Journal Of Harmonized Research (JOHR)

Journal Of Harmonized Research in Engineering
3(4), 2015, 145-150

ISSN 2347 – 7393

Original Research Article

A STUDY ON LOSS OF THICKNESS OF CORRODED PIPES DUE TO INTERNAL PRESSURE AND CYCLIC BENDING

Bhawani Shankar Soni, Ashish Kumar Khandelwal

Chouksey Engineering College Bilaspur, India

Abstract - Internal corrosion would not be identified as a threat for any pipeline that could be confirmed to be free of liquid water. However, for the majority of pipelines, the possibility of introducing some water with the supply gas or liquid cannot be ignored, so an evaluation of the threat of internal corrosion would be appropriate. Stress Corrosion Cracking would not be identified as a threat unless the following three conditions are present. It can be maintained by Risk assessment and risk management **(**Hot-dipped tin plating**)** are processes essential to the successful management of pipeline integrity. These processes provide the foundation for prioritizing efforts on the highest risk pipelines and serve as the technical basis for the actions implemented to mitigate the threats to the pipeline. Integrating quality data into the models ensures that the risk models accurately reflect the conditions of and relative risks to the pipeline.

Key Words:-Internal corrosion, pipeline, risk model.

Introduction: As a flexible pipe, ductile iron has several advantages to consider during water and wastewater pipeline designs. Some of these are its thicker wall, availability, and utility and contractor familiarity – provided the correct corrosion control methods are used. As with all metallic pipes, however, failures will occur if corrosion is not adequately addressed. It is just a matter of time.

For Correspondence:
vickysn96@gmail.com
Received on: November 2015
Accepted after revision: November 2015
Downloaded from: www.johronline.com

A wide range of opinions surrounds the need for and methods of corrosion control for ductile iron. The need for tight-bonded coatings, cathodic protection, and the effectiveness of polyethylene encasement is a controversial subject with many differing opinions and numerous references in the corrosion industry.
The fundamental task of a design engineer and corrosion consultant is to provide a constructible project that meets the owner's requirements at the lowest total cost and in compliance with applicable laws and codes. Bid specifications also include supplemental

requirements for materials. Such supplemental requirements (including corrosion control) are common for projects in which large quantities of pipe materials are used. It is common for pipe manufacturers to lobby for and argue against various supplemental requirements that may affect sales of their particular products.

The major issue in the pipeline market is the selection of pipe materials and choice of corrosion control protection methods. Corrosion control costs may be the market difference among different pipe types. As water is becoming a more precious and expensive resource and leak repair costs escalate, the pipeline useful life and reliability is becoming more critical to utilities faced with major rehabilitation of their infrastructure. Therefore the need for and the type of corrosion control selected are becoming more.

The National Association of Corrosion Engineers (NACE) generally agrees on corrosion control procedures for steel and concrete structures and pipelines but there is a full spectrum of opinions on ductile iron and the use of polyethylene encasement. Claims by pipe manufacturers, coating suppliers, and cathodic protection firms are often slanted by their vested interests in selling their products. Since corrosion is time dependent it may take a number of years for corrosion problems to become apparent and correct methods to prove themselves. Corrosion control is therefore part an art, part scientific, and part individual experience. No non-biased independent study has been completed that shows one position is more correct than the other. We must, therefore, draw on our experience in similar environments, not only with ductile iron pipe but also with other buried metallic pipe materials. One of the major challenges in the pipeline market is choosing appropriate corrosion control methods for the different metallic pipe materials that provide equal levels of long-term protection. Since corrosion control costs may represent the market difference between different pipe types, the need for it is widely debated by the different pipe manufacturers for their own and their competitors pipe type. Different types of corrosion are shown in figure.1.

Figure.1 Different types of water pipeline corrosion during water flow.

If a water supply network is exposed to aggressive and harmful environmental conditions, this can induce significant deterioration and compromise its ability to deliver safe water. the "bathtub curve" and describes the lifecycle of a typical buried pipe. It shows the instantaneous probability of failure (hazard function). It is possible to identify three stages in the life of a pipe. The first is called the "burn-in" phase and relates to the period immediately after the installation: here, breaks are usually due to faulty installation or faulty pipes. These interruptions appear gradually and at a declining rate.

In the second phase, the pipe works essentially without problems; there is a low rate of failure caused by random phenomena such as unusually heavy loads and interference of third parties. The final stage is the "wear-out-phase", the last period of the pipe's life, with an increasing failure rate caused by the deterioration and ageing of the pipe. Not all pipes go through all the three phases, and the length of each phase can vary widely between different pipes and in different conditions.

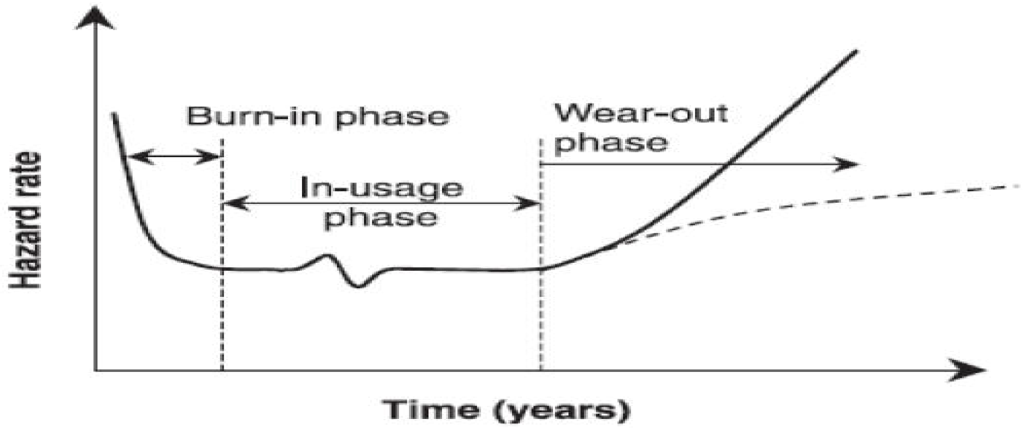

Figure 2 Failure caused by heavy loads and interference of third parties

Objective of Work: The recommended pipes for GFS construction in rural are the polyethylene (PE) plastic pipes.

PE pipe are flexible, present less joints (thus less risk of leaks), and they come in rolls of 50 or 100m, so they are very easy to install, whereas PVC pipes have to be glued together, which can be a tedious task if the network is long. However, it is usually very difficult to find PE pipes and fitting in the shops in rural areas, they often have to be ordered from large towns like Jakarta or Surabaya. On the opposite, PVC pipes and fittings are available almost everywhere, and are usually quite cheap, so the community can maintain their GFS easily after the handover.

Control Pipeline Corrosion during supplying

Four common methods used to control corrosion on pipelines are protective coatings and linings, cathodic protection, materials selection, and inhibitors. Coatings and linings are main tools for defending against corrosion. They are often applied in conjunction with cathodic protection systems to provide the most cost-effective protection for pipelines.

- ❖ Cathodic protection (CP) is a technology that uses direct electrical current to counteract the normal external corrosion of a metal pipeline. CP is used where all or part of a pipeline is buried underground or submerged in water. On new pipelines, CP can help prevent corrosion from starting; on existing pipelines; CP can help stop existing corrosion from getting worse.
- ❖ Materials selection refers to the selection and use of corrosion-resistant materials such as stainless steels, plastics, and special alloys to enhance the life span of a structure such as a pipeline. Materials selection personnel must consider the desired life span of the structure as well as the environment in which the structure will exist. Corrosion inhibitors are substances that, when added to a particular environment

decreases the rate of attack of that environment on a material such as metal or steel reinforced concrete.

- ❖ Corrosion inhibitors can extend the life of pipelines, prevent system shutdowns and failures, and avoid product contamination.

Experimental Procedure: About 245.34g of NaCl was dissolved in 9L of water followed by the addition of 40.94g of anhydrous sodium sulphate to this solution. 200ml of stock solution # 1 which consists of 555.6g/l of MgCl2.6H2O, 57.8g/l of CaCl2 (anhydrous) and 2.1 g/l of SrCl2.6H2O was added to the above solution. To this solution 100ml of stock solution # 2 containing 69.5g/l of KCl, 20.1 g/l of NaHCO3,10 g/l of KBr,2.7 g/l of H3BO3 and 0.3g/l of NaF. Finally the solution was made up to 10 litres. The pH of the solution was adjusted to 8.2 using 0.1NaOH. Throughout the study a constant volume of four litres of test solution was taken. All the solutions were prepared in deionised water. The test media used for the present investigation were

- NaCl solution – 1%, 5%, 15% and 30% concentrations.
- 4 M MEA solutions in NaCl (966ml of MEA+3034ml of NaCl solution of 1,5,15 and 30% concentrations).
- 4 M MEG solutions in NaCl (892ml of MEG+3108ml of NaCl solution of 1,5,15 and 30% concentrations).

Experiments were carried out using the atmospheric Rotating Cage to evaluate the corrosion of all the metals. ASTM standards G170, G184, and G202 provide detailed descriptions of this methodology and a procedure to conduct rotating cage experiments. The experimental setup is shown in Figure and (b). Experiments were performed in a Rotating cage with 4 litres of deareated and pre CO2 saturated NaCl solution. Eight identical coupons of dimensions 7.5 x 1.9 x 0.3cm were supported between two PTFE disks (of 80-mm diameter) mounted 75 mm apart on the stirring rod. After the exposure to the different test media for a specific period of rotation, the metals were washed with water and then rinsed in acetone and dried. The corroded surface of carbon steel I, carbon steel 5LX 42, carbon steel 5LX 60, 304 SS and 314 SS coupons and their polished samples were characterized by inverted metallurgical microscope KOZO optics model XJM 404T.

Discussions: In the present study, a numerical analysis for predicting temperature development for classical problem of fluid flow inside a pipe with constant wall heat flux by solar radiation in which there is leakage of the heat flux to the ambient has been established. The outer surface of the pipeline is exposed to solar radiation and wind stream. The radiation heat exchange with ambient is also taken into account. The effects of exterior surface paint color which represented by emissivity and absorptivity has been studied. The model has been developed to study crude oil flow temperature development along flow direction in an aboveground pipeline. The results of the numerical solution are in good agreement with those of the experimental model of the kharg oil pipeline with off white as envelope color. The results obtained by the model show that the bulk temperature of the fluid and pipe surface along pipe varies exponentially in the direction of tube length. In the limit $x \to \infty$, the bulk temperature and surface temperature of the pipe do not increase unboundedly; rather, they tend to an asymptotic value. Based on the results which indicated significantly of exterior surface paint color, one should choose the paint color by considering its effects on temperature development. For increasing fluid temperature, the paint color that has high absorptivity and low emissivity should be used and for lower growing or constant temperature objective the paint color that has low absorptivity and high emissivity could be proposed.

Cost Analysis: Water supply organizations should adopt network design and operating strategies that prioritize issues closely linked to water supply hygiene. In particular, such strategies should specify how the organization would:

- ❖ Identify and prevent low pressures, especially negative pressures, in the system;
- ❖ Prevent pressure surges in the network;
- ❖ Design the network to minimize the risks of contamination during

- Operational activities and to avoid water stagnation;
- Design and operate service reservoirs to avoid contamination by ingress and to avoid stagnation;
- Control disinfectant residuals in distribution systems;
- Assess the effect of different supplies entering the network, determine the benefits and problems of zoning the network;
- Select construction materials that do not promote microbial growth;
- Prevent cross-connections and backflow.

The cost of aluminium alloy coating inside the pipe costing as shown in fig 3 in this case costing of aluminium are shown for both purpose regarding their length and diameter. The cost choosen above the base line will be more beneficially for long duration. The cost analysis will be made by internationally.

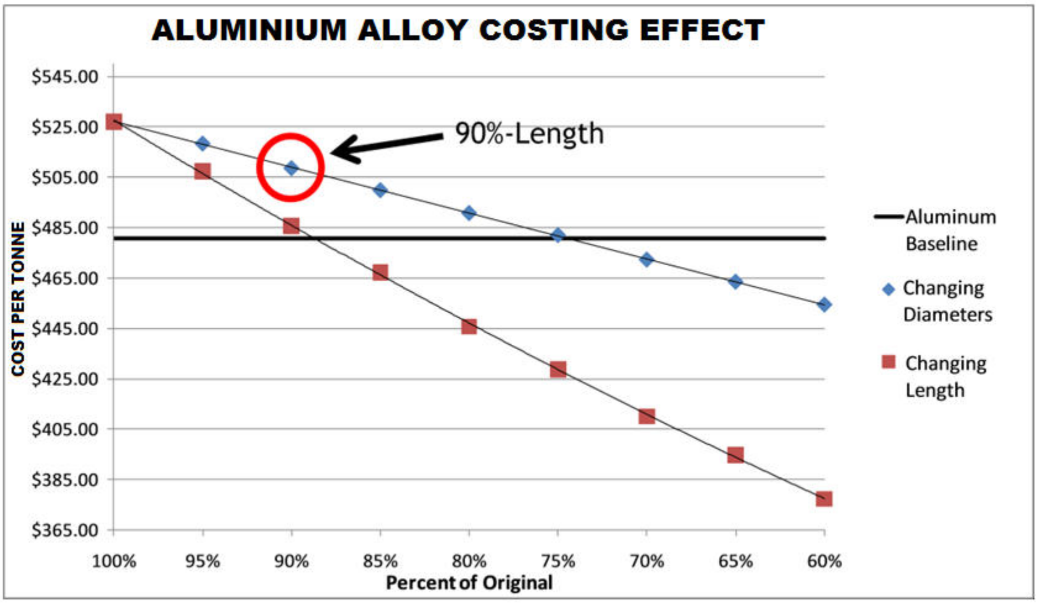

Fig 3 Cost of Aluminium Alloy

Conclusions: Based upon the results obtained, it could be concluded that the crude water pipeline failed due to a combination of MIC and chemical corrosion, the former corrosion type being the predominant contributor. Sulphate reducing bacteria is responsible for MIC, which becomes severe in the presence of low flow and high water cut conditions that prevailed in the pipeline.. The cost basis of a new structural-coating model for calculating and predicting the discharge on 20 inch diameter with aluminium alloy has been recommended for high and super high discharge pressures have been proposed.

References

[1]. Dávid Széplaky, Zsolt Vaszi, Augustin Varga, Effect Of Temperature Distribution Around Pipelines For Transportation Of Natural Gas On Environment, The Holistic Approach to Environment 3(2013)1, 33-40, ISSN 1848-0071.

[2]. Andrzej J. Osiadacz, MaciejChaczykowski , "Comparison of isothermal and non-isothermal pipeline gas flow models" Chemical Engineering JournalVolume 81, Issues 1–3, 1 January 2001, Pages 41–51

[3]. Loganayaki, N., Rajendrakumaran, D. and Manian, S "Antioxidant capacity and phenolic content of different solvent extracts from banana (Musa paradisiaca) and mustai (Riveahypocrateriformis)", Food Sci. Technol., Vol.19, No.5, pp.1251–1258, 2010.

[4]. Venkatesan, P., Anand, B. and Matheswaran, P. "Influence of Formazan derivatives on corrosion inhibition of mild steel in hydrochloric

acid medium", E. J. Chem., Vol.6, No.1, pp.438-444, 2009.

[5]. Lebrini, M., Robert, F., Lecante, A. and Roos, C. "Corrosion inhibition of C38 steel in 1M hydrochloric medium by alkaloids extract from Oxandraasbeckii plant", Corros. Sci., Vol.53, No.2, pp.687-695, 2011.

[6]. Ghanbari, A., Attar, M. M. and Mahdavian, M. "Acetylacetonate complexes as new corrosion inhibitors in phosphoric acid media: Inhibition and synergism study", Prog. Color Colorants Coat, Vol.2, pp.115-122, 2009.

[7]. Forster, M., Rodriguez, E., Martin, J. D. and Romero, C. D. "Distribution of Nutrients in edible Banana pulp", Food Technol. Biotechnol., Vol.41, No.2, pp.167-171, 2003

[8]. Chen Y., Wang X.H., Li J., Lu J.L., and Wang F.S., (July 2007), Corrosion Science, 49, 7, pp 3052-3063.