Evaluation of Environmental Performance and Impact Study on Marine life around the QP offshore facility — NF-A

By

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Introduction

- QP, North Field Alpha (NF-A) is a gas producing platform located in Qatar North field, at seawater depth of around 50 m.
- The platform is located at 145 km, NNE, from Doha.
- Qatar North field is considered to be the largest single non-associated gas field in the world.
- The NF-A facility was commissioned in 1991 and its current production capacity:
  - Gas - 800 MMSCFD
  - Condensate - 36000 BPD
- Gas is dehydrated and condensate is dried and exported via pipelines to NGL plant at Mesaieed.
- NF-A supplies 9 MW power to Al-Morjan.
- This paper examines the performance of environmental practices and assesses the impact on natural habitat around NF-A
Policy, Regulations, Standards

- QP HSE policy – commitment to “.. consider the environmental impact in phases of QP business, including engineering design, construction, testing, commissioning, operations, maintenance and decommissioning of plants, facilities and equipment”.

- State of Qatar Environmental regulations

- Consent to operate condition “no floating solids, foam and free oil discharge to Gulf”


- Environmental performance evaluation as per ISO-14031 guidelines

- QP standards, Guidelines, Procedures

- Gas Operations management commitment for regular inspection, and assessment of day to day activities
Impact sources

Due to the potential ecological risks posed by some of the chemicals in the discharge water. This study is mainly focused on aquatic effect due to the operational phase of offshore platform and the main sources are:

- Platform discharges
  - Produced water
  - desalination water
  - cooling seawater
  - sewage water
  - kitchen material

- Other anthropogenic activities
  - operation of large vessels
  - other O&G operations adjacent to NF-A

- Hydrodynamic processes

Key physical process affecting water quality in the Gulf (from Raynold, 2002)
Environmental control

- Evaluation of chemical as per HOCNF
- Use of chemical as per ROPME
- Toilet and kitchen water treatment
- Kitchen waste maceration process
- Cooling water discharge at 10 m depth
- Daily Monitoring of Residual Chlorine
- Transfer of separated oil for recovery
- Segregation of wastes and inventory
- Reporting and investigation of incidents
- Monitoring of NORM
- Emergency Preparedness
- Process water treatment
Env. Performance Assessment

Implementation of EMS and Regulatory requirement

- Identification of environmental risks
- Control and mitigation of environmental risk
- Monitoring of environmental effects

Environmental Audit

- Routine compliance inspection by operational staff and management
- Management systems (ISO-9001, ISO-14001 & OHSAS-18001) internal and third party audits
- Development of key performance indicators

Evaluation of Environmental Performance

- Management Performance Indicators
- Operational Performance Indicators
- Environmental Condition Indicators
Environmental monitoring

- Regular monitoring by operations for
  - Produced water quality
  - Cooling seawater discharge quality
  - Physical observation around the platform
- Two ecological studies carried out in 2005 and 2010 by the specialist contractors; main objectives were:
  - Document the status of the environment in terms of seawater quality, sediments and biota in the marine environment around the NF-A.
  - Comparisons of the results with previous studies and detect any positive or negative changes in the survey site; act as a benchmark for future surveys.
  - Pinpoint any potential sources of pollution to the marine environment, so it can be eliminated as early as possible to minimize their effects.
  - Provide a comprehensive database for environmental parameters regarding the Qatari marine environment compiled with other surveys and studies.
What is Produced water?

• Produced water is a fossil water that has been trapped with oil and gas in the geologic reservoir, deep below the earth for millions of years, and brought to the surface with the oil and gas, or seawater injected into the reservoir during the production phase of oil or gas extraction.

• Produced water is a complex mixture of:
  • petroleum hydrocarbons
  • suspended solids
  • metals
  • naturally occurring radioactive materials (NORM)
  • organic acids and
  • inorganic ions etc.
Produced water status at NF-A

- Average Oil concentration - 14.8 mg/l
- Average Oil quantity - 0.18 t/yr
- Average produced water discharge volume – 12,322 m3/yr
- Oil in produced water discharges have been largely consistent and well within the CTO permit limit. This is mainly due to:
  - Improving the quality of produced water is a priority concern
  - A key focus on the improvement of plant/process uptime which in turn encourages better oil in water separation.
  - In addition to plant stability, NF-A is implementing enhancements to the produced water treatment plant, including repair, refurbishment and reinstatement of settlement tank.

<table>
<thead>
<tr>
<th>Item</th>
<th>CTO limit</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
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</thead>
<tbody>
<tr>
<td>Oil Concentration (mg/l)</td>
<td>40</td>
<td>17.5</td>
<td>15.6</td>
<td>14.2</td>
<td>15</td>
<td>12</td>
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<tr>
<td>Oil Quantity (t)</td>
<td>-</td>
<td>0.216</td>
<td>0.195</td>
<td>0.174</td>
<td>0.185</td>
<td>0.146</td>
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<tr>
<td>Produced water volume (m3)</td>
<td>-</td>
<td>12354</td>
<td>12469</td>
<td>12273</td>
<td>12368</td>
<td>12144</td>
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</tbody>
</table>
Seawater and biota sampling

- Samplings carried out at 38 stations and two reference stations
- Transects were set at distances of 50, 250, 500, 1000 meters, and 2, 5, and 10km
- Seawater samples were collected from 3 depths
- Sediment and biota samples were collected with the help of special vessel and video filming performed.
- Standard sampling procedures were applied for collection, preservation and transferring of all samples to the laboratory.

Map showing the position of sampling sites in relation to NF-A
Type of Sampling and analysis

- Seawater samples
- Sediment samples
  - Organic pollutant
  - Heavy metals
  - NORM samples
- Marine biota samples
  - Undersea photography
  - Video film footage
- Analysis
  - Analytical methods were used as per the USEPA and APHA
  - Used calibrated equipment
  - Established Quality Control and Quality Assurance programs
- Statistical analysis of data
  - Average
  - Standard deviation
  - Analysis of variance

<table>
<thead>
<tr>
<th>Seawater</th>
<th>Sediment</th>
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</thead>
<tbody>
<tr>
<td>Turbidity</td>
<td>O&amp;G</td>
</tr>
<tr>
<td></td>
<td>Ac-228</td>
</tr>
<tr>
<td>pH</td>
<td>BOD</td>
</tr>
<tr>
<td></td>
<td>Bi-214</td>
</tr>
<tr>
<td>Temp.</td>
<td>COD</td>
</tr>
<tr>
<td></td>
<td>Pb-214</td>
</tr>
<tr>
<td>Salinity</td>
<td>TPH</td>
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<td>K-40</td>
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<tr>
<td>Cond.</td>
<td>TOC</td>
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<td>Th-228</td>
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<tr>
<td>DO</td>
<td>VOC</td>
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<td></td>
<td>Ur-228</td>
</tr>
<tr>
<td>O&amp;G</td>
<td>PAHs</td>
</tr>
<tr>
<td></td>
<td>Pb-210</td>
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<tr>
<td>BOD</td>
<td>O&amp;G</td>
</tr>
<tr>
<td></td>
<td>Cs-137</td>
</tr>
<tr>
<td>COD</td>
<td>PCB</td>
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<tr>
<td></td>
<td>Gross-α</td>
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<tr>
<td>TPH</td>
<td>15 Heavy metals (Hg, Al, As, Ba, Cd, Co, Cr, Cu, Fe, Mn, Ni, Pb, Se, V and Zn)</td>
</tr>
<tr>
<td></td>
<td>Gross-β</td>
</tr>
<tr>
<td>TOC</td>
<td></td>
</tr>
<tr>
<td>VOC</td>
<td></td>
</tr>
<tr>
<td>PAHs</td>
<td></td>
</tr>
</tbody>
</table>
Analysis results

• Seawater results
  – Majority of chemical analyte tests were below the laboratory limits of reporting.
  – Toxic components are in low concentrations in produced water.
  – Results of the chemical studies in water column were satisfactory and the values obtained for all parameters were below recommended standards.
  – There were no significant differences observed in the physicochemical and chemical parameters of year 2010 and 2005 data

• Sediment samples results
  – The analysis of TOC, TPH, PAH, PCB, VOC obtained low concentrations in sediment samples.
  – Most of the highest heavy metals concentrations were obtained within the proximity of the platform
  – NORM in majority of stations shows negative, except Ur and Th in two stations
  – Very little debris was encountered at the bottom
Marine biota presence

• Undersea photography
  – The seabed is made up of coarse sandy seafloor with occasional rubble-stony corals.
  – The biota of NF-A is characteristic of seabed habitat within the Gulf, comprising of hard and soft corals, bivalves and other mollusks, echinoderms, crustaceans and pelagic and demurral fishes.
  – Organisms observed in undersea photography at all stations with a maximum of 10 number.
  – These organisms belong to six animal groups: corals, shrimps, gastropods, echinoderms, bony and sea snake.

• Video film footage
  – A total of 250 taxa were noted in the video films. Some occurred as a single individual whereas others occurred as schools.
  – The corals detected are those that survive in deep waters.
  – The types of fish were quite varied-mostly of species encountered in deeper water. They included the carpet shark, barracudas, tuna and flounders, lion fish and others.
  – The epi-benthic community marine organisms mainly belonging to corals, crustaceans, gastropods, and echinoderms.
  – There were 1704 organisms retrieved from sediments samples.
  – Study evident that the Chlorophyll element (seaweeds and sea grasses) is absent.
Fishes around the NF-A
Marine species around NF-A
Marine species around NF-A
Conclusions

This paper reviews the constituents of produced waters and their effects on marine environment. The overall environmental management and interpretation of considerable laboratory & field data, leads to the following conclusions:

- Environmental controls are in place for all possible pollution sources.
- Implementation of EMS and evaluation of environmental compliance carried out to assess the effectiveness of EMS and continual improvement.
- Two ecological studies revealed that the sandy seafloor was made up of mostly coarse sand, and rubble in some places.
- Factor affected species richness and abundance are:
  - Depth of the sea
  - Operational activities involving O&G production from NF-A and other platforms in the vicinity
- Due to these factors, marine organisms were much fewer in abundance and richness of species, in comparison to shallow water in Qatar.
- Two reference points were surveyed far enough (10 km) from NF-A, which were beyond range of any pollution originating from the station and analysis results were compared.
Conclusions

• NF-A is in compliant to the relevant water quality national and international guidelines/standard.
• There was no evidence that the substratum in the vicinity of NF-A had been physically modified by station activities and vessel movement.
• Bottom sediments throughout the area appeared healthy and showed recent and widespread occurrence of burrowing organisms.
• There were no sites encountered during survey that would suggest that epi-benthic organisms may be stressed or unhealthy or evidence of acute pollution effects.
• Water within NF-A did not have any substantial impact on fish community as evident by the 44 species observed.
• There were 1704 organisms retrieved from sediments samples. This showed that bottom sediments throughout NF-A had widespread occurrence of epifauna and infauna species.
• Study concludes that offshore Operators shall continue control of various harmful discharges and undertake an environmental assessment to address the potential impact on the marine environment in order to develop strategies, procedures and best practices to manage and mitigate those specific effects of their activities.
Thank you for your attention