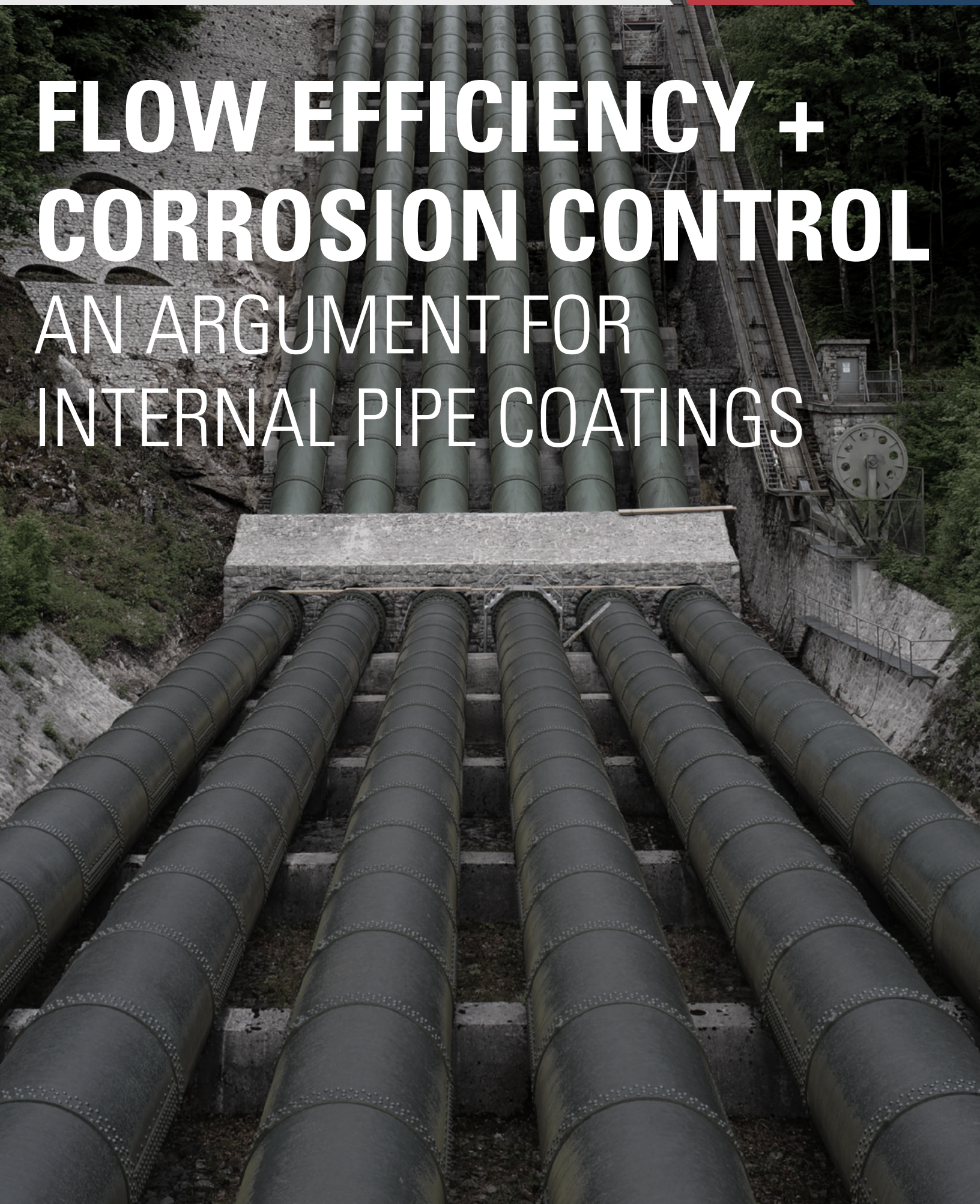
US COATINGS

FLOW EFFICIENCY + CORROSION CONTROL

AN ARGUMENT FOR INTERNAL PIPE COATINGS



The purpose of flow efficiency coatings

How coatings affect pipeline pumping efficiency

Flow efficiency coatings are meant to reduce operational costs associated with pumping petroleum products through a pipeline by enhancing the smoothness of the pipe's interiors.

These pipe linings improve hydraulic efficiency by smoothening the interior surface and preventing the buildup of corrosion and deposits inside of the pipeline. The elimination of even minor variations in surface height inside of a pipeline has been shown to drastically reduce the costs associated with pumping products through the line.

The American Petroleum Institute (API), one of the agencies which publishes standards for flow efficiency coatings, cites the following four benefits of flow efficiency coatings; improved flow characteristics, corrosion protection during the period preceding construction, enhancement of visual inspection of the internal pipe surface and the improvement of pigging efficiency.

The International Organization for Standardization (ISO) has also issued guidelines for friction-reduction coatings. In 2001, these standards began to account for some developments not accounted for in the standards issued by the API. But neither of these most common industry standards for flow efficiency coatings makes any provision for the presence of corrosive gasses. In fact, ISO 15741 explicitly states that the standards do not account for the presence of corrosive gasses.

As more and more oil is procured from water-intensive methods such as hydraulic fracturing, pipeline owners will have to account for the presence of corrosive materials. This trend will have to be reflected in domestic or international standards regarding the use of flow efficiency coatings, and has potential to shift the most desirable formulations for flow efficiency coatings.

FLOW EFFICIENCY COATINGS: A HISTORY

For years, the most common formulations of flow coatings were based on low solids epoxies. But recent regulations governing VOCs emissions at the regional, national and international levels have made these formulations difficult or impossible to use. In response, some companies have begun to experiment with new formulas for internal pipe coatings.

Water-based epoxies emerged early as a potential solution, but problems have surfaced. Water has proven difficult to remove once the coatings have been applied. This makes climate a major factor in the application process. In predominantly humid environments, water-based coatings have a tendency not to dry at all.

Plural-component, 100 percent solids coatings have superseded water-based epoxies as a potential solution to the problem of flow efficiency coatings and emissions regulations. These have been shown to have quick cure times regardless of weather conditions. Even in rain, 100 percent solids have been found to dry. And of course, because they contain no solvents, they comply with even the strictest regulations.

It is true that some investments must be made in order for an operation to make use of plural component coatings. Pumps and other application equipment are on consideration. The products themselves are generally about twice as expensive as well. This turns into a relative wash, though, because they also tend to cover twice the surface area of lower solids coatings, so about half as much product is required. Waste also becomes a non-issue, since plural component coatings are not mixed until the moment before they are applied.

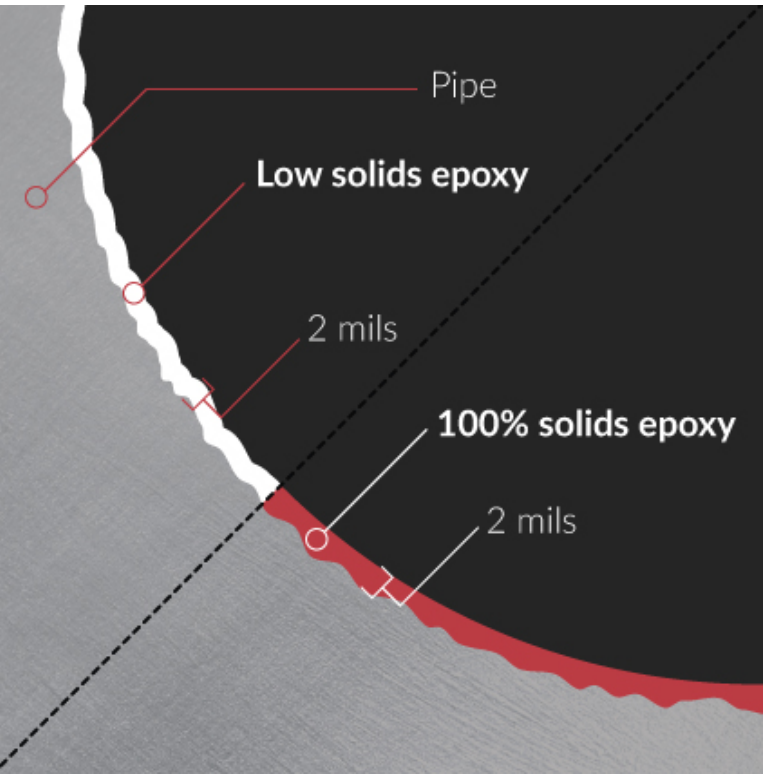
These benefits make 100 percent solids a viable option for use as flow efficiency coatings. But there is another benefit high solids coatings can bring to flow efficiency that may ultimately tip the balance in favor of the cost-effectiveness of these types of coatings.

FLOW EFFICIENCY PLUS CORROSION CONTROL

For years, regulatory agencies have focused on the issue of external pipeline corrosion, sometimes neglecting or leaving aside the question of internal corrosion. Not surprisingly given the harsh environments many oil and gas pipelines operate in, most of the energy has been allocated to preventing corrosion occurring on the outside of pipelines.

Only recently have pipeline owners begun to focus serious attention on problems (and missed opportunities) stemming from internal buildup and corrosion. As documented cases of internal corrosion pile up, the argument for flow efficiency coatings being a smart investment is strengthened. The proliferation of hydraulic fracturing and similar methods of oil and gas extraction only furthers this conclusion. For an explanation of why these methods introduce more corrosive elements than traditional extraction methods, see this post on tank linings in the age of hydraulic fracturing.

Traditionally, internal pipeline coatings have been divided into two groups: those aimed at improving hydraulic efficiency and those aimed at controlling corrosion. Flow coatings, typically applied at a thickness of around 2 mils, were not sufficiently thick to be considered corrosion resistant linings, which are typically around 5 mils thick.



But 100 percent solids can help to close this gap between traditional flow coatings and corrosion resistant ones. Unlike with water or solvent-based coatings, 100 percent solids allow for the addition of mil thickness until the desired level is reached. There is no danger of water or solvents becoming trapped within the film build, because there is no water or solvent.

This feature allows 100 percent solids to provide added value as internal pipeline coatings, since they serve both to increase hydraulic efficiency and to fight the sort of corrosion that can lead to disastrous financial and environmental setbacks.

Increased attention is being paid to flow rate and instances of internal corrosion. According to a study conducted by the API, corrosion was still the leading cause of leaks by 2012. There were 204 total incidents of internal corrosion between 1999 and 2012. Of these incidents, 31 occurred in portions of pipeline that intermittent flow and seven in portions that had no flow. In these instances of low to no flow, water is more likely to collect against the side of the pipe, creating the conditions necessary for corrosion to occur.

The report concludes that, while instances of external corrosion continue to be the leading cause of incidents along pipelines, much more has been done to address these external issues. As a result, their rate of occurrence is dropping far faster than instances of internal corrosion.

When the stakes include the costs of a damaged asset, time lost with the asset out of service, leaked material and environmental liabilities, then it stands to reason that internal anti-corrosion coatings justify the initial cost output. If they also combine flow-efficiency properties, their value is all the more certain.

THE COST EFFECTIVENESS OF FLOW EFFICIENCY COATINGS

Flow coatings have been shown to reduce both capital and operating expenditures over the long term. A 2000 study demonstrated that flow coatings were able to cut friction coefficients by 50 percent in carbon steel pipes.

Another study by Rafael Zamorano shows that a 1,200 km pipeline owned by GasAtacama returned substantial savings by using internal flow coatings. The company reported saving $2.4 million in fuel for compressor stations alone. When this figure was added to reductions in capital and operating costs, savings exceeded $20 million.

Shell Global Solutions was recently able to demonstrate cost savings of 5% on a 250 km stretch of pipeline because flow efficiency coatings allowed them to move to a smaller diameter pipe. France's Institut Francais du Petrole realized cost savings of 7-14% in lightly corroded pipe and 15-25% cost savings in the case of highly corroded pipe.

Sticker shock that accompanies these 100 percent solids has discouraged owners from investing in them, despite the returns on investment they have been found to deliver. As mentioned above, 100 percent solids run around twice the cost of the same amount of 50 percent solids, on average.

Fortunately, these higher solid coatings are capable of covering about twice the surface area of the lower solid option, making up for the higher initial price tag. Considering the added benefits of a 100 percent solids coating—zero VOCs, no loss factors since the components aren't mixed until the time of the application and added corrosion protection—they end up bringing far more to the table than their seemingly lowerer-priced counterparts.

The debate over the cost-effectiveness of flow efficiency coatings has raged for some time. But developments in 100 percent solids coatings lead to added benefits as internal pipe coatings that tip the balance in favor of these coatings. Unlike their forerunners, these coatings allow for added mil thickness when corrosion protection is a concern. In addition to increasing hydraulic efficiency and preventing buildup, internal pipeline coatings are now able to provide effective corrosion protection. And given the rise of new forms of oil and gas extraction, corrosive materials will soon be flowing through a lot more pipeline.

REQUEST A CONSULTATION

Our on-site analysis consultations allow a coatings professional to evaluate your asset and make site-specific recommendations.

Visit offers.uscoatings.com/request-a-consultation

ABOUT US COATINGS

US Coatings is a leading provider of high-performance coatings and linings. We custom tailor our products to fit the needs of clients across a wide variety of markets, and we pride ourselves on offering superior customer service through the duration of the job.

Founded in 2000 in St. Louis, Missouri, US Coatings has grown from a two-man operation to a company doing business all over the country and with close connections spanning a vast number of industries. Despite this success, we're committed to remaining nimble enough to be able to take on any coatings challenge, large or small. We still make all of our products in-house, from formulations we own to new products designed by our technical R&D department.

Where some of the big-box stores pull a product off the shelf and wave goodbye after checkout, US Coatings is focused on building relationships with our customers through our consulting services. We're here before, during and after the sale with personalized attention to your project that our competitors can't match.

More than just purveyors of paint, we take collaborating with our customers seriously, providing superior service throughout the course of your job.

CONTACT

Mike Reed
General Manager
NACE Level 3 Coating Inspector #31422

Email mreed@uscoatings.com
Mobile 314.220.4768
Office 314.205.1500