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An overview of the localized corrosion problems in seawater desalination plants — Some recent case studies

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ABSTRACT

Uniform corrosion, localized corrosion (pitting and crevice corrosion), cavitation, stress corrosion cracking, corrosion and mechanical fatigue, galvanic corrosion, dealloying, etc., are the common types of corrosion by which materials in desalination plants are subject to deterioration. Carbon steel, austenitic stainless steels, cupronickel alloys and titanium are prevalent materials in a modern day desalination plant. However, the majority of the failures in multistage flash (MSF) and seawater reverse osmosis (SWRO) plants have been attributed to localized attack. Localized attack in the form of pitting and/or crevice corrosion arise due to stagnation of chloride containing water, CO_2 attack, presence of internal stresses, weld defect, foreign material carryover, mismatch of the material, etc. Flash chamber, pipelines, pumps, valves, heat exchanger, demister, storage tanks, intake system and power generating ancillary units may be affected by local attack. Right selection of material, skillful control of environmental conditions and thoughtful design can create the situation ideal for proper operation of the plant. In recent years, introduction of new materials such as high alloy stainless steels, metal matrix ceramic/plastic composite and polymer coatings has resulted in lowering down the cases of failure due to local attack and thus increasing the efficiency of plant. This paper presents an overview of the localized corrosion problems arising in different components of desalination plants with particular emphasis on the need of applying new materials which would likely restrict the damage due to corrosion. Also, some recent case studies during the last decade are cited covering the highlights of the problem, causes, mechanism and recommendations. The selected case studies include corrosion of flash chamber bottom plates, failure of micron cartridge filter in a SWRO plant, duplex steel bolt failures in a desal pump, failure of bottom plate of a potable water tank, failure of a cement-mortar internally lined water transmission pipeline, premature failure of repainted epoxy coating on the internal bottom plate of a fuel oil tank, failure of a high pressure pump motor bearing oil cooler, leakages in the weldments of a brine rejection pipe in a SWRO plant, failure of a water transmission line and shearing of a shaft in a brine recycle pump.

Keywords: Localized corrosion; Seawater; Desalination plant

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