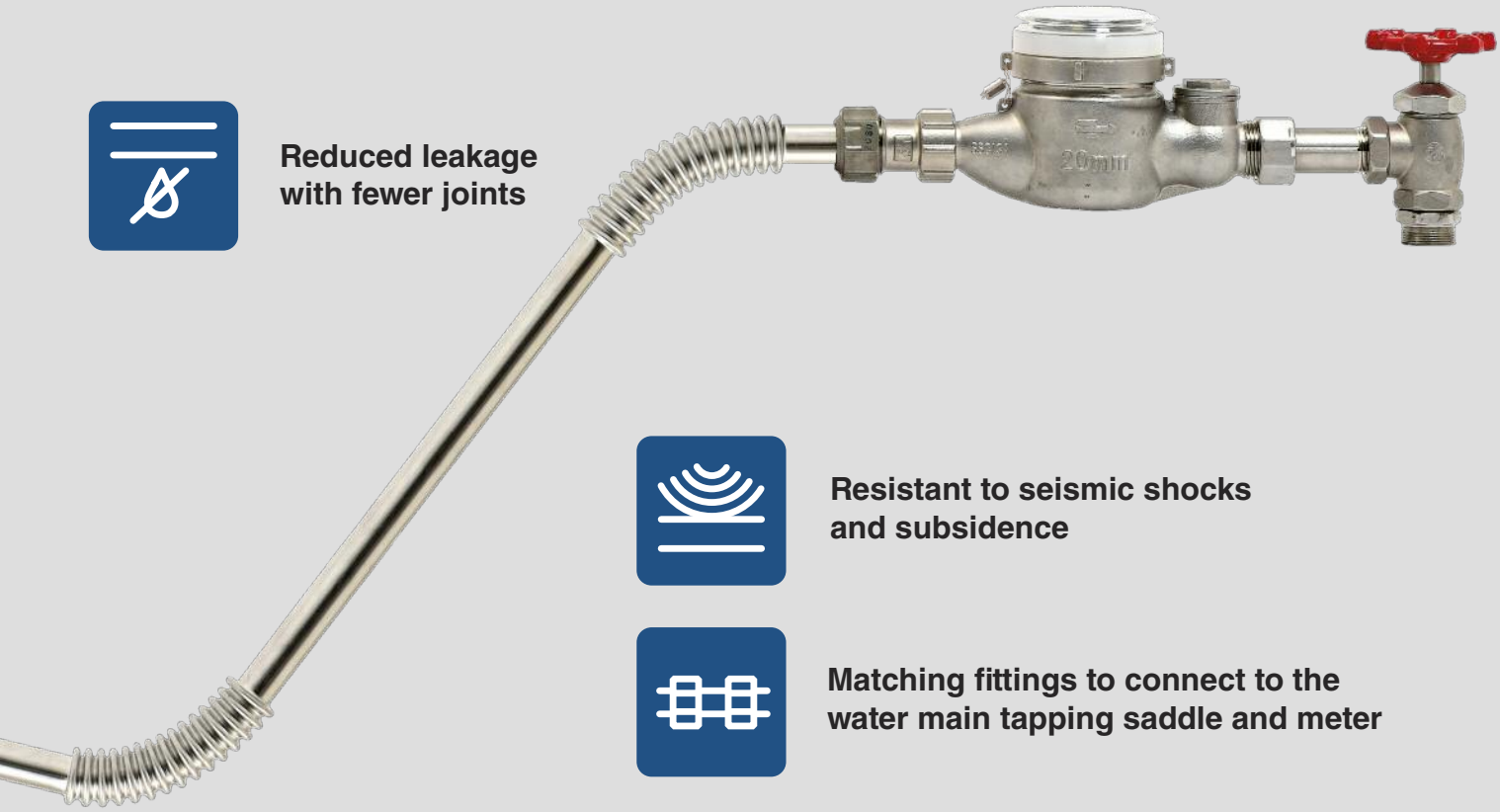
Much quicker to fit with less training

Case study: Drought averted in Taiwan

Taipei's leakage rate was more than 28% and a severe drought in 2002 left the city with intermittent water supply for more than a month. This led the Water Authority to embark on a program in 2003 to reduce leakage rates, including the replacement of service pipes, with Type 316 stainless steel.

Between 2003 and 2014, about 35% of service pipes in Taipei were replaced with corrugated stainless steel. NRW has fallen from 27% to 17%, saving some 146 million cubic meters of water per year.

In 2014, the city experienced an even more severe drought than in 2002, but with the leak reduction program well underway there was no disruption of supply.



Reduced leakage with fewer joints

Resistant to seismic shocks and subsidence

Matching fittings to connect to the water main tapping saddle and meter

Resilient and hygienic solution

Stainless steel gives exceptional protection against corrosion in a wide range of soils and conditions. It is strong and ductile, meaning that it will bend rather than break. It is capable of withstanding pressure from the surrounding soil, the weight of heavy traffic and even movements during seismic events.

Inert in water, stainless steel is hygienic, so it can deliver safe and high-quality drinking water. It is also suitable for a full range of potable waters. Because of its resilience, stainless steel prevents chemical and bacterial contaminants entering the water through cracks in the pipe when mains pressure falls and hydraulic integrity is lost.

The durability of stainless steel means that cost savings are achieved year after year, greatly improving the performance of water delivery.

Benefits of using stainless steels:

Corrosion resistant

Long service life

Tough and crack resistant

Lower maintenance and repair costs

Strong, durable and resilient

Lower life cycle cost

Hygienic, protecting water quality

100% recyclable

Case study: Near zero water leakage in Tokyo

In 1980, the Tokyo Water Authority started a project to replace leaking lead service pipes with stainless steel. The project achieved a 20% reduction in water leakage in the first five years, leading the Authority to implement a program to retrofit all houses with stainless steel service pipes.

In 2004, nearly all of the city's service pipes had been replaced with Type 316 stainless steel. Together with improved leak detection, quicker repairs and introduction of ductile cast iron water mains, the project reduced Tokyo's water leakage rate from 15.4% in 1980 to 2.2% in 2013. Repair cases reduced from 57,970 cases to 9,774 cases per year over the same period.

In 2011, Tokyo reported annual water savings of 240 million cubic meters and an associated reduction in CO_2 emissions by 54,000t over 1980 levels. Cost savings of hundreds of millions of dollars per year were realized.

Questions & Answers

What is the cost of the stainless steel solution over its service life?

Stainless steel is similar or lower in initial cost to other metal solutions. Because of its durability, stainless steel does not need to be repaired or replaced for 100+ years. Compared to plastics, its initial installed cost is about 10% higher. However, if a plastic solution needs to be replaced even just once in 100 years, it would be 70% more expensive than stainless steel, even without accounting for the cost of disruption.

Why is stainless steel so much better than the lower cost alternatives?

Type 316 stainless steel is durable, resilient, corrosion resistant, hygienic and maintenance-free. Because it is both flexible and strong, it is also much more resistant to damage from earthquakes, traffic vibrations, and accidental movement. Stainless steel will easily resist pressure variations and is impervious to freezing. Stainless steel is already used in many parts of the water supply system. This product extends the excellent service attributes of stainless steel to the bulk of the distribution infrastructure.

What about the quality of the water supplied by this solution?

Stainless steel is basically inert, meaning that it will not react with water or leach chemicals, as some other materials can. It is a hygienic solution which protects the quality of drinking water. Stainless steel will not react with chemicals used to sanitize the water, ensuring highest quality water at lowest sanitation cost.

What about customer satisfaction – what are the benefits for consumers and can it reduce customer complaints?

Because of the durability of stainless steel, service and traffic disruptions can be minimized, leading to fewer customer complaints. And because stainless steel cannot 'leach' chemicals, it protects the quality of the water. Low leakage and repair costs mean lower total water costs, reducing pressure on water prices.

What is the fail rate of stainless steel piping compared to the alternatives?

Stainless steel pipes will give at least 100 years of service without cracking or bursting. Failure of stainless steel pipe is extremely rare.

How long does it take to install this solution compared to the traditional alternatives?

The installation of stainless steel partially corrugated water tube and fittings involves simple methods with no welding or soldering. Connections are quickly made, installation time is similar to the fastest connections possible in other service pipe materials and the completed installation is robust, making stainless steel the best choice overall.

Can a replacement be completed quickly?

Yes. Because the pipe is corrugated, it is simply bent to fit the trench, overcoming any obstacles or variations in depth between the main and the meter.

In what sizes are the pipes available?

The pipes are standardized with nominal diameters from 13 to 50 mm and lengths up to four meters.

How is the pipe connected to the meter and to the main?

In Asia, a tapping saddle sits on top of the water main, with compression fittings attaching the pipe to the saddle and to the meter. All the fittings are Type 316 stainless steel, except for the ductile iron base of the tapping saddle which clamps around the main.

This leaflet is published by the Nickel Institute and the International Molybdenum Association, both not-for-profit global trade associations dedicated to promoting and supporting the greater use of nickel and molybdenum in appropriate applications.

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