CHAPTER 11: SOIL CORROSION

Read Chapter 11: SOIL CORROSION. Then answer the questions at the end of the chapter

DEFINITION: Soil corrosion is the corrosion of metals from exposure to soils. The soil contains the electrolyte. It affects Carbon steel, cast iron, and ductile iron.

Common morphology: external thinning with a roughened surface and localized deeper attack or pitting.

PICTURE 17. SOIL CORROSION IN THE INTERFACE OF BURIED PIPE

INTERFACES

Soils with high acidity, high moisture, and high dissolved salt are the most corrosive. Soil-to-air interface areas are susceptible to corrosion because of moisture and oxygen availability. (Figure 64)

To estimate soil corrosivity, soil resistivity tests are used; however, they can produce widely variable results within a single site.

COATING

A Coating in poor condition can lead to soil corrosion. A damaged coating in a pipeline will be detected using DCVG or PCM analysis

TEMPERATURE

Corrosion rates increase with increasing metal temperature.

SOIL CORROSION VARIABLES

Soil corrosivity is dependent on many variables. Some of them are: operating temperature, moisture and oxygen availability, soil resistivity, soil type and homogeneity, cathodic protection, stray current drainage, and coating type, age, and condition. g) Other factors that affect soil corrosion include galvanic corrosion, dissimilar soils, stray currents, differential aeration corrosion cells, and MIC.

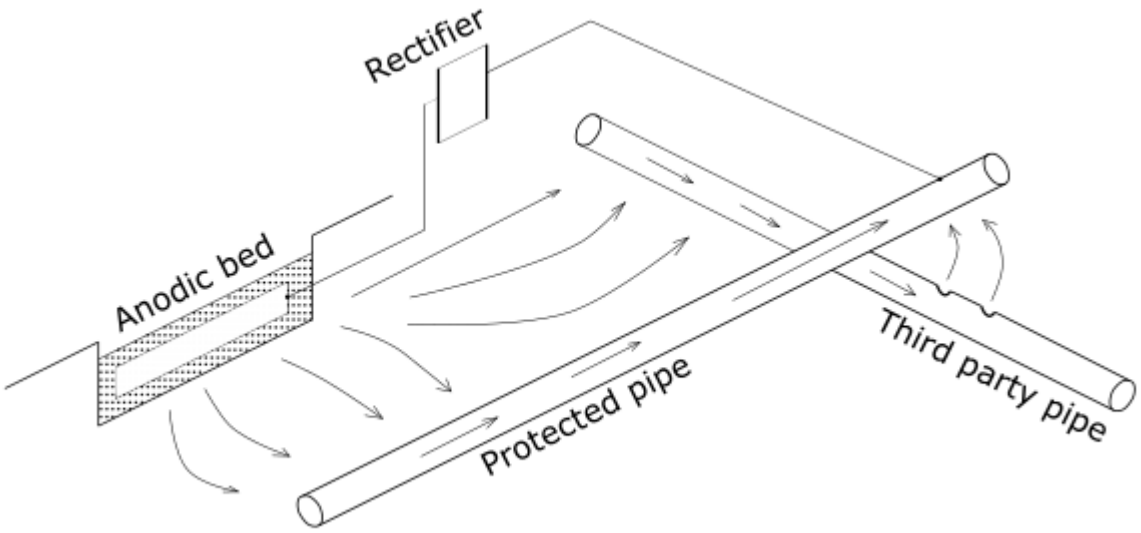
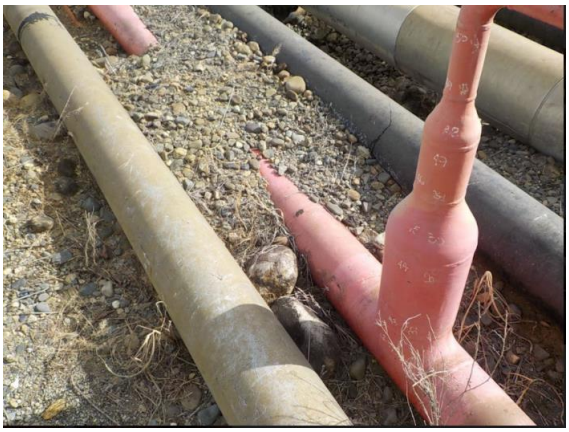


FIGURE 18 STRAY CURRENTS IN PIPES

AFFECTED UNITS OR EQUIPMENT

Underground piping and equipment. The bottoms of aboveground storage tanks. Ground supported metal structures. Piping running close to the ground under which soil has accumulated over the years to the point of reaching and contacting or partially covering the pipe. Piping exiting road or other crossings where soil has sloughed off and is laying on or covering the pipe.



PICTURE 18 SOIL THAT HAS ACCUMULATED OVER A PIPE

PICTURE 19. THIS PIPE LOOKS GOOD FROM A DISTANCE, BUT THERE IS SEVERE SOIL CORROSION UPON FURTHER EXAMINATION

PICTURE 20. SEVERE SOIL CORROSION IN A BURIED PIPE IN A PROCESSING FACILITY

PICTURE 21 TEMPORARY FIX IN A LEAK RESULTING FROM SOIL CORROSION

PREVENTION MITIGATION

The most effective protection against soil corrosion is a combination of a corrosion-resistant coating and a cathodic protection system. The use of a backfill that doesn´t contain rocks is also indispensable. In the bottom of a tank, however, adjusting the CP value of current when there is a coating can be a little tricky.

PICTURE 22. THE USE OF A BARRIER PREVENTING WATER INGRESS OR A VCI SYSTEM CAN HELP REDUCE SOIL CORROSION IN TANKS

INSPECTION AND MONITORING

The following techniques can be used for inspecting equipment for soil corrosion:

-An aboveground visual survey over the pipe´s right of way can identify leaks coming to the surface of the soil.

-The use of pigging devices employing UT or MFL will help in the detection of dents, flaws, and corrosion.

- A close-interval potential survey on a cathodically protected line may be used to verify that a buried piping has a protective potential throughout its length. This technique may be used as a screening tool for follow-up inspection.

- DCVG (direct current voltage gradient) is a technique used to locate coating defects on coated pipes that can be performed on newly coated pipe before being buried, in buried pipe or on pipe that has been excavated.

- Visual inspection of the pipe or equipment coating after excavation is the most reliable method to determine its condition.

In pipes that change from air to soil, the soil should be removed down to about 12 in. (305 mm) below the surface to expose the most corrosion-prone area for inspection.

PICTURE 23. INTERFACES SHOULD BE EXCAVATED 12 IN. (305 MM) BELOW THE SURFACE TO EXPOSE THE MOST CORROSION-PRONE AREA

GWT can be used as a screening tool for metal loss detection on buried piping. Pressure testing, on the other hand, can determine whether buried equipment is leaking at that particular time but does not provide information concerning the degree of corrosion on the equipment.

Lately, a combination of UT techniques and big data analysis is being used to assess the condition of a tank´s bottom while it is in service, acquiring large amount of high density data and applying analysis algorithms.

PICTURE 24. A INTERPHASE CORRODING IN A POTABLE WATER TREATMENT SYSTEM

QUESTIONS FOR CHAPTER 11: SOIL CORROSION

1. Tell some of the variables that affect soil corrosion?

2. How deep do you have to inspect an interface?

3. What effect has rock under a tank bottom?

4. What´s the best defense against soil corrosion in a tank bottom?