

# Corrosion Management and Failure Cases Study in Offshore Oil and Gas Production

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Offshore Oil and Gas Production has unique corrosion failure due to different environments compared to other industries. All offshore platforms are facing to marine environment which is subjected to severe corrosion. Corrosion management for offshore oil and gas production facilities can be separated into topside, splash zone and submerge zone due to different fluid that facilities are exposed to both internally and externally.

Corrosion control in offshore gas production can be principally divided into that during design stage and during production stage.

In the design stage, design of corrosion protection involve corrosion evaluation and material selection, along with design for corrosion mitigation and monitoring. Following process design, production streams and equipment of each stream is specified. Then, corrosion assessment for the facilities can be identified. Corrosion rates are typically assessed for Carbon Steel as based cases. Required corrosion allowances are identified. If such allowances are more than 6 mm for topside equipment, corrosion resistance alloys will be selected. Mitigation is specified to control corrosion to be within design, along with specified monitoring methodologies and tools. Corrosion specification is issued to EPCI phase for material purchase, construction, installation and commissioning. Finally, corrosion control is transferred to production stage.

For example, with a specific fluid stream, corrosion rate for carbon steel sealine can be very high. Hence, corrosion mitigation by continuous corrosion inhibitor injection is required. To assess inhibitor efficiency, corrosion probe is installed. Intelligent pigging shall be performed regularly to identify metal loss in a pipeline. Frequency of the pigging depends on corrosion severity in each pipeline. During commissioning, corrosion control is vital. Corrosion inhibitor injection pumps, corrosion probe reading, cathodic protection system shall be functioned properly. Baseline pipe thickness by pigging operation is recommended within one year after first gas in the sealine.

During production stage, corrosion management is performed in accordance with company general specifications which are consist of corrosion monitoring, corrosion assessment, corrosion mitigation by chemical treatment. Corrosion monitoring is to be executed as determined in the design stage and/or per specifications. Monitoring results and inspection results are integrated to indicate the corrosion rates and corrosion control performance. Adjustment may be required in case design or current control is not sufficient due to e.g. too high corrosion rates, other mechanisms detected or change of production conditions. Change in such corrosion control shall be done via manage of change in company system for systematic tracking and management.

For examples, for the same sealine after put in operation, corrosion probe reading and residual inhibitor and Fe ion sampling is to be conducted every 3-12 months. Pigging is to be conducted every 3-5 years. Results of such monitoring are to be evaluated against production/operation conditions to assess if the current corrosion control is within designed and/or specification. Adjustment on injection rate may be required – this can be higher or lower depending. In addition, biocide injection and H<sub>2</sub>S scavenger may be required if it is later found that there is bacteria and H<sub>2</sub>S being generated.

Although corrosion is well managed, some failure can be unforeseen as it is unique for offshore oil and gas operation. These failure cases are lesson learn for improvement in the next platform design and operation. Some of failure cases in oil and gas operation and its mitigation will be also presented.