



iGEM 2017
CMU | Qatar

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Interviewer: Dina Nayel Altarawneh

Interviewee: Taher Al Kilani, Chemical and Corrosion Engineer
Occidental Petroleum (Oxy) of Qatar

1. Job title, experience and nature of work

Taher Alkilani, oil and gas professional with 21 years experience in process, production, corrosion & scale. Taher is an expert in corrosion control; in depth hands-on experience in Microbial Induced Corrosion (MIC) monitoring and control, pipelines integrity management, well completion integrity management, failure analysis and materials selection.

2. What is the process of oil extraction in Doha?

Oil is extracted from subsea wells. A process called oil sweeping is used to extract the remaining oil. This process involved pumping sea water into the well from different direction, and based on the fact that water is denser than oil, the remainnig oil is 'swept' up into the pipeline and extracted to be putified later.

The oil and water separation happens at high temperatures, this is because low temperatures minizes separation based on different densities.

Pipelines are Subsurface and carry carry mixed fluids, therefore, to get crude (pure) oil:

- Dewatering: this is the removal of water
- Degasing: removal of gases, which can be used as gas lift to enhance production, export for sale, or used directly as fuel

Once the crude oil is obtained above sea level, it is carried to mainland in VLCC, very large crude carriers.

3. How many barrels are extracted everyday.

Approximately 350,000 barrels of unpurified oil per day

4. What is the diameter of underwater pipelines used in Qatar?

Range of pipe diameter: 6 to 48 inches

5. What is the temperature and pressure of the oil when it is extracted?

The oil temperature is very high, and it's pumped at high pressures in the pipelines

6. What does oxy currently do to combat MIC in the oil pipelines?

Corrosion happens in well-to-separator-tank pipes, because of the sea water that is pumped in order to sweep the oil. This is because sea water provides ideal environment for SRB growth.

There are 2 types corrosion that happens in these pipes:

- External corrosion, which can be solved by a method called cathodic protection and cement coating.
- Internal corrosion, which is the big challenge: Acid gases: CO_2 , SRB produces H_2S gives iron sulfide which is the film but it's protective for the pipeline. De-aeration removes oxygen → Iron oxide causes corrosion

The current measure used are:

- Chemicals: biocides (Biodegradable chemicals are cheap and effective) → Biocides: weekly batch, high concentration for a short period of time, e.g Glutaraldehyde. Need to sample water before adding biocide, because different biocides require different conditions to work effectively, two types of water-oil mixtures:
 - Sweet: does not contain H_2S
 - Sour: contains H_2S , which causes the biocide Glutaraldehyde (Biocide) inactivation
- Process control: prevent the pipeline from being stagnant (Deadleg: related to bacteria, which is when there's not enough flow in pipe: 1m/seconds flow considered slow and is suitable for bacteria to grow)
- Material renewal: localized

Current sampling protocols:

- MPN most probable number : inoculate in media but takes time, accurate (two weeks)
- ATP : instantaneous but will give count to all bacteria not just SRB
- NACE method to find bacterial population in oil systems: 10^2 - 10^4 bacteria is alarming:
<https://www.enes26.ru/forum/attachment.php?attachmentid=583&d=1409765851>
- Sample both locations before pipes go into water and after they come out. Comparison of colony count is done; end of pipeline shouldn't have more bacteria.

Additional information:

- Chloride kills SRB - NaCl not very high in sea water but high in oil wells
- This is pumped into the sea water that is to be used for oil sweeping
- 23,000 mg/L Chloride is the indication to distinguish between seawater and oil water
- Sulfate is food for bacteria → makes sulfate scales (Calcium sulfate and barium sulfate for e.g) but a Sulfate removal unit is very expensive and there's no space to implant it
- H₂S at high conc is toxic for SRB and humans
- Temperatures are not a problem for SRB - it can adapt to a wide range of temp
- SRB: Localized corrosion, bits close together, edges well finished, blackened (call it MIC or black corrosion)
- Pipeline is carbon steel: not stainless because it's costly, not easy to handle because it's sensitive, the steel treated with corrosion inhibitor. Another alternative is CRA: corrosion resistant alloys, but this is expensive
- Calcium Carbonate is part of corrosion problem; it forms a layer and prevents biocides from reaching SRB colonies attached to pipeline surface. Pigging is used to scrape off colonies, clean debris that act as a protection to bacteria