



FATE, BEHAVIOUR AND POTENTIAL DAMAGE & LIABILITIES ARISING FROM SPILLS OF ALTERNATIVE FUELS INTO THE MARINE ENVIRONMENT: OVERVIEW

Report for the International Group of P&I Clubs Alternative Fuels Working Group

February 2024



I. Introduction

ITOPF, as part of the International Group of P&I Clubs Alternative Fuels Working Group, has been requested to provide a series of brief summary documents to describe the expected fate and behaviours of the following alternative fuels and to outline the possible damage and liabilities that may arise from incidents involving vessels carrying these fuels as bunkers.

The alternative fuels covered are:

- Biofuels
- Liquefied Natural Gas (LNG)
- Liquefied Petroleum Gas (LPG)
- Hydrogen
- Ammonia
- Methanol

ITOPF has also been requested to provide a summary document for lithium-ion batteries as a new technology for vessel propulsion.

A review of Nuclear as a means of vessel propulsion will be described separately, with the summary report provided by ENCO.

II. Overview table

A summary table giving a high-level overview of the behaviour & hazards associated with each of the alternative fuels can be found below. Please refer to the individual reports on each substance for more detail.

	State		Longevity in the environment	Flammability	Toxicity to humans	Health & Safety: Main Concerns	Protracted Response to recover pollutant
	Under Ambient conditions	During transport					
Biofuels	Liquid	Liquid	Weeks to months	<5% flammable range	Toxic (direct contact)	Low risk from initial exposure. Toxicity poses a risk if exposed for extended periods	Likely
Liquefied Natural Gas (LNG)	Gas	Liquid (cryogenic)	Hours to days	5 - 20% flammable range	Non-toxic	Significant risks linked to flammability, explosivity, asphyxiation, and cryogenic temperatures	Unlikely
Liquefied Petroleum Gas (LPG)	Gas	Liquid (pressurised and refrigerated)	Hours to days	5 - 20% flammable range	Non-toxic	Significant risks linked to flammability, explosivity, asphyxiation, and extreme low temperatures	Unlikely
Hydrogen	Gas	Liquid (cryogenic), or pressurised gas	Hours to days	>20% flammable range	Non-toxic	Significant risks linked to flammability & explosivity	Unlikely
Ammonia	Gas	Liquid (pressurised and refrigerated)	Hours to days	5 - 20% flammable range	Acutely toxic (vapours and upon direct contact)	Immediate risk in vicinity of substance, high toxicity with particular risk from vapours	Unlikely
Methanol	Liquid	Liquid	Hours to days	>20% flammable range	Toxic (direct contact & inhalation of vapours)	Significant risks linked to toxicity & flammability	Unlikely