JCSE The Journal of Corrosion Science and Engineering
ISSN 1466-8858 Volume 14, Preprint 9 submitted 16 March 2011

Control of Corrosion in gas pipeline

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Abstract

Nowadays, pipeline is the most important transportation artery and the researches indicate the pipeline will be the most security for energy transmission to over fifty years and this is more significance for petrochemical, oil and gas industries.

The large part of chemical fluids, especially natural gas, transmit with pipelines. this pipelines are made by large pipes that they can bear high pressure about several thousand kg/cm^3. the gas pressure obtains by high pressure station in long distance. due to significance functions of gas pipelines, they have to be safe. but unfortunately, increasing utilization of aging pipelines in operation, increases probability of occurrences. the most significance cause of making this occurrences, is internal and external corrosion that is very effective in damaging of gas pipelines and maybe it decreases safety. so, for controlling of corrosion in gas pipelines, it have to use inspection of gas pipelines and then get decision.

In this paper, is investigated the corrosion of gas pipelines and then protection of them.

Key words: gas pipeline; corrosion; inspection

1. Introduction

One of the gas pipeline threats is corrosion. researches indicate corrosion is the most significance damaging mechanism of pipeline and it is effective on the pipeline security and integrity in long time, so it always needs continuous inspection.

also, one of the reasons for making leakage is external corrosion of surface pipeline. notwithstanding all of gas pipelines protect with cathodic protection but is seen different reasons for damaging of pipeline, such as using unsuitable coating, leakage in coating, defects in cathodic protection system and making cracks. also mechanical ingredient, such as earthquake, slip earth and mechanical damage, can make leakage in gas pipeline locally. so it is possible that pipeline leaks and injures to environment, people life and economy [1].

1.1. Corrosion as one of the most important threats in gas pipeline

Corrosion is an electrochemical process. It is a time dependent mechanism and depends to the local environment on the pipeline. Corrosion usual appears as general corrosion or localized corrosion (especially pitting). moreover, There are many different types of corrosion on the pipeline, such as galvanic corrosion, microbiologically induced corrosion, AC corrosion and etc. Fig (1) is showed types of corrosion in gas pipelines.

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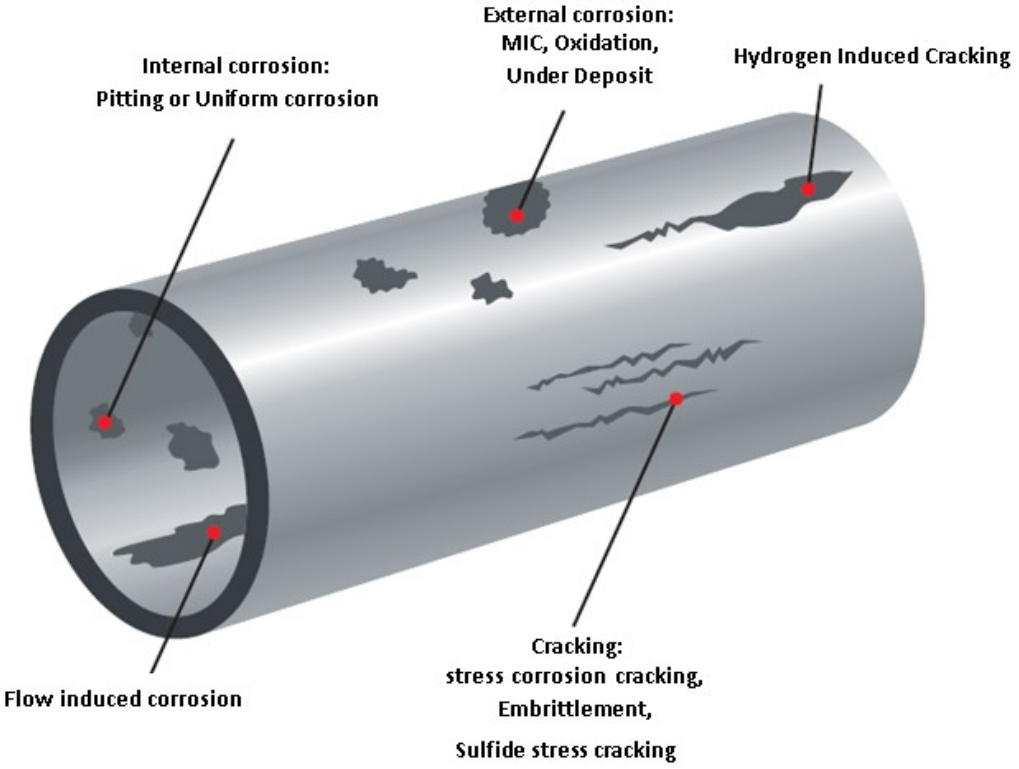

Fig. 1. types of corrosion in pipeline

Corrosion causes metal loss. It can occur on the internal or external surfaces of the pipes[2]. corrosion usually occur in high stress points, such as welding points, seams, high affected zone (HAZ) and etc. also environmental corrosion such as stress corrosion cracking (SCC) and hydrogen induced cracking (HIC) can damage pipeline. Corrosion in a pipeline may be difficult to characterize. Typically, it will have an irregular depth profile and extend to irregular pattern in both longitudinal and circumferential directions (as illustrated in fig (2)). of course, operators of pipeline use especial equipment for corrosion assessment, the most important them is intelligent pigs[3].

JCSE The Journal of Corrosion Science and Engineering
ISSN 1466 8858 Volume 14, Preprint 9 submitted 16 March 2011

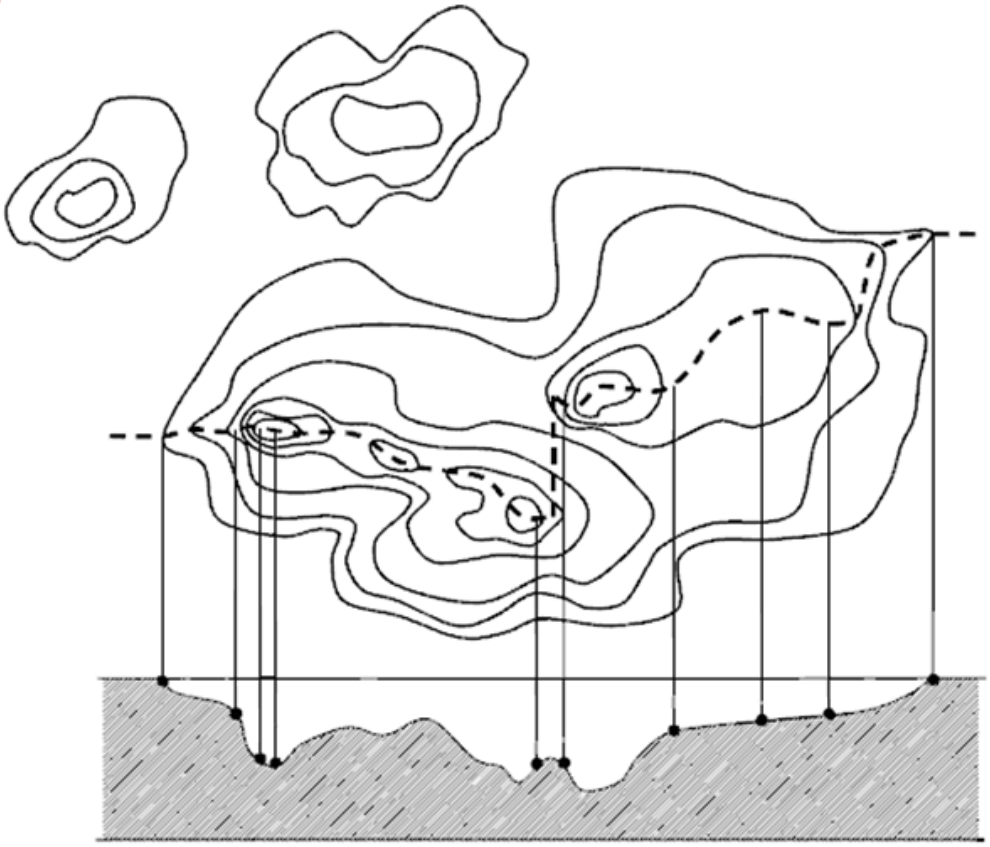

Fig. 2. The irregular length, width and depth of a typical corrosion defect[3].

nowadays, monitoring process is very important in industrial usages and designs, that it is affected from economical and technical effects. so, if corrosion does not control, can be have intense results. thus, transmission of multiphase fluids need good monitoring because it has more corrosion[4].

1.2. Methods for controlling of corrosion

According to the researches, there are several methods for control of corrosion before operation of gas pipelines that it is according to the following methods:

1- using coatings

2- cathodic protection

because of coatings do not have 100% output, so it needs to have a system for protection of corrosion. this system is cathodic protection, it can protect pipelines from corrosion or it can decrease rate of corrosion.

for protection of corrosion, pipelines inspect and but nowadays there is a method for inspection of gas pipeline, it is pigging. nowadays there are many companies that do pigging.

A pig is a device inserted into a pipeline which travels freely through it, driven by the product flow to do a specific task within the pipeline. These tasks fall into a number of different areas:

(a) Utility pigs which perform a function such as cleaning, separating products in-line or dewatering the line;

(b) In-line inspection pigs which are used to provide information on the condition of the pipeline and the extent and location of any problem (such as corrosion);

ISSN 1466-8858 Volume 14, Preprint 9 submitted 16 March 2011

(c) special duty pigs such as plugs for isolating pipelines[2].

The main inspection methods that are used are MFL (Magnetic Flux Leakage) and UT (Ultrasonics). MFL is an inferred method where a strong magnetic flux is induced into the pipeline wall. then Sensors pick up any leakage of this flux and the extent of this leakage indicates a flaw in the pipe wall. For instance, internal material loss in the line will cause flux leakage that will be picked up by the sensors. Defect libraries are built up to distinguish one defect from another[5]. components of MFL device is showed in fig(3).

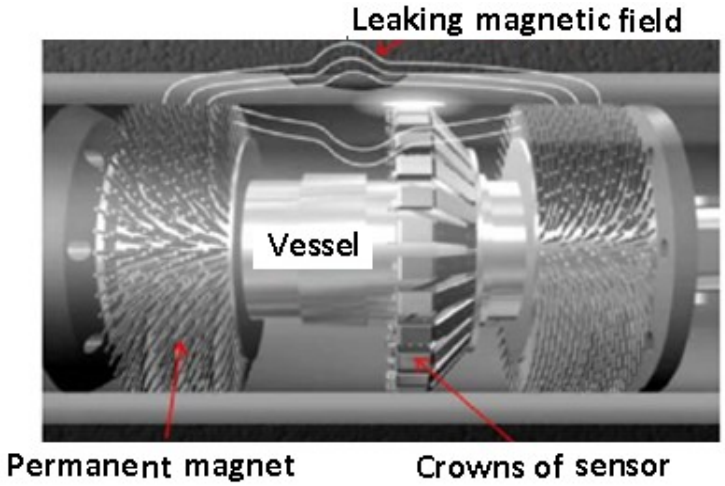

Fig. 3. components of MFL [6]

Ultrasonic inspection is a direct measurement of the thickness of the pipe wall. A transducer emits a pulse of ultrasonic sound that travels at a known speed. The time taken for the echo to return to the sensor is a measurement of the thickness of the pipe wall. this technique needs a liquid through which the pulse can travel. The presence of any gas will affect the output[2].

2. Corrosion management

Corrosion management is the activities that use in working for a system that corrosion is controlled, equipments are corroded with corrosion, maintenance and other equipments are been useless with corrosion, replacement.

maintenance activities use for returning damaged equipments to primary state. this activities are applicable during longevity of facilities and equipments. maintenance and inspection plans regulate periodically and implement in annually plans. in fact, the objective of corrosion management is indicating a regulation plan for corrosion monitoring and then preventing and controlling of corrosion.

in the oil and gas industry, is tried to decreasing cost and increasing safety and standard and it is caused improvement of monitoring corrosion[4].

3. Results and discussion

It is increasing transmission gas pipeline every day and this pipeline have to transport one of the most dangerous fluids, it is natural gas. also, it is better that pipeline be safety. also due to corrosion is the most significance threats for pipeline, it have to prevent and control. thus, in transmission gas pipeline use cathodic protection systems and continuous monitoring for control of corrosion to

ISSN 1466-8858 Volume 14, Preprint 9 submitted 16 March 2011

management corrosion. but sometimes, even with using cathodic protection, corrosion occures and so it should inspect and one of the most important tools for inspection is pigging.
with pigging can appoint corrosion and its sites.

References

[1] J.B. Choi, B.K. Goo, J.C. Kim, Y.J. Kim , W.S. Kim, Development of limit load solutions for corroded gas pipelines, International Journal of Pressure Vessels and Piping, 2003, 121–128

[2] Hossam A. Kishawy, Hossam A. Gabbar, Review of Pipeline Integrity Management Practices International Journal of Pressure Vessels and Piping, 2010

[3] A. Cosham, P. Hopkins, K.A. Macdonald, Best practice for the assessment of defects in pipelines – Corrosion, Engineering Failure Analysis, 2007, 1245–1265

[4] H. Bouazaze, F. Huet, R.P. Nogueira, A new approach for monitoring corrosion and flow characteristics in oil/brine mixtures, Electrochimica Acta, 2005, 2081–2090

[5] A One-day seminar on pipeline pigging meeting the challenges of pipeline pigging, presented by the PIGGING PRODUCTS & SERVICES ASSOCIATION, UK, 17th November 2010

[6] N.B.S. Gloria, M.C.L.Areiza, I.V.J.Miranda, J.M.A.Rebello, Development of a magnetic sensor for detection and sizing of internal pipeline corrosion defects, NDT&E International, 2009, 669–677