26th Annual George Mason University Conference on Atmospheric Transport and Dispersion Modeling, July 26-28, 2022

Phast modelling of the Desert Tortoise and FLADIS ammonia trials for the Jack Rabbit III model inter-comparison exercise

Alison McGillivray[1], Mike Harper[2], Frank Hart[2], Stephen Puttick[3], Adeel Ibrahim[3], Laurent Verdier[4], Simon Gant[1] and Rory Hetherington[1]

[1] Health and Safety Executive (HSE), Buxton, Derbyshire, UK
[2] DNV, Stockport, UK
[3] Syngenta, Huddersfield, Yorkshire, UK
[4] DGA Maîtrise NRBC, Vert le Petit, France

Abstract: As part of the Jack Rabbit III (JRIII) project, an international model inter-comparison exercise has been conducted where a number of dispersion modelling groups around the world have been invited to simulate six experiments from the Desert Tortoise and FLADIS ammonia trial series. The objective of this work has been to understand the strengths and weaknesses of models that may be used to design the forthcoming JRIII ammonia experiments.

This presentation at the GMU AT&D conference summarises the dispersion modelling work undertaken by five groups for the exercise: HSE, DNV, Syngenta, DGA and Equinor, who all used the DNV Phast dispersion model. All of the groups were provided with the same set of requirements for the modelling exercise, which included recommended source conditions and meteorological data. The five groups then worked independently of each other to setup and run Phast. The presentation discusses the different approaches used by the modelling groups and the impact of their choice of modelling approach on the dispersion results.

The results show that, overall, the models are in good agreement with measured concentrations in the Desert Tortoise trials and in reasonably good agreement with the FLADIS trial data. Results from the different groups are within a factor of two of each other for Desert Tortoise and a factor of ten for FLADIS. The main cause of discrepancy in the results for the FLADIS trials was the specification of exit pressures and temperatures that resulted in vapour source conditions being used in some Phast runs, instead of saturated liquid source conditions. The default isentropic atmospheric expansion model in Phast was also used in some cases, which overpredicted the release velocity for two-phase releases. Suggestions are given on the suitable modelling approach, going forward, when using Phast to simulate the future Jack Rabbit III pressure-liquefied ammonia release trials.

© British Crown Copyright, 2022

Acknowledgement: Each of the contributors to this work were self-funded, i.e., contributions by HSE staff were funded by HSE. The contents of this work, including any opinions and/or conclusions expressed, are those of the authors alone and do not necessarily reflect HSE policy. The authors would like to express their sincere thanks to Sandra Nilsen and colleagues at Equinor for providing results for this exercise.