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The Secretary,
Petroleum & Natural Gas Regulatory Board,
1st Floor, World Trade Centre,
Babar Road,
New Delhi – 110001

Sub: Comments on the proposed amendments in the PNGRB (Technical Standards and Specifications including Safety Standards for Retail Outlets dispensing Petroleum, Auto LPG and CNG), Regulations 2018

Respected Madam,

This has reference to the public notice soliciting views on the proposed amendments in the PNGRB T4S for Retail Outlets (RO) covering various technical and safety aspects of storage, handling and dispensing at LNG/LCNG ROs.

We welcome the initiative of the PNGRB for issuing a consolidated set of technical and safety standards enabling setting up LNG/LCNG ROs by the interested parties either on a standalone basis or co-locating dispensing facilities of green fuels such as LNG/CNG along with MS & HSD as required under the new fuel retail policy. LNG is emerging as one of the most preferred fuels for long-distance travel by HDVs globally. The development of LNG ROs is vital for accelerated adoption of the fuel, and T4S standards play an important role in the Auto LNG market development by enabling the standardization of the supply chain and optimization of the project costs. The existing industry standards such as ISO16924 (International standard for Natural gas fuelling stations — LNG stations for fueling vehicles) and the best practices from around the world can be leveraged to develop the most appropriate T4S regulation for India.

Keeping this in view, we have reviewed the proposed standards and provided various recommendations for the consideration of the honorable Board. While the detailed recommendations are provided in Annexure 1, a summary of the key recommendations is provided below:

1. **Safety (separation) distances**: Safety distances are required to prevent escalation upon hydrocarbon release. The distance is dependent on the system operating conditions, the recovery barriers implemented in the design (e.g. ESD system response time) and the potential consequence on people in the vicinity. It is crucial to prescribe distances on the basis of:

a. Distances shall be based on the calculated release rate and the determined Lower Flammability Limit (LFL) distance for the system under consideration. It should be noted that the highest release rate in case of a process upset is associated with LNG transfer (and not with LNG storage).
b. Safety distances around the LNG storage are associated with the heat radiation of external sources onto the storage. Hence, it is safety-critical to prevent pool formation (e.g. impoundment) around the tank, jet fires near the tank (e.g. welding instead of flanged connections) and radiation from an ignited vent stack onto the tank.
c. Distances shall be tailored to the number of people and assets potentially impacted on- and off-site.

2. **Sizing of safety relief system**: Pressure Relief Valves (PRV) & Vent stack

   a. The size of PRVs is normally based on relief scenarios. PRV's line-up should be staggered as to avoid chattering.
   b. Upon activation of the PRVs, it is critical to ensure that LNG is dispersed at height. This is required to prevent liquid (LNG) rainout that could form a pool and to prevent potential cloud at ground level that could lead to Vapor Cloud Explosion (VCE). Therefore, it is recommended to use a vent stack at height (where the height is determined by the governing relief case). The additional measures are recommended to ensure the vent stack nozzle is free of debris and does not accumulate rainwater.

3. **Dead Man Button (DMB)**: The unloading and dispensing of LNG requires at least one qualified person to be in constant attendance of the operation (T4S 10.0 (4)). A DMB is usually applied in the design to ensure that at least person is focused on the LNG transfer operation. In case of a process upset, the person walks away (or is incapacitated), the DMB is released. As a result, the transfer and associated potential release is automatically stopped. Hence, it is recommended to apply a DMB at the unloading and dispensing operation.

4. **Designing a comprehensive ESD System using existing industry guidance**: We recommend the following additional criteria to the proposed list in the T4S.

   a. it is recommended to follow IEC 61508 and IEC 61511. IEC 61508 and IEC 61511 provide methods for analyzing, assessing, designing, installing and maintaining ESD systems.

      As a minimum, to apply a SIL 2 overfill protection for the LNG storage tank. The ESD system is critical to manage this safety risk. Overfill protection should include a provision to accommodate for the liquid swelling of the stored LNG such as calibrating the level measurement using the LNG density at PRV setpoint as the PRV may malfunction if the gas cap is not maintained.

5. **Manage safety during LNG unloading: ESD Interlink**

   The unloading of the LNG is the highest risk activity at an LNG retail facility as the transfer is associated with the highest LNG flowrates and unsaturated LNG is prone to pooling. The

potential upset may lead to multiple fatalities. It is a common practice to isolate hydrocarbons in case of trips, i.e. once an ESD is initiated, valves are closed, pumps are stopped, and the hydrocarbon transfer is interrupted. However, as the delivery trailer is not part of the Retail site, ESDs are not communicated to the trailer, and the inventory of the trailer (up to 40 m3) could be released.

a. The ESD Interlink is a (pneumatic or electronic) link that communicates the ESD from the Retail site to the trailer. This enables a quick response to an unloading hose rupture or leak, thereby minimizing the amount of inventory released.
b. The ESD Interlink is one of the most crucial recovery barriers in an LNG unloading operation. Upon a process trip, it will de-energize the ESD valves on the trailer side, isolating the LNG in the trailer and effectively stopping the release from the station, as well as the trailer. This is an industry best practice captured in various local standards, and several ESD Interlink schematics are available in standards such Society of International Gas Tanker & Terminal Operators (SIGTTO).

6. LNG Storage Design

ASME Sect. VIII prescribes the standards for the adequate design, construction and maintenance of the LNG storage tank, which is fundamental for a safe process. Additionally, we recommend the following measures to address LNG specific behavior.

a. Welding up to first ESD valves: To ensure LNG can be isolated in main storage tank in case of emergency, it is recommended to weld all the lines (e.g. filling, discharging) up to the first ESD valve. Flanges are potential leak sources, especially in thermo-cyclic operation. In a fire scenario, flanges can pose a risk to jet-fires which may impinge on the tank and cause tank failure.
b. Insulation material: The insulation materials reduce the Boil Off Gas during operation. At the same time, insulation is a crucial barrier in case of impinging pool/ jet fire to avoid further escalation (e.g. Boiling Liquid Expansion Vapor Explosion - BLEVE). It is recommended to select and design the insulation that can remain intact during a fire.
c. Vacuum Lift Plates: The mechanical stress of the vacuum in combination with the thermal stresses caused by caused a fire impinging on the tank can result in buckling of the outer jacket and failure of the tank. It is therefore recommended to prescribed vacuum lift plates to remove the vacuum in the annular space in a fire case (T4S 4.0 (b)).
d. Sloping area underneath the tank: To route a potential LNG spill away from processing areas, a slope shall be created underneath the LNG tank. This design measure will help manage the risks of a pool fire impinging on the LNG tank, which may escalate to a BLEVE.

7. Impoundment

Large atmospheric LNG spills can be managed through a spill containment system (e.g. impoundment, bunding). However, if this is not designed appropriately, containment may contribute to further escalation instead of bringing the desired safety gain.

a. It is critical to ensure that the spill is safely directed away from hazardous process units, especially the LNG storage tank as this may lead to BLEVE.
b. In the containment system, the LNG vaporization rate shall be minimized (through the utilization of a perlite concrete mixtures, or vapor suppression systems) to prevent large vapor clouds forming, which could ignite and may lead to VCE.
c. The utilization of bunding walls shall be subject to careful study to ensure the risk for congestion is properly managed and thereby minimizing the consequences of a potential ignition of the LNG vapor (VCE).
d. Upset scenarios during LNG unloading have the largest potential spill rates. If a spill containment system is applied, it is recommended to route this potential spill to a safe location.

8. Methane venting – BOG management System

We recommend permitting the RO operator to use the BOG for supplying to any gas customer in the vicinity of the RO, including supplying into the near-by CGD distribution network to avoid venting of Methane. If such alternative use is not possible, it is recommended to implement additional measures (Sec 6.3.2 of ISO16924) such as insulation, operational optimization of the pump and LNG circulation to minimize venting as optimization of the tank capacity doesn't help in effective BOG management.

We request the honorable Board to consider the above inputs while finalizing the T4S regulation enabling development LNG ROs and adoption of LNG as an Auto Fuel. We will be happy to provide any further information if required.

Your Sincerely,
For **Shell Energy India Private Limited**

Ashwani Dudeja
Director