BACKGROUND OF CO2 CORROSION

According to the study of “Corrosion Costs and Preventive Strategies in The United States” in 2002, pipeline corrosion cost approximate $7 billion annually in the USA. This cost does not include the cost of downtime or lost oil and gas. In addition, this article also stated that the total cost of corrosion in the US pipeline system could grow up to 20 billion annually if the costs on production, process, and refining down time, and on the environment were included.

Figure 1: The Trans-Alaska Pipeline System

CO2 related corrosion failure accounts for 25% of all safely incidents, 8.5% increase of expenditure of capital, 5% of lost/deferred production, 2.2% of tangible assets, and 2.8% turnover.

Figure 2: Corroded Pipe

The study also stated that with the currently available technologies there are approximate 30% cost of corrosion can be avoided.

Challenges

The main challenges that oil and gas producers face regarding corrosion are:
- Aging pipeline infrastructure
- Cost of equipment and pipe replacement
- Stricter regulations
- Environmental issues

What is CO2 corrosion?

CO2 corrosion or sweet corrosion is the corrosion of carbon and low-alloy steel by carbonic acid and its derivatives. Carbonic acid is formed by gaseous carbon dioxide first dissolving into water, and then reacting to it. There are three main types of CO2 induced corrosion in pipelines:
· Pitting corrosion
· Mesa-Type Attack
· Flow-Induced Localized Corrosion

Pitting Corrosion: Pitting takes place at low velocities and at the dew point in gas-producing wells. And what happens is a small shallow is formed in the pipe wall, which is gradually corroded away until a sAs temperature and CO2 partial pressure increase, the pitting susceptibility increase as well.

Figure 3: Pitting Corrosion

Mesa-Type Attack: Mesa attack is a type of localized corrosion and happens in low to medium conditions where the protective ion carbonate film forms but it is unable to bear the operating flow regime.

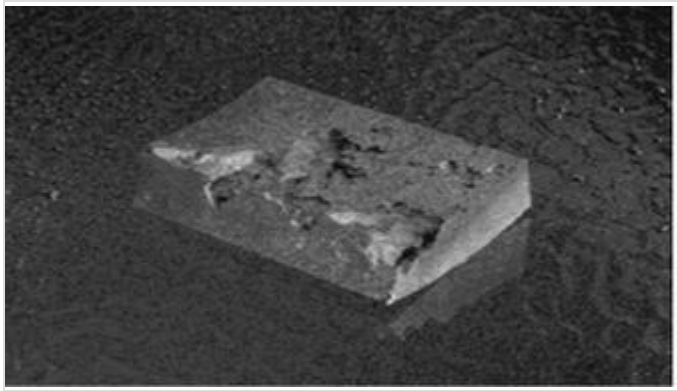

Figure 4: Mesa -Type Attack Corrosion

Flow-Induced Localized Corrosion: This kind of corrosion happens in areas of transient and turbulent flow and it is when the protective barrier covering the pipe wall is stripped away, leaving a small exposed area for where all corrosion activities take place.

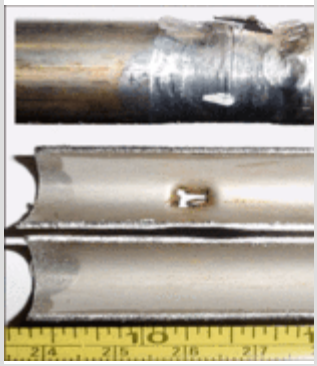

Figure 5: Flow-Induced Localized Corrosion

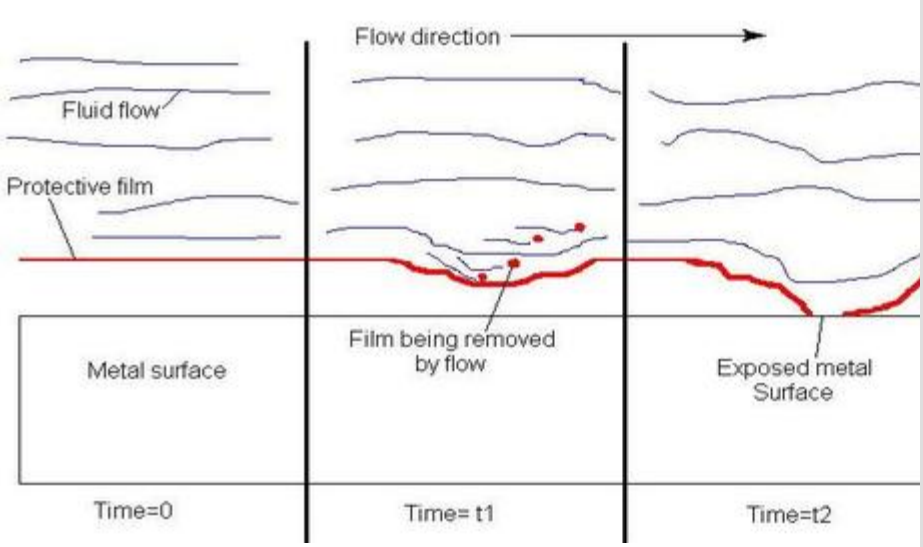

Figure 6: Flow-Induced Localized Corrosion Process

Key Factors Influencing CO2 Corrosion

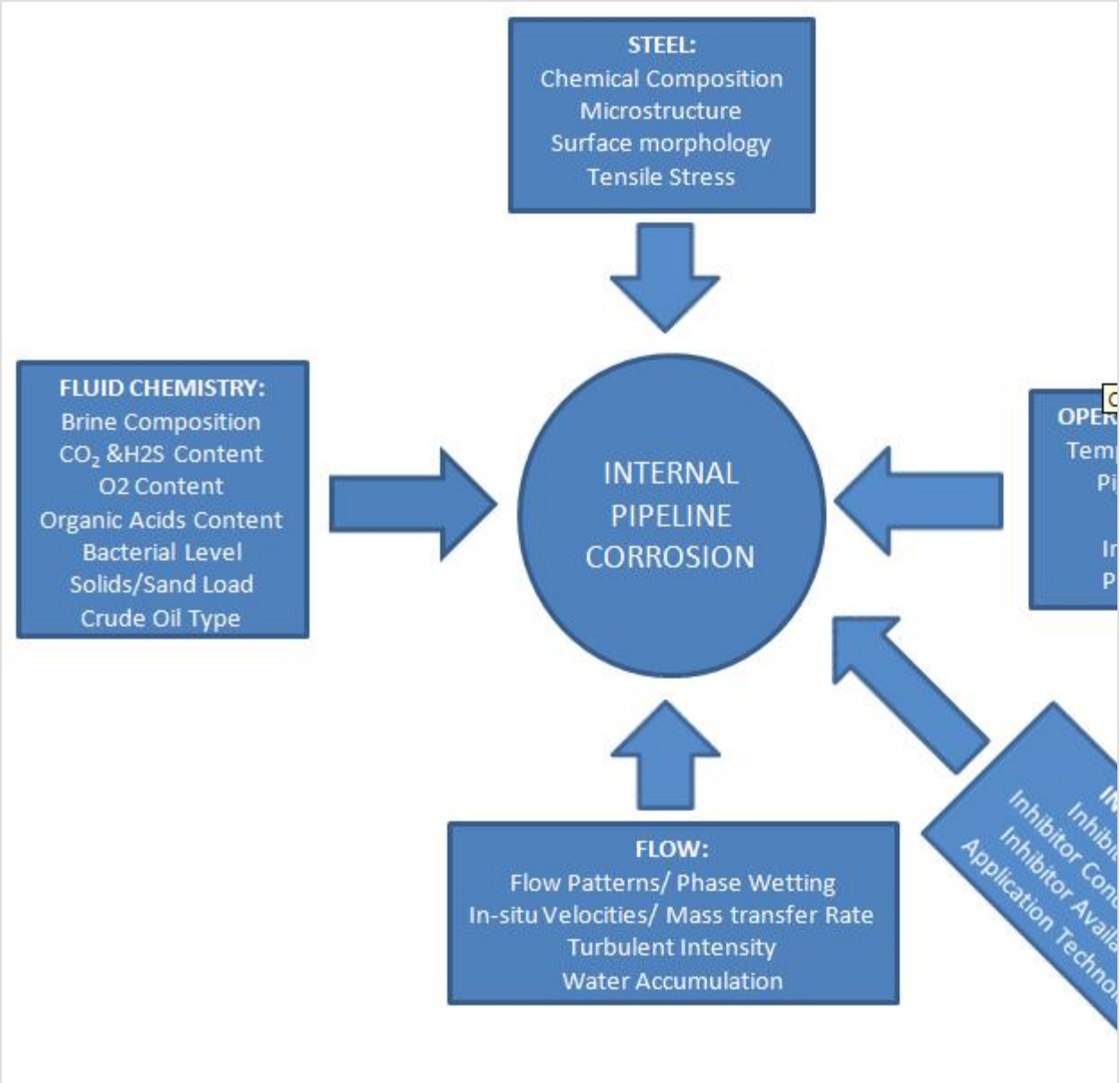

Figure 7: Key Factors Influencing CO2 Corrosion

Methods of Corrosion Control

Coating and Linings: are inert barriers that are placed between the pipe wall and the flowing fluid and are often applied in conjunction with cathodic protection systems to provide the most cost-effective protection.

Cathodic Protection: apply a direct electrical current to counteract the normal external corrosion of a metal pipeline.

Materials Selection: making a selection of corrosion-resistant materials, such as

stainless steel, plastics and special alloys.

Corrosion Inhibitors: are chemicals that are injected into the pipeline that can reduce the pH, act as a barrier, and react with possible oxidizing agents and so on. They extend the life of pipelines and prevent system shutdowns and failures.

Source : http://co2corrosionchem409.wikispaces.com/Background+of+CO2+Corrosion