

NO. 6

## **Preliminary calculations relating to LNG Impounding Basin Sizing**

The Shannon LNG facility is being designed to comply with EN1473 (2007 edition).

### **EN1473 Criteria**

Per Paragraph 13.1.8, an LNG spill within the process and transfer areas shall be confined in the vicinity of, or remote from the spill collection area. The spill collection area and the impounding basin shall be connected by open channel.

For process equipment areas, the spill collection system or impounding basin capacity shall be at least 110% of the total liquid inventory of the largest piece of equipment or vessel which could fail and the related piping or other equipment that could drain through and from this equipment<sup>1</sup>.

- The SLNG design review of the proposed facility equipment identified the boiloff recondenser as the largest vessel associated with the process design.
- Recondenser vessel spill volume, including associated piping drainage has been determined to be 77 m<sup>3</sup>

At transfer areas and in the interconnecting pipe-work, where there is a possible risk of spills or leaks, the impounding basin capacity shall be determined by risk analysis which takes into consideration possible leak sources, flow rates, detection systems, manning levels and response times to determine the possible maximum size of any such spill or leak.

- The SLNG design review of the proposed facility transfer piping identified the LNG tank pumpout transfer piping spill as the largest piping system credible spill. For sizing purposes, Shannon LNG has assumed a full volume leak occurs from this piping with all pumps running. Detection and response time to stop flow was determined to have a duration of 3 minutes.
  - Pumpout transfer piping spill volume, including an associated piping drainage with 4 pumps running, has been determined to be 89 m<sup>3</sup>. The minimum sump size for this spill would 110% greater or 98 m<sup>3</sup>.
  - Pumpout transfer piping spill volume, including an associated piping drainage with 5 pumps running<sup>2</sup>, has been determined to be 109 m<sup>3</sup>. The minimum sump size for this spill would 110% greater or 120 m<sup>3</sup>.

A sump meeting the design criteria of EN1473 would need to be 120 m<sup>3</sup>. A typical sump would be 5m x 6m x 4m deep.

### **NFPA 59A Analysis**

In addition to analyzing the required basin size based on EN 1473, an analysis of the spill impoundment sizing under NFPA 59A was also conducted. Under NFPA 59A, impounding areas serving vaporization, process or transfer areas shall have a volumetric capacity equal to the greatest volume of LNG that can be discharged into an area during a

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<sup>1</sup> Per EN 1473, flash is allowed to be considered (netted out) in the calculation of the spill volume.

<sup>2</sup> Initial design provided for 4 (four) LNG pumps to be installed in each tank. This was subsequently increased to 5 (five) in the maximum design build-out scheme. Recalculation of the design spill volumes was required to meet new maximum build-out design.

10 minute spill from a single accidental leakage source or a shorter time based on demonstrable surveillance and shutdown provisions acceptable to the authority having jurisdiction.

- The largest single accidental leakage source is the LNG pumpout transfer system at maximum pumpout rate (assuming 5 pumps running)<sup>3</sup>. The spill volume calculated for this design spill is 378m<sup>3</sup>.

### **Process Impoundment Size Selection**

The Process area spill impoundment (sump) volume is approximately 400 m<sup>3</sup> (10m x 10m and 4m deep). This size selection was based upon review of EN1473 and NFPA 59A with the more conservative NFPA 59A criteria selected as the basis of impoundment sizing for the project.

Two spill impoundments have been located to facilitate spill collection in the 4 tank design scheme.

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<sup>3</sup> Initially this calculation was conducted assuming 4 pumps running, resulting in a sump size selection of a 400 m<sup>3</sup> impoundment was made (10m x 10m x 4 m deep). Subsequent to the addition of the 5<sup>th</sup> pump in the tank, the calculation of sump size verified and as the original sump size met NFPA 59A sizing criteria with 5 pumps, the sump size was not increased..