

Investigation and Prevention on Corrosion Fatigue of Low Alloy Steel in Ultra-High Pressure Intercooler

Jatuporn Kaew-on^{a,*}, Pongpat Lortrakul^a and Pornchai Jamawatr^a

^aRayong Engineering and Plant Service Company, Rayong, 21150, Thailand

**jatupoka@scg.com*

Keywords: Crevice corrosion, Corrosion fatigue, Chemical cleaning

Crevice corrosion occurs randomly at intercooler stagnant area where high pressure low-alloy-steel pipe is connected to another jacketed pipe by screw thread under cooling water treatment environment. Pits are initiated and their growth are driven by oxygen concentration cell. Pitting corrosion elevates stress concentration overtime. Furthermore, high cyclic load from reciprocating compressor introduces fatigue crack at pit tips; and subsequently cracks propagate thoroughly pipe wall thickness where it resulted to gas leaks; in which leading to an emergency shutdown. This whole mechanism takes 14 years with silent warning. In this paper, systematic root cause analysis is performed. Fracture surface is analyzed by optical microscope (OM) and scanning electron microscope (SEM) revealing evidence of corrosion fatigue. Ferroxyl indicator mock-up test illustrates oxygen concentration cell. Chemical cleaning and passivation should be applied to clean the pipe and to build the passivation film on the metal surface. Both copper cladding on high pressure pipe and shrink fit-up flange are new proposed design to double its lifetime with greater life cycle cost (LCC).