Study of Environmental Measures for Crude Oil Shipping Terminal in Middle East Area (Saudi Arabia)

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1. Background

As the background to launching the project, the crude oil delivery department and environment department at Saudi Aramco previously submitted a proposal to the company's management for recovery of VOC (volatile organic compounds) that are discharged by tankers when shipping crude oil. In response, the management gave its approval to promote examinations and countermeasures for VOC recovery, and the two departments began a joint effort to pursue the proposal. Information about this initiative reached JCCP, and led to the implementation of the project.

JX Nippon Oil & Energy Staging Terminal Corporation's Kiire Terminal functions as a crude oil stockpiling terminal, as well as a staging terminal that temporarily receives crude oil from the Middle East and ships it to affiliated refineries. During the transfer of crude oil, gas containing VOC (mainly LPG fractions), which has caused urban ozone, used to be discharged from the hold of the tankers. The JX Group has thus developed a ground-installed VOC recovery unit called Tanker Vapor Recovery (TVR) unit, which characteristically cools crude oil and uses the crude oil as a VOC adsorbent to enhance VOC recovery rate, and built and placed it in operation at the Kiire Terminal.

2. Progress of the Project

Taking into consideration that large supplies of crude oil are exported from the Middle East oil-producing countries to Japan, JCCP launched a project in FY2011 that aims to introduce TVR technology to the Middle East region, to help prevent air pollution using a commercially proven unit developed in Japan, and to contribute to promoting environmental countermeasures in oil-producing countries.

In FY2011, a demonstration test of an improved TVR unit (TVR combined with a membrane separator to increase VOC recovery rate) was performed at the Kiire Terminal using a small-scale facility. Saudi Aramco stipulates a prescribed VOC recovery rate, but the FY2011 test verified that Saudi Aramco's requirement would be satisfied.

In FY2012, efforts were made to develop a shipboard VOC recovery unit for tanker vapor recovery on single-point mooring (SPM) such as at Saudi Aramco's Juaymah Terminal. As the VOC recovery process was planned to be installed onboard a seaborne ship, waves were expected to cause large fluctuations during the winter when the coastal regions are hit by extreme weather. This created the concern that if a conventional adsorption tower were introduced to the floating VOC recovery process, it would be affected by wave fluctuation and not be able to achieve proper VOC adsorption performance. As a result, it was considered preferable for the shipboard TVR process to incorporate technology that can maintain VOC recovery rate without being easily affected by the fluctuation of waves, and a demonstration test using new technology was performed to collect the necessary and sufficient data for designing a commercial unit.

By December 2012, a proposal was submitted to organizations in Saudi Aramco involved in the selection of a VOC recovery process, and FY2012 came to a close while waiting for Saudi Aramco to establish a selection process.

In June 2013, an inquiry was made to Saudi Aramco regarding the status of deliberation of a selection process, but their response stated that adoption of the TVR technology had been deferred at the first candidate terminal. To satisfy the recovery rate requested by Saudi Aramco, an apparatus that utilizes new technology developed in the FY2012 project was proposed, but a different system backed by a better track record was ultimately chosen.

At a different terminal, it was said that the decision on whether or not adopt the TVR technology would be made in September, but when Saudi Aramco was asked about the situation in October, it revealed that the selection has been delayed, and that there is little possibility of a conclusion being reached by the end of FY2013.

3. Future Plan

From a subsequent survey, it was found that the market for the TVR plant itself, excluding the vessel, is worth about 100 billion yen in the Middle East Gulf countries. As shipping facilities are predominantly of the SPM type installed on the water, the shipboard installation specification that was newly developed in FY2012 is expected to become the mainstream. Since the shipboard TVR comprises a new market, efforts for its development are expected to be made going forward.

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TVR at the Kiire Terminal