

From: Khalil- CORTEC ME <kabed@cortec-me.com>
Sent: Wednesday, August 28, 2013 9:45 PM
To: Andijani, Ismaeel N.
Subject: Why we should protect ASTs against soil side corrosion of bottom plates
Attachments: 10043 - Final Paper on Evaluation of the Tank Bottom Corrosion and CP Ef....pdf; 651 _Ed3_with_highlighted_changes_final.pdf; 2242 Mitigating Soil-Side Corrosion on Crude Oil Tank Bottoms Using Vol....pdf

Dear Dr. Isamaeel,

❖ **The need for a protection method**

Corrosion of AST bottoms is attributed to many reasons, such as; corrosive soil, ingress of moisture and corrosive elements into the under-tank environment, air gaps between the bottom plates and the cushion pad, differential aeration, stray current and galvanic corrosion. The use of Asphaltic layer is proved to have counter effect in the prevention of soil side corrosion of AST bottoms due to various reasons such as accelerating pitting and trapping moisture.

Tank owners always seek adequate corrosion prevention of AST bottoms due to several reasons, such as; repair and inspection costs, production down-time, product loss, clean-up costs, regulation penalty costs, extending service life of the tank, prevention of environmental pollution.

❖ **Available protection method**

Historically speaking, Cathodic protection has been perceived as the only effective way to protect AST bottoms from soil-side corrosion, but recently a number of technical articles questioned the effectiveness and future of this method in providing the anticipated protection. For more information, please find attached the below paper from Aramco and API 651 code:

1. **“Evaluation of the Tank Bottom Corrosion and CP Effectiveness at Saudi Aramco Crude Oil Tank Farm”.**
The paper highlights the inevitable reason for the malfunctioning of CP in some areas of the tank bottom, which is the gaps between the bottom plates and the sand due to foundation settlement, high density repair patches and the filling-refilling cycles. Other reasons also thought to exacerbate soil side corrosion are; the use of the oily sand and ingress of moisture/water from the periphery of the tank. The use of Vapor phase Corrosion Inhibitors is one of the recommendations in this paper.
2. According to **API 651**, cathodic protection is not considered an effective way to combat corrosion in the presence of asphalt cushion, especially if deteriorated, as it may shield the cathodic protection current. Cortec technology provides protection irrespective of the pad material. When a VPCI output is released within an AST interstitial space, protective vapors disseminate and migrate to the metal and replace moisture and corrosive elements without the need to be in direct contact with tank bottom.

❖ **Alternative protection method**

Cortec Corrologic technology that is based on the use of Vapor phase Corrosion inhibitors (VpCI®) is cost effective and practical. It can be applied on CP protected and unprotected new tanks, in-service tanks and also out of service tanks. We also have design solutions for the tanks that have oily/bituminous sand and asphalt pad beneath the floors and can innovate different systems as needed . Our Corrosion Engineering and Field services

(CEFS) team has a long history and strong track record in successfully implementing this technology in the united states for more than 300 tanks and more recently in the Middle East. Our Technology is comprehensive and includes a system for introducing the VpCI®, a system for monitoring the corrosion rate and a system for future replenishment, when needed. Please find below a technical paper from Aramco on the effectiveness of the using Cortec Corrologic technology in providing protection against soil side corrosion of bottom plates:

1. **“Mitigating Soil-Side Corrosion on Crude Oil Tank Bottoms Using Volatile Corrosion Inhibitors”**. This Nace paper, describes a pilot project that was conducted in 2011 on an aboveground storage tank (AST) at Saudi Aramco crude oil tank farm. This project was designed to evaluate the procedures for application of volatile corrosion inhibitor VpCI® beneath selected areas of the tank floor and then evaluate the effectiveness of the VpCI® in reducing the corrosiveness of the environment under the tank floor.

Should you have questions or require further clarification, please don't hesitate to contact me

Looking forward to getting your recommendation for our system

Regards,

Khalil Abed

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