

Corrosion Management Learnings for Storage Tanks

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ABSTRACT

Historical inspections of atmospheric storage tanks in a major onshore Oil and Gas terminal identified underside floor corrosion. Investigations suggested that the corrosion was likely caused by a number of factors, namely, issues with the cathodic protection (CP) system and water ingress. Based on previous experience gained from atmospheric storage tanks inspection of similar design, a decision was taken to act on this matter.

The intent of this paper is to share learnings and observations on how potential damages were flagged, repaired and/or mitigated, including improvements made at site to ensure repeat issues do not occur, maintenance costs are reduced, and reliability is maintained for long-term utilization

Key words: tanks, cathodic protection, voids, subsidence, vapor corrosion inhibitor (VCI)

INTRODUCTION

The terminal is subdivided for Oil, Gas and Produced Water plants. Each of these plants has number of storage tanks. The age of the tanks varies between 15-25 years. The products held within these tanks varies, from crude oil, condensate, produced water, potable water, to off spec oil and diesel fuel.

Most of the tanks within the facility have a similar CP arrangement and design. Each tank base is protected by an impressed current grid mesh anode buried in compacted, clean, sand backfill beneath the tank base and is powered by a transformer-rectifier placed outside the bund wall or within an electrical switch room. Permanent reference electrodes are installed beneath all tank bases to enable

accurate potential measurements. Reference electrodes vary from Copper/Copper Sulphate, Silver/Silver Chloride to Zinc.

CORROSION CHALLENGES

The general goal of the facility's Tank Corrosion Management program is to identify corrosion threats, define and implement appropriate corrosion control measures, assess performance, and maintain barrier effectiveness. Through execution of the program, inspections revealed underside floor corrosion on many of the tanks. Investigations suggested that the corrosion was likely caused by a number of factors, namely issues with the CP system and water ingress.

Based on previous experience from tank inspections along with inspections performed for storage tanks (Internal Robotic, Acoustic Emission and Medium Guided Wave UT) underside floor corrosion has been defined as the predominant contributing factor. Fitness for Service assessments for the tanks across the facility have been done using minimum recorded thicknesses and a worst-case scenario corrosion rate of 1.5 mm/year has been calculated based on these inspections.

Tank A- Material loss has been noted during the analysis of the data. A minimum thickness of 5.2mm has been recorded. No liner damage was recorded, and all thickness variations were from the soil side of the tank floor plate (Figure 1).

Tank B- It has been detected 0% to 42% wall loss against a nominal thickness of 9.0mm. A minimum thickness of 5.3mm has been noted iThe following figure each run and their minimum remaining wall thickness. (Figure 2).

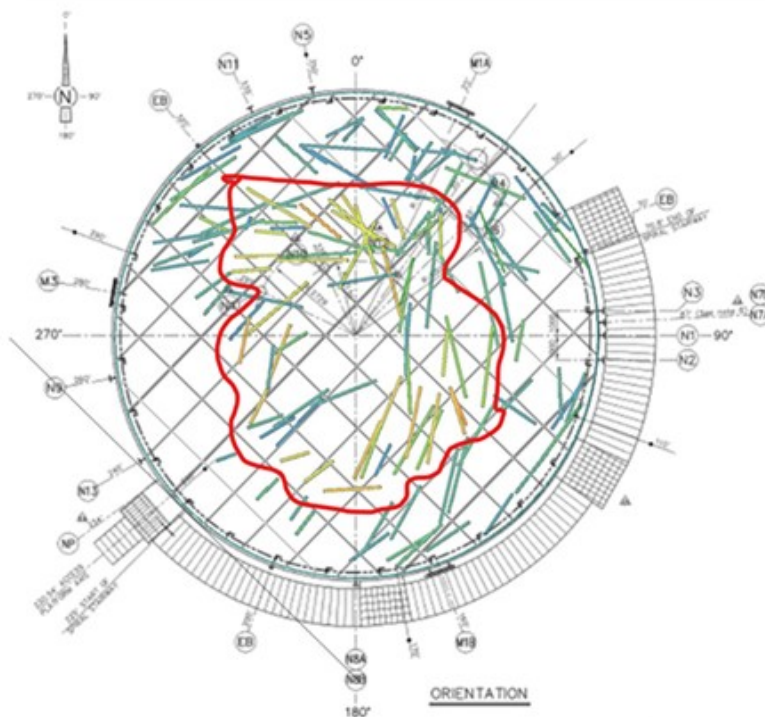


Figure 1: Tank “A” 0%-42% metal loss (minimum remained thickness 5.2mm out from nominal 9mm) from soil side (highlighted in red corroded area)

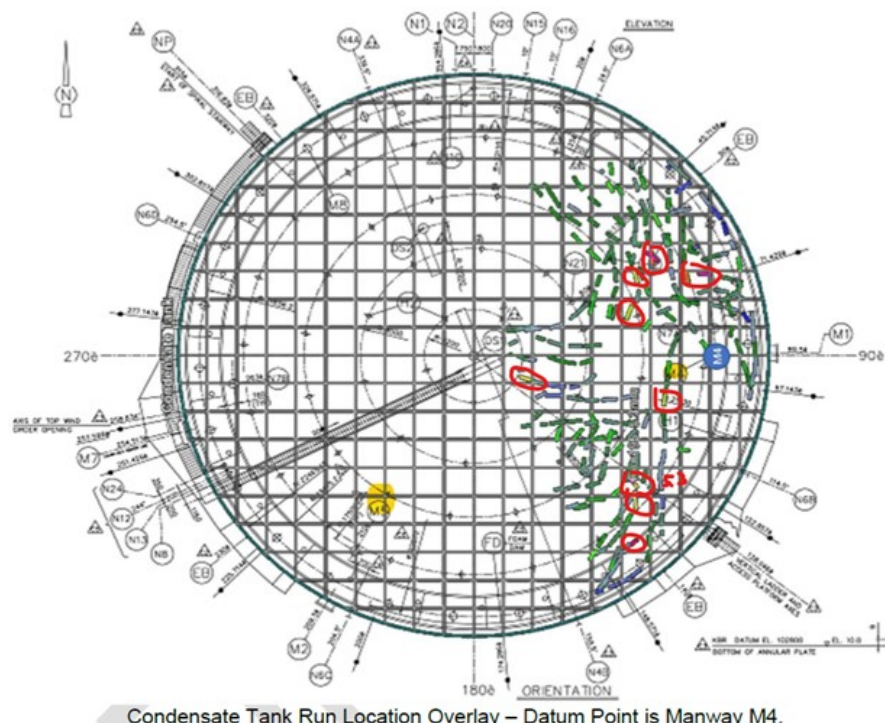


Figure 2: Tank “B” 0%-41% metal loss (minimum remained thickness 5.3mm out from nominal 9mm) from soil side (highlighted in red corroded area)

Tank “C” is a 21-meter nominal diameter, 8 strakes, fixed dome self-supporting tank, commissioned in mid-2000s and built under API⁽¹⁾ 620 standards (Figure 3).¹ The tank is internally and externally coated and installed on a concrete ring within boundary area. External corrosion cathodic protection was ensured by under floor grid type impressed current. Inspection and assessment were carried out in accordance with the requirements of the API⁽¹⁾ 653 standards,² and API⁽¹⁾ RP 575 standards³.

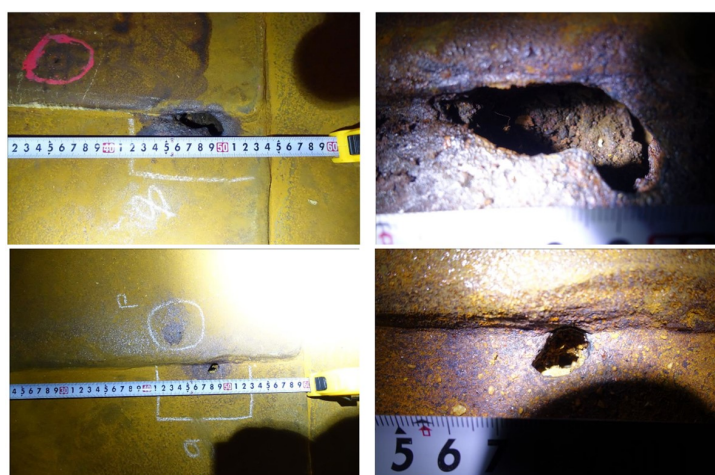


Figure 3: Example of corroded areas (perforations)- Tank “C”

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