Sustainable waste management at PERU LNG’s marine terminal

2016 Maritime Award of the Americas

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PERU LNG is a Peruvian company established in 2003, dedicated to the liquefaction of natural gas.

It consists of a 408 km pipeline from the highlands of Peru to the LNG Plant located 165km south of Lima.

The LNG Plant consists of a process train, two storage tanks, and a marine terminal.

The jetty includes a 1.3 km trestle bridge, a LNG loading platform and a 800 m long x 25 m wide breakwater.

Shareholders: Hunt Oil, SK, Shell and Marubeni.
Open sea without natural structures or protection.

Strong waves up to 4.5m height versus 0.8m required for safe vessel operations.

Regular dredging of navigational channel (i.e. recurrent impact versus recovery & resilience)

Coexistence of maritime activities (> 60 LNG ships / year) with marine biodiversity
Environmental Management at PERU LNG’s Marine Terminal

- Based on “environmental mitigation hierarchy” and industry best practices.
- Includes 4 key elements:
  1. Integrated Management System.
  2. Solid & Liquid waste management.
  3. Pollution prevention on vessels and jetty maintenance activities.
1. Integrated Management System

HEALTH & SAFETY:
- Risk Assessment
- Risk Control

ENVIRONMENT & SOCIAL:
- Impact Assessment
- Mitigation Hierarchy

QUALITY MANAGEMENT:
- Quality Assurance
- Monitoring & Control

- ISO 9001
- ISO 14001
- OHSAS 18001
- OSHA 1910.119
2.1. Solid waste management

1. Minimization & Segregation at source
2. Temporary storage & classification
3. Waste transportation by authorized Contractors
4. Composting

Prioritize reuse & recycling: In 2015-2016 >1.5 TN recycled paper exchanged with diapers for donation
Prioritize reuse & recycling: In 2015-2016 >3 TN recycled plastic used to produce blankets for donation

> 140 TN per year of solid waste is recycled.
Recycled streams include: paper, cardboard, plastics, spent oil, metal, wood, tetra pack, glass, tonners, used batteries.
Composting of organic waste from food preparation & gardening waste.

1,355 training hours to PERU LNG employees & Contractors in waste management.
Recycled plastic donated to a campaign organized by the Ministry of Environment to produce blankets for vulnerable communities in the Peruvian highlands.
Every year Paper & Cardboard are exchanged with diapers and donated to hospitals and nurseries along the pipeline right of way.
Three main waste water streams:
1. Brine from the Reverse Osmosis Unit.
2. Treated effluent from oil & grease separator.
3. Treated effluent from the Sewage Treatment Plant (STP).

Brine and treated effluent from oil & grease separator discharged to sea.

100% of STP effluent reused onsite for dust control and irrigation.

STP includes a “constructed wetland” (i.e. tertiary treatment) ensuring a high quality of treated effluents.

Robust monitoring program to ensure compliance with discharge standards.

From 2010 to date > 330,000m3 of domestic treated wastewater reused on site.
3. Pollution prevention on vessels and in jetty maintenance activities.

- LNG Tankers audited against IMO requirements: oil, air, sewage and garbage pollution prevention certificates, ballast records, anti fouling systems.
- Ballast water monitored against IMO standards. Plankton is also analyzed to identify potential invasive species.
- Regular HSE Inspections and audits to tug boats, pilot boats and support vessels.
- Waste transfer and disposal certificates from tugboats checked to ensure regulatory and EIA compliance.
- Jetty maintenance activities include a prior-to-the-job risk assessment and environmental impacts identification to ensure appropriate pollution prevention.
- Sandblasting & painting above water in built-in enclosures to prevent marine pollution.
4. Monitoring & Assurance

- Participatory marine monitoring carried out with the participation of Fishermen Associations and Environmental authorities. Monitoring includes: Currents, Seawater, Marine Sediments, Plankton.

- Comprehensive marine biodiversity monitoring program (BMAP) carried out with the support of Smithsonian Conservation Biodiversity Institute. Monitoring includes: Fish, Benthos and Seabirds.

Monitoring reports distributed to key stakeholders such as local fishermen and environmental Authorities.

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<th>In 2007 (before Project)</th>
<th>In 2016 (after construction and in ops)</th>
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<tbody>
<tr>
<td>Fish</td>
<td>45</td>
<td>69</td>
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<tr>
<td>Seabirds</td>
<td>11</td>
<td>27</td>
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Conclusions

A marine terminal management strategy based on the “mitigation hierarchy” and industry best practices ensures a sound environmental performance, a proactive culture of pollution prevention, good marine biodiversity management and constructive relations with stakeholders.

The design and Implementation of an adequate waste management strategy fosters:

✓ Waste minimization with the corresponding reduction of disposal costs.
✓ More efficient use of resources.
✓ Opportunities to benefit stakeholders when recycled waste is exchanged for materials and products that are donated within the area of influence.
✓ Control and assurance that any discharge to sea is not adversely impacting the marine environment.

Involvement of stakeholders in monitoring activities helps the Company to openly share monitoring results, build trust, and to manage expectations by keeping stakeholders informed about the Port’s main activities and corresponding marine environmental conditions.