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TNO 2024 R10081 – 6 November 2024

Methanol Under Water Venting Tests

Public summary

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Classification report	
Title	
Summary	TNO Public
Report text	
Number of pages	
Number of appendices	
Project name	MENENS
Project number	060.48968

Summary

The standard location for accidental methanol vapour venting is above deck, similar to the system for fossil fuels. Methanol vapours are toxic, hence an alternative promising location to vent methanol vapour is under water. TNO has investigated how to safely test the underwater venting of methanol and what the influence of parameters such as bubble size, pressure, and venting depth is on the dissolving of methanol. The TNO report (TNO 2024 R10081) describes the background and the aim of the tests, the set-up, instrumentation, test preparation and results. A public summary of this report is given here. The full report is (only) available after request and approval from the MENENS consortium.

The aim of this study is to determine the effectiveness of underwater venting of methanol as a means of safely disposing of methanol vapours. To accomplish this, several lab-scale experiments are conducted using nitrogen, ethanol and methanol.

The initial experiment analysed the bubble size produced by bubbling nitrogen gas through water with varying nozzle geometries to identify the factors affecting bubble size, residence time, and therefore the absorption of vapours in the water. Depth of venting was found to have largest influence on the effectiveness.

Subsequent experimentation involved venting ethanol vapour into the water tank at different temperatures and nozzle configurations to study its absorption behaviour, which was then compared to methanol's absorption behaviour in water.

A photoionization detector (PID) sensor used to measure (m)ethanol vapour concentrations was found to be non-linear at high concentrations, necessitating calibration through reference measurements and curve-fitting techniques.

In the final experiment, a high concentration (m)ethanol vapour was directly vented into the water tank to observe absorption behaviour and its dependence on venting height. The results demonstrated comparable absorption for methanol and ethanol in water, with over 99% absorbed after 15 cm of water depth in the laboratory set-up. The CFD calculation used to model the venting progress were progressive and further investigation is required to clarify the presence of some methanol particles at the water's surface.