Tacoma LNG SEIS Data and Information Request for TOTE Maritime

Date: May 3, 2018

1. Describe the vapor management system employed by TOTE when transferring LNG into the fuel storage tanks.

   Please refer to section 1.3.4.2.1 Marine Bunkering in the Background Information Document provided.

2. Please provide the methane losses associated with LNG transfers
   a. LNG connection trapped volume
   b. Vapor releases

   Please refer to section 1.3.4.2.1 Marine Bunkering in the Background Information Document provided. Table 6 on page 9 of the document outlines the assumed loses.

3. Please describe the onboard vaporization system employed and quantify any losses associated with vaporization and transfer to engines

   The shipboard system consists of two LNG storage tanks each with a capacity of 1,100m^3.

   During normal operations, LNG is conveyed to the vaporizing skid via two submerged pumps in each tank. Variable speed drives are used to control the pumps to keep the required LNG flow and pressure. At low flow LNG is also re-circulated back to the tank through a control valve. There is also the ability to consume any gas vapors that accumulate at the top of the tank without the use of the pumps.

   The vaporizing skid consists of two heat exchangers per tank in parallel, however a cross over valve can be employed to utilize any combination of heat exchangers in parallel regardless of tank suppling the LNG. A glycol loop is the heating medium for the vaporization of the natural gas. The glycol system uses waste heat from the engines low temperature cooling water circuit.

   Once vaporized the gas flows to the consumers in two independent pipelines. Each pipe line supplies two engines. A crossover valve also allows the pipeline to be operated in parallel off the same heat exchangers. Four MAN duel fuel engines and one boiler will consume the gas.

   Each tank is also equipped with a spray bar to collapse any vapor forming at the top of the tank.

The system has been designed such that during normal operations no unburned methane will be lost or vented through the vent stacks on the ship.

4. Please provide emission factors for the LNG engines (CO, VOC, CH_4, N_2O) in g/bhp-hr

   Please refer to section 1.3.6.1, table 13 of the Background Information Document.

5. Please provide data allowing quantification of annual fuel consumption (e.g. BSFC, average load factor, hours/trip, # of trips per year, etc.)

   Please refer to section 1.3.6.1, table 12 of the Background Information Document.

6. Please confirm that alternate propulsive system would be a new low NOx engine operating on 1000 ppm S fuel oil.

   For TOTE vessels to be compliant with the ECA regulations they have either of two options available;

   - **Continue use current engines in their current configuration utilizing compliant 0.1% Sulphur fuel within the ECA.**
   - **Retrofit exhaust scrubbers to the vessel and continue to burn HFO.**

   As a point of clarification the options above would result in lower SOx emissions as required under the ECA. However, the ECA does not regulate NOx emissions, therefore the options listed above would not result in lower NOx emissions during engine operations.

   Please also refer to section 4.2 Impacts of No Action, in the Background Information Document on page 27.

7. Please provide emission factors and fuel consumption for alternative diesel propulsion.

   Please refer to section 1.3.6.1 in the Background Information Document and table 14 for the emissions factors used for modeling the LCA in Background Information Document.

8. Would the alternative marine diesel propulsion use emission controls such as selective catalytic reduction that use reagents like urea? If that is the case what is the consumption rate?

Please refer to question 6. No alternative marine diesel propulsion would be required. The current engines would remain and utilize 0.1% Sulphur compliant marine fuel (MGO). Please also refer to section 4.2 of the Background Information Document.