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FASTWATER
FAST Track to Clean and Carbon-Neutral WATERborne Transport

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1 EXECUTIVE SUMMARY

This summary provides results of the FASTWATER project deliverable report on recommendations on rules and regulations.

1.1 Abbreviations

AD&A	Alternative Design and Arrangement
CEN	European Committee for Standardization
CESNI	European Committee for drawing up Standards in the field of Inland Navigation
ES-TRIN	European Standard laying down Technical Requirements for Inland Navigation vessels
IGF Code	International Code of Safety for Ship Using Gases or Other Low-flashpoint Fuels
ILO	International Labour Organization
IMO	International Maritime Organization
ISO	International Organization for Standardization
MSC	Maritime Safety Committee
RBC	Risk Based Certification
SOLAS	International Convention for the Safety of Life at Sea

1.2 Problem definition

The currently developed regulations for methanol fuelled ships support the safe use of this fuel in this sector. Although methanol as a chemical is well known, regulations for methanol used as fuel is quite new and regulations for this fuel have been released quite recently. In general, it can be said that the regulations developed represent the current agreement of working groups and safety committees with regard to the minimum requirements for the safe use of methanol as fuel on ships.

These regulations are typically based on past experience, but also on the consideration of goal-based requirements where certain experience with this fuel is not available. Driven by potential existing regulations for fuels used as a basis for the rule development for methanol as fuel or potential conservativism driven by the available knowledge at that time, the available regulations for methanol as fuel might have areas for potential improvement or refinement. This report captures possible recommendations on rules and regulations, components and equipment that emerged during this FASTWATER project.

1.3 Conclusions and recommendation

Regulations for Methanol have been developed and released by IMO, CESNI and classification societies. Developed rules and regulations represent the agreed safety-related state of the art at the time these rules were created. Depending on how the rules are designed, whether they are goal-oriented or prescriptive, new technical solutions or applications cannot be incorporated into the design of methanol-fuelled ships, or it may be difficult to do so. Additionally, further testing may be required to qualify other or novel technical solutions.

In this report possible recommendations on rules and regulations, components and equipment and further area for investigation that emerged during the FASTWATER project have been captured. These components, regulatory aspects or technical alternatives have been identified in technical discussions and interviews held with the individual project members. Recommendations addressing fuel piping systems, fuel tanks, fuel detection, safety system, release scenarios and hazardous atmospheres are provided in this report. It is recommended to close gaps of knowledge in order to keep and improve the level of safety by allowing in parallel potential alternative and cheaper solutions and support the acceptance of Methanol as fuel.

2 Safety and regulations relevant to methanol as fuel

In the following the current safety and regulations relevant to methanol as fuel in the marine environment will be addressed. Overall, the maritime transportation sector is well regulated through international bodies such as IMO and individual vessels are further to comply with classification rules. Detailed regulations for low-flashpoint fuels and gases have been or are in development by the “International Maritime Organization” (IMO) and “European Committee for drawing up Standards in the field of Inland Navigation” (CESNI). Low-flashpoint fuels and gases are covered in e.g. the “Lloyd’s Register, Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels”. Different low-flashpoint fuels are currently covered or are just in front of being released by the “Rules for Low-flashpoint Fuels” and by the “European Standard laying down Technical Requirements for Inland Navigation vessels” (ES-TRIN). For Methanol reference is made to the IMO, MSC.1/Circ. 1621, INTERIM GUIDELINES FOR THE SAFETY OF SHIPS USING METHYL/ETHYL ALCOHOL AS FUEL. Specific rules and technical references for Methanol fuelled ships were published by Lloyd’s Register already in advance to the MSC.1 Circular 1621 and with the technical reference “Introduction to Methanol Bunkering” in July 2020. Currently they are integrated as Appendix LR1 “Requirements for Ships Using Methyl Alcohol (Methanol) or Ethyl Alcohol” in the “Lloyd’s Register, Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels, July 2023”

A number of low flash point fuels related industrial standards and publications by national and international organisations are available. On ISO and CEN level development will take place relating Specification of Methanol as a Fuel for Marine Applications and Methanol Bunkering Standards. Although most relate to LNG some are referenced in the following chapters for potential guidance. Furthermore, goals and functional requirements are introduced in the IMO regulations addressing low-flashpoint fuels. A risk assessment is required by the applicable rules in order to eliminate or mitigate any adverse effect to the persons on board, the environment or the ship.

For arrangements and systems which are considered as either deviating from those set out in the applicable ship rules or be designed for a fuel not specifically addressed in this code the Alternative Design and Arrangement process and/or Requirements for Machinery and Engineering Systems of Unconventional Design must be considered. Specific rule arrangements are referenced in the chapter for low-flashpoint fuels.

Classification Societies e.g. American Bureau of Shipping, Bureau Veritas, China Classification Society, Det Norske Veritas, Lloyd’s Register, Registro Italiano Navale have their individual rules in place. For this specific deliverable reference is made to the Rules and Regulations of Lloyd’s Register.

The following procedures, guidelines and regulations relevant to methanol as fuel in the maritime transportation sector are addressed in this report:

- Lloyd’s Register, Rules and Regulations for the Classification of Ships
- Lloyd’s Register, Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels
- Lloyd’s Register, Ship Right, Design and Construction, Additional Design Procedures, Risk Based Designs (RBD)
- IMO, MSC.1/Circ. 1621, INTERIM GUIDELINES FOR THE SAFETY OF SHIPS USING METHYL/ETHYL ALCOHOL AS FUEL

- European Committee for drawing up Standards in the field of Inland Navigation (CESNI), European Standard laying down Technical Requirements for Inland Navigation vessels (ES-TRIN), Edition 2023/1
- European Committee for drawing up Standards in the field of Inland Navigation (CESNI), LEAFLET ON DELIBERATION ON DEROGATIONS AND EQUIVALENCES OF TECHNICAL REQUIREMENTS OF THE ES-TRIN FOR SPECIFIC CRAFT, March 2019

Further standards or guidelines can be identified as applicable to natural gas and liquefied natural gas or to methanol. As development of standards for other low-flashpoint fuels or gases might take time these standards might be considered as providing guidance based on the fuel as referenced in e.g. CWA 17540: 2020 Ships and marine technology - Specification for bunkering of methanol fuelled vessels, EMSA, Guidance on LNG Bunkering to Port Authorities and Administrations, 2018, EMSA, Safe Bunkering of Biofuels, 2023. It shall be highlighted that the physical properties of methanol are rather different compared to natural gas or especially liquefied natural gas. Standards and guidelines not specifically referring to methanol shall be considered with good engineering judgement.

2.1 Lloyd's Register, Rules and Regulations for the Classification of Ships

The "Lloyd's Register, Rules and Regulations for the Classification of Ships" are covering the applicable provisions for the classification of ships. Ships built in accordance with Lloyd's Register Group Limited's Rules and Regulations, or in accordance with requirements equivalent thereto, will be assigned a class in the Register Book and will continue to be classed as long as they are found, upon examination at the prescribed surveys, to be maintained in accordance with the requirements of the Rules.

Compliance is required with all applicable mandatory international IMO and ILO conventions and codes e.g. International Convention on Load Lines, International Convention for the Safety of Life at Sea, International Convention for the Prevention of Pollution from Ships, International Convention on the Control of Harmful Anti-Fouling Systems on Ships, International Convention on Tonnage Measurement of Ships, etc., and with requirements of the National Administration.

The "Lloyd's Register, Rules and Regulations for the Classification of Ships" are addressing the following provisions:

- Manufacture, Testing and Certification of Materials
- Ship Structures
- Main and Auxiliary Machinery
- Control, Electrical, Refrigeration and Fire
- Other Ship Types and Systems
- Rules for Ice and Cold Operations

Materials used for the construction, conversion, modification or repair of ships, other marine structures and associated machinery which are classed or are intended for classification by Lloyd's Register, are to be manufactured, tested and inspected in accordance with these requirements. Details are provided for material testing procedures, the specific tests and test specimen types required for each material type, grade and product type. Requirements are provided for steel plates and bars, castings, forgings, pipes, castings and specific alloys. Furthermore, equipment for mooring and anchoring, welding consumables, welding qualification, welded constructions, plastic and non-metallic materials and corrosion prevention are covered.

Requirements for ship structures are addressing materials, the structural design and strength aspects, machinery spaces, specific structure details and arrangements for e.g. shell, deck and bulkheads. Provisions are provided e.g. ventilator, air, and sounding pipes, overboard discharge, ship control systems, e.g. rudders, steering gear, stern thrust units, stabilizer, mooring equipment and securing of cargo. Main and auxiliary machinery requirements are addressing provisions for e.g. combustion engines, turbines, gearing and propulsion shafting, propellers, podded units, pressure vessels and piping, piping systems, propulsion systems and steering systems.

Control, Electrical, Refrigeration and Fire requirements are addressing requirements for control engineering systems, electrical engineering, refrigerated cargo installations and fire protection, detection and extinction. Further types and systems are addressed, and requirements are provided for e.g. controlled atmosphere systems process plants for chemicals of liquefied gases, dynamic positioning, for unconventional design, refrigeration systems, for ice and cold environment.

For the sake of completeness, it should be noted that in addition to the Lloyd's Rules referenced in this report further Lloyd's Rules and Regulation might be applicable e.g. Rules for Naval Ships, Special Service Crafts, Ships for the Carriage of Liquefied Gases in Bulk, Liquid Chemicals in Bulk, LNG Ships and Barges Equipped, Ships with Regasification Systems, etc.

2.2 Lloyd's Register, Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels

This Lloyd's Register, Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels is providing mandatory provisions for the arrangement, installation, control and monitoring of machinery, equipment and systems using low-flashpoint fuel to minimize the risk to the ship, it's crew and the environment, having regard to the nature of the fuels involved. The basic philosophy of the code considers the goal-based approach (see MSC.1/Circ.1394). Goals and functional requirements were specified for each code section forming the basis for the design, construction and operation.

The current version of these rules includes specific requirements for ships using natural gas, Methyl/Ethyl Alcohol, Ammonia and Hydrogen. As previously stated, regulations for other low-flashpoint fuels are in development on IMO and CESNI level and will be added to the individual low-flashpoint fuels accordingly when they have been ratified. The IMO, MSC.1/Circ. 1621, INTERIM GUIDELINES FOR THE SAFETY OF SHIPS USING METHYL/ETHYL ALCOHOL AS FUEL was released in December 2020.

It shall be noted that for other low-flashpoint fuels compliance with the functional requirements must be demonstrated through the alternative design route. The Lloyd's Register, Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels include the following requirements:

- Goal and Functional Requirements
- General Requirements
- Ship Design and Arrangement
- Fuel Containment System
- Material and General Pipe Design
- Bunkering
- Fuel Supply to Consumers

- Power Generation Including Propulsion and Other Gas Consumers
- Fire Safety
- Explosion Prevention
- Ventilation
- Electrical Installations
- Control, Monitoring and Safety Systems
- Manufacture, Workmanship and Testing
- Drills and Emergency Exercises
- Operation

As already addressed the basic philosophy of the code considers a goal-based approach. The goal is to provide for safe and environmentally friendly design, construction and operation of ships and their installation of systems for propulsion machinery, auxiliary power generation machinery and/or other purpose machinery. The following requirements are addressed in Part A Ch. 3 Goal and Functional Requirements:

- The safety, reliability and dependability of the systems shall be equivalent to that achieved with new and comparable conventional oil-fuelled main and auxiliary machinery.
- The probability and consequences of fuel-related hazards shall be limited to a minimum through arrangement and system design, such as ventilation, detection and safety actions. In the event of gas leakage or failure of the risk reducing measures, necessary safety actions shall be initiated.
- The design philosophy shall ensure that risk reducing measures and safety actions for the gas fuel installation do not lead to an unacceptable loss of power.
- Hazardous areas shall be restricted, as far as practicable, to minimize the potential risks that might affect the safety of the ship, persons on board, and equipment.
- Equipment installed in hazardous areas shall be minimized to that required for operational purposes and shall be suitably and appropriately certified.
- Unintended accumulation of explosive, flammable or toxic gas concentrations shall be prevented.
- System components shall be protected against external damages.
- Sources of ignition in hazardous areas shall be minimized to reduce the probability of explosions.
- It shall be arranged for safe and suitable fuel supply, storage and bunkering arrangements capable of receiving and containing the fuel in the required state without leakage. Other than when necessary for safety reasons, the system shall be designed to prevent venting under all normal operating conditions including idle periods.
- Piping systems, containment and over-pressure relief arrangements that are of suitable design, construction and installation for their intended application shall be provided.
- Machinery, systems and components shall be designed, constructed, installed, operated, maintained and protected to ensure safe and reliable operation.
- Fuel containment system and machinery spaces containing source that might release gas into the space shall be arranged and located such that a fire or explosion in either will not lead to an unacceptable loss of power or render equipment in other compartments inoperable.
- Suitable control, alarm, monitoring and shutdown systems shall be provided to ensure safe and reliable operation.

- Fixed gas detection suitable for all spaces and areas concerned shall be arranged.
- Fire detection, protection and extinction measures appropriate to the hazards concerned shall be provided.
- Commissioning, trials and maintenance of fuel systems and gas utilization machinery shall satisfy the goal in terms of safety, availability and reliability.
- The technical documentation shall permit an assessment of the compliance of the system and its components with the applicable rules, guidelines, design standards used, and the principles related to safety, availability, maintainability and reliability.
- A single failure in a technical system or component shall not lead to an unsafe or unreliable situation.

For the elimination or mitigation of any adverse effects to the persons on board, the environment or the ship a risk assessment is to be carried out. Where risks cannot be eliminated, an inherently safer design is to be sought in preference to operational or procedural controls. The risk assessment is to be carried out and to be documented in accordance with the Lloyds's Register, Ship Right, Design and Construction, Risk Based Certification (RBC). All risks shall be analysed based on recognised risk assessment techniques. Except for LNG fuelled ships loss of function, component damage, fire, explosion and electric shock shall be examined as a minimum. Consequences of an explosion shall be limited and shall not:

- cause damage to or disrupt the proper functioning of equipment/systems located in any space other than that in which the incident occurs;
- damage the ship in such a way that flooding of water below the main deck or any progressive flooding occur;
- damage work areas or accommodation in such a way that persons who stay in such areas under normal operating conditions are injured;
- disrupt the proper functioning of control stations and switchboard rooms necessary for power distribution;
- damage life-saving equipment or associated launching arrangements;
- disrupt the proper functioning of firefighting equipment located outside the explosion-damaged space;
- affect other areas of the ship in such a way that chain reactions involving, inter alia, cargo, gas and bunker oil may arise; or
- prevent persons access to life-saving appliances or impede escape routes.

In case the low-flashpoint fuel, appliances, arrangement and systems either deviate from those set out in the code or be designed for a fuel not specifically addressed in this code the alternative design and arrangement process must be considered. Evidence is to be provided that fuel, appliances and arrangement are meeting the intent of the goal and functional requirements and provide an equivalent level of safety demonstrated as specified in SOLAS reg. II-/55. Approval of this Alternative Design and Arrangement is in case for sea going vessels the responsible Flag state. Specific requirements for inland water way vessels are provided in the chapter "European Committee for drawing up Standards in the field of Inland Navigation (CESNI), LEAFLET ON DELIBERATION ON DEROGATIONS AND EQUIVALENCES OF TECHNICAL REQUIREMENTS OF THE ES-TRIN FOR SPECIFIC CRAFT".

For machinery and engineering systems of unconventional design reference is made in this chapter to the "Lloyd's Register, Rules and Regulations for the Classification of Ships"

Part7, Chapter 14 Requirements for machinery and engineering systems of unconventional design.

The requirements of this chapter aim to ensure that risks to maritime safety and the environment, stemming from the introduction of machinery or engineering systems of unconventional design, are addressed insofar as they affect the objectives of classification. The requirements of this section are to be satisfied where:

- machinery is required to be constructed, installed and tested in accordance with Lloyds Register's (hereinafter referred to as LR) Rules and Regulations and for which the corresponding machinery class notation is to be assigned and,
- the machinery and engineering systems are considered by LR to be of an unconventional design and which, as a result, are not directly addressed by LR's extant Rules and Regulations.

While requirements for information to be submitted is provided in the applicable chapters further detailed requirements are provided on quality assurance, design definition, risk management, configuration management integration and validation. A risk management procedure is to be established in order to ensure that any risks stemming from the introduction of the machinery or engineering system are addressed, in particular risks affecting:

- The structural strength and integrity of the ship's hull.
- The safety of shipboard machinery and engineering systems.
- The safety of shipboard personnel.
- The reliability of essential and emergency machinery and engineering systems.
- The environment.

2.3 Lloyd's Register, Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels, Appendix LR1 Requirements for Ships Using Methyl Alcohol (Methanol) or Ethyl Alcohol (Ethanol) as Fuel

The Lloyd's Register, Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels are providing requirements for machinery using methanol as fuel. These rules were developed by Lloyd´s Register in advance to the IMO MSC Guidelines and incorporates now the final text of the Interim Guidelines for the Safety of Ships Using Methyl/Ethyl Alcohol as Fuel as published in MSC.1/Circ.1621. The objective of this regulation is as well to provide a level of safety that is commensurate with conventional oil-fuelled propulsion and auxiliary machinery. These requirements are in addition to the applicable requirements of the Rules and Regulations for the Classification of Ships.

The requirements for methanol fuelled ships and the following requirements are addressed in this classification rule:

- General Requirements
- Submission Requirements
- Ship Design and Arrangements
- Fuel containment system
- Material and general piping design
- Bunkering
- Fuel supply to consumers
- Power generation including propulsion and other energy converters

- Fire safety
- Explosion prevention and area classification
- Ventilation
- Electrical installations
- Control, monitoring and safety systems
- Drills and emergency exercises
- Operation
- Manufacture, Workmanship and Testing

In order to evaluate the specific applied safety considerations, the dependability of essential service and specially considered arrangements which may deviate from these rule requirements risk-based studies have to be carried out. These are e.g. safety risk assessments, system dependability assessments, failure modes and effects analysis, hazardous area classification studies, system hazard and operability studies, bunkering studies and other risk-based studies identified by the risk assessment.

Materials used in methanol fuelled ships shall comply with the requirements of the Lloyd's Rules for the Carriage of Liquid Chemicals in Bulk. Further requirements are provided for tank coatings, stainless steel and different alloys. Electrical equipment and components for use in hazardous areas are required to be of a certified safe type. Specific location and arrangements are demanded for the bunkering station, fuel storage tanks, fuel supply equipment, methanol-fuelled consumer equipment, access to a hazardous space, ventilation and pressurisation and hazardous areas.

Specific requirements are provided for the system design relating methanol bunkering system, the fuel storage tanks, associated coffer dams, the methanol supply system, potential used methanol-fuelled combustion engines and turbines, boilers and, the inert gas system. For the design and construction of piping reference is made to the Loyd's Rules for Ships as well specific requirements are provided and details are requested for the control, alert and safety systems, electrical installation and fire safety and to testing of consumers and trials.

2.4 Lloyd's Register, Ship Right, Design and Construction, Additional Design Procedures, Risk Based Certification (RBC)

The Lloyd's Register, Ship Right, Design and Construction, Risk Based Certification (RBC) is providing additional guidance and support in satisfying the requirements for risk-based designs. The following sections are included in this procedure:

- Introduction
- Process overview
- Process application
- Process description
- Reference rules, regulations, standards and guidance
- Information requirements
- Acceptable risk criteria
- System integration

A risk-based analysis and demonstrating equivalence with the regulation under consideration is required in the application of the rules for low-flashpoint fuels and the AD&A process. Furthermore, an RBC process is typically applied for designs which deviate from the existing rules or for novel or complex designs for which prescriptive rules and regulations do currently not exist. The scope of this process is depending on the degree of novelty, degree of deviation, design complexity, and safety consideration. The RBD process comprises the following stages and is shown in the following figure:

Stage 1 – Design and Safety Statement.

Stage 2 – Risk Assessment.

Stage 3 – Revision and Supporting Studies.

Stage 4 – Final Design Assessment.

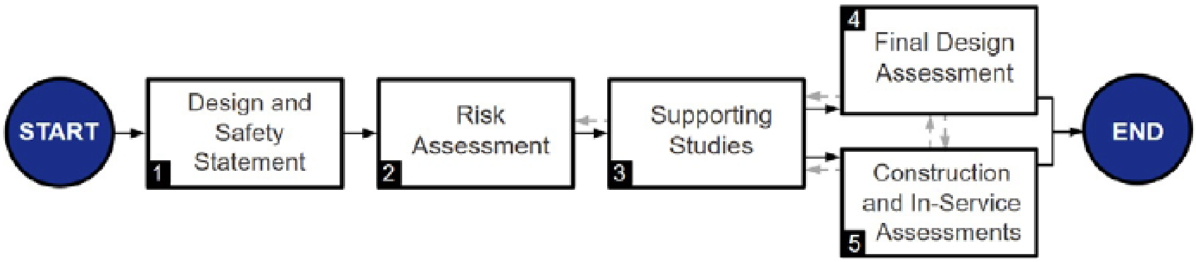

Figure 1 Generic Process for Risk Based Certification (RBC), taken from [3]

In Stage 1 "Design and Safety Statement" responsibilities are shown, potential relevant regulations and items to be considered are referenced for, e.g. for the development team, definition of novel or alternative design, scope of novel or alternative design, classification and statutory requirements not complied with, safety objectives to be met, functional requirements to be met, integration requirements to meet safety objectives and functional requirements and the preparation of Stage 1 Appraisal Report.

The Stage 2 "Risk Assessment" items to be considered are provided e.g. for the assessment team, method, acceptance criteria, hazard identification, consequences, likelihood, risk categorization, acceptance criteria, additional measures, justification and the preparation of Stage 2 Appraisal Report.

The Stage 3 "Revision and Supporting Studies" is providing items to be considered in case criteria are not satisfied and supporting studies, assessments and revisions are requested. Responsibilities are given, potentially relevant regulations are addressed with items to be considered e.g. objective and scope of assessment, acceptance criteria, assessment team, method and techniques and justification of appropriate safety with a Stage 3 Appraisal Report.

In Stage 4 "Final Design Assessment" items to be considered and responsibilities are shown for the final design assessment.

2.5 IMO, MSC.1/Circ. 1621, INTERIM GUIDELINES FOR THE SAFETY OF SHIPS USING METHYL/ETHYL ALCOHOL AS FUEL

IMO had published this interim guideline as a Maritime Safety Committee Circular in December 2020. This interim guideline follows a goal-based approach and includes provisions to meet functional requirements for methyl and ethyl alcohol as fuel. The following provisions are addressed in this interim guideline:

- Goal and functional requirements
- General provisions
- Ship design arrangements
- Fuel containment system
- Material and general pipe design

- Bunkering
- Fuel supply to consumers
- Power generation including propulsion and other energy converters
- Fire safety
- Explosion prevention and area classification
- Ventilation
- Electrical installations
- Control, monitoring and safety systems
- Training, drills and emergency exercise
- Operation

As addressed in the IGF code, arrangements and appliances may deviate from the requirements in the interim guidelines for methyl and ethyl alcohol as fuel. Provided the arrangements and appliances meet the intent of the goal and functional requirements and provide an equivalent level of safety.

The equivalence shall be demonstrated as specified by SOLAS regulation II-1/55 – Alternative design and arrangement. Reference is made to the "Lloyd's Register, Ship Right, Design and Construction, Risk Based Certification (RBC)" and "Lloyd's Register, Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels".

"The goal of these Interim Guidelines is to provide for safe and environmentally friendly design, construction and operation of ships and in particular their installations of systems for propulsion machinery, auxiliary power generation machinery and/or other purpose machinery using methyl/ethyl alcohol as fuel." The functional requirements to be met are provided in the following:

- The safety, reliability and dependability of the systems should be equivalent to that achieved with new and comparable conventional oil-fuelled main and auxiliary machinery.
- The probability and consequences of fuel-related hazards should be limited to a minimum through arrangement and system design, such as ventilation, detection and safety actions. In the event of fuel leakage or failure of the risk reducing measures, necessary safety actions should be initiated.
- The design philosophy should ensure that risk-reducing measures and safety actions for the fuel installation do not lead to an unacceptable loss of power.
- Hazardous areas should be restricted, as far as practicable, to minimize the potential risks that might affect the safety of the ship, persons on board and equipment.
- Equipment installed in hazardous areas should be minimized to that required for operational purposes and should be suitably and appropriately certified.
- Unintended accumulation of explosive, flammable or toxic vapour and liquid concentrations should be prevented.
- System components should be protected against external damage.
- Sources of ignition in hazardous areas should be minimized to reduce the probability of fire and explosions.
- Safe and suitable fuel supply, storage and bunkering arrangements should be provided, capable of receiving and containing the fuel in the required state without leakage.

- Piping systems, containment and overpressure relief arrangements that are of suitable design, material, construction and installation for their intended application should be provided.
- Machinery, systems and components should be designed, constructed, installed, operated, maintained and protected to ensure safe and reliable operation.
- Suitable control, alarm, monitoring and shutdown systems should be provided to ensure safe and reliable operation.
- Fixed fuel vapour and/or leakage detection suitable for all spaces and areas concerned should be arranged.
- Fire detection, protection and extinction measures appropriate to the hazards concerned should be provided.
- Commissioning, trials and maintenance of fuel systems and fuel utilization machinery should satisfy the goal in terms of safety, availability and reliability.
- The technical documentation should permit an assessment of the compliance of the system and its components with the applicable rules, guidelines, design standards used and the principles related to safety, availability, maintainability and reliability.
- A single failure in a technical system or component should not lead to an unsafe or unreliable situation.

A risk assessment is required using acceptable and recognized risk analysis techniques by considering loss of function, component damage, fire, explosion, toxicity and electric shock, as a minimum, in the assessment. Reference is made to the "Lloyd's Register, Ship Right, Design and Construction, Additional Design Procedures, Risk Based Designs (RBD)" process. The consequences of explosions are to be limited in that way that any explosion in any space containing a potential source of release and potential ignition should not:

- cause damage to or disrupt the proper functioning of equipment/systems located in any space other than that in which the incident occurs;
- damage the ship in such a way that flooding of water below the main deck or any progressive flooding occur;
- damage work areas or accommodation in such a way that persons who stay in such areas under normal operating conditions are injured;
- disrupt the proper functioning of control stations and switchboard rooms necessary for power distribution;
- damage life-saving equipment or associated launching arrangements;
- disrupt the proper functioning of fire-fighting equipment located outside the explosion-damaged space;
- affect other areas of the vessel in such a way that chain reactions involving, inter alia, cargo, gas and bunker oil may arise; or
- prevent persons' access to life-saving appliances or impede escape routes.

Requirements are provided for the fuel tanks, fuel containment system, access or other openings to hazardous areas, fuel piping, propulsion, fuel supply system and minimizing the probability of a fire or explosion. The fuel containment system shall have an at least equivalent level of safety to a conventional oil-fuelled ship. Provisions are addressed for fuel tank venting and the gas freeing system, inerting and atmospheric control within the fuel storage system. Materials and general pipe design and provisions for bunkering is addressed.

A safe and reliable distribution of fuel to consumers is requested by defining requirements and provisions for the fuel supply system, e.g. by an outer pipe or pipe duct, a redundant fuel supply, safety functions of the fuel supply system and fuel preparation spaces and fuel pumps. The safe and reliable delivery of mechanical, electrical or thermal energy is requested by addressing functional requirements and provisions for dual-fuel and single fuel engines.

The goal and functional requirements for providing fire protection, detection and fighting for all systems is given as well as for explosion prevention and area classification. A prescriptive area classification is provided in the interim guidelinesand as an alternative area classification according IEC 60079-10:1 is proposed with special consideration by the Administration. Ventilation requirements, provisions for electrical installations and for bunkering, training and operation are given in the last chapters.

2.6 European Committee for drawing up Standards in the field of Inland Navigation (CESNI), European Standard laying down Technical Requirements for Inland Navigation vessels (ES-TRIN), Edition 2023/1

Fuels with a flashpoint equal to or lower than 55°C are currently addressed in the Chapter 30 Special Provisions Applicable to Craft Equipped with Propulsion or Auxiliary Systems Operating on Fuels with a Flashpoint equal to or lower than 55°C of the ES-TRIN rules. Propulsion and auxiliary systems operating on these fuels may be installed on craft provided the requirements in this chapter and Annex 8 of ES-TRIN is complied with. Annex 8 of ES-TRIN consists currently of three section applicable to the fuel storage of Liquefied Natural Gas, Methanol, Hydrogen and Energy converters.

The Chapter 30 is containing provisions for:

- Definition
- Scope of application
- General
- Tasks of the inspection body and technical service, documentation
- Risk assessment
- Safety organisation
- Marking
- Independent propulsion
- Fire safety
- Electrical installations
- Control, monitoring and safety systems
- Testing

The Annex 8 Supplementary provisions applicable to craft equipped with propulsion or auxiliary system operating on fuels with a flashpoint equal to or lower than 55°C is providing in Section I-III requirements for Liquefied Natural Gas, Methanol and Hydrogen. Where the chapters for Methanol and Hydrogen are currently left void. The publication of the requirements for Methanol is planned with the ES-TRIN 2025 edition. Details are provided for:

- Definitions
- Fuel storage LNG,
- Fuel storage Methanol (left void)
- Fuel storage Hydrogen (left void
- Energy converters Propulsion or auxiliary systems with fuel cells

- Energy converters Propulsion or auxiliary systems with internal combustion engines using LNG as primary fuel
- Energy converters Propulsion or auxiliary systems with internal combustion engines using methanol as fuel (left void)

A risk assessment is required for all concepts and configurations addressing risks arising from the use of the fuel affecting people on board, the environment, the structural strength and the integrity of the craft. The risk assessment shall include at least a HAZID and the classification of hazardous areas. As a minimum the HAZID shall consider the following risks:

- hazards associated with physical layout,
- the mechanical damage to components,
- operational, maintenance, cargo-related and weather-related influences,
- electrical failures,
- unintended chemical reactions,
- release of toxic vapours,
- self-ignition of fuels,
- fire,
- explosion,
- temporary power outage (blackout),
- flooding of water in parts of the craft which may contain fuel or hazardous vapours,
- craft sinking

Furthermore in regard to potential fire or explosions in parts of the craft which may contain fuel or hazardous vapours, this shall not:

- damage or disrupt the proper functioning of equipment/systems located in any space other than that in which the incident occurs
- damage the craft in such a way that flooding of water below the main deck or any progressive flooding occurs
- damage work areas or accommodation in such a way that persons who stay in such areas under normal operating conditions are injured or exposed to hot temperatures or toxic substances
- injure persons as well as prevent persons' access to life-saving appliances or impede escape routes either by physical blockage, heat or toxic substances

2.7 European Committee for drawing up Standards in the field of Inland Navigation (CESNI), LEAFLET ON DELIBERATION ON DEROGATIONS AND EQUIVALENCES OF TECHNICAL REQUIREMENTS OF THE ES-TRIN FOR SPECIFIC CRAFT, March 2019

Craft operating on the Rhine and in the EU waterways are to be compliant with the technical requirements of the ES-TRIN. A Rhine vessel inspection certificate or a Union certificate for inland navigation vessels issued by the national competent authority confirm this compliance. Derogations to the technical requirements of the ES-TRIN are allowed in justified cases in order to encourage innovation and the use of new technologies in inland navigation and when technical requirements are technically difficult to apply or where their application might entail disproportionate costs. The "Leaflet on deliberation on derogations and equivalence of technical requirements of the ES-TRIN for specific craft" providing support and guidance in this certification process. The following details are provided in this leaflet:

- Inland navigation vessel certificate
- Possibilities for international derogations to the technical requirements
- Advantages of an approval of derogation at CCNR or European Union level
- Derogation approval validity period
- Application for approval of derogations and examination of application documents in practice

Responsible for initiating this derogation process at his national competent authority is the ship owner. This authority is responsible for examination of the application and decides together with the owner whether the vessel should receive a Rhine certificate or a Union certificate. Depending on this certificate decision the member state applies to the Central Commission for the Navigation of the Rhine or CESNI Committee for approval to derogate from ES-TRIN.

The procedure for application and approval consists of three basic steps: preparation of a technical file, technical examination by an international working group (either CESNI/PT or RV/G) and administrative validation by international bodies. A summary of the procedure is provided in the following figure.

Steps	**Type of certificate**	
	Rhine vessel inspection certificate (request for derogation according to RVIR)	**Union certificate for inland navigation vessels** (request for derogation according to Directive (EU) 2016/1629)
I File preparation	Project initiators and national authority (3-12 months)	
II Submission of the application	via the CCNR Secretariat in the case of the RV/G working group (max. 3 months, i.e. in good time prior to a meeting)	via the CCNR Secretariat in the case of the CESNI/PT Working Group (max. 3 months, i.e. in good time prior to a meeting)
III Technical examination	Working group RV/G (6-9 months)	Working Group CESNI/PT (6-9 months)
IV Approval process	CCNR (publication) (2 weeks)	Communication from the MS to the EC - adoption of the implementing act[3] (roughly 12 months)

Table. 1 Application and Examination, taken from [13]

3 Recommendation on rules and regulation

Developed rules and regulations represent the agreed safety-related state of the art at the time these rules were created. Depending on how the rules are designed, whether they are goal-oriented or prescriptive, new technical solutions or applications cannot be incorporated into the design of methanol-fuelled ships, or it may be difficult to do so. Additionally, further testing may be required to qualify other or novel technical solution.

In the following possible recommendations on rules and regulations, components and equipment and further area for investigation that emerged during the FASTWATER project are presented. These components, regulatory aspects or technical alternatives have been identified in technical discussions and interviews held with the individual project members.

3.1 Fuel pipe systems

Flexible hose assemblies could be advantageous in retrofitting conventionally powered ships. Flexible double-walled pipeline systems, such as the "FLEXWELL safety pipe", can simplify the conversion from conventional fuels to methanol.

Figure 2 FLEXWELL Safety Pipe, taken from [20]

The use of flexible pipeline systems or flexible hose lines is generally possible according to the rules of the ship classification societies. The use of flexible hose lines for the connection of e.g. replaceable fuel tanks or as bunker hoses is generally intended. However, they are subject to limitations when used as a piping system in the ship.

The current prescriptive regulatory approach takes them into account to compensate for relative movement. They should be short in length, the number of these pipes should be kept to a minimum, they should be shielded when carrying flammable media and hot surfaces are present and they should always be accessible and inspectable. When used as a fuel line, they should be fire-resistant and tested according to certain standards (ISO6802/6803, ISO15540/15541, ISO10380). See also LR Rules for Ships Part 5, Chapter 2 Section 7 Flexible hoses.

It can be concluded that these prescriptive requirements are driven by the higher failure probabilities of flexible hose lines and, in the case of fuels, have additional requirements to take into account the increased risk potential in the event of a release. A direct transfer of these requirements is only possible to a limited extent due to the different design, properties and operating conditions. Basically, for parts and components that are not yet covered by the current regulations or that deviate from existing regulations the Alternative Design & Arrangement process can be applied. In principle, the intended component would have to be tested regarding its suitability for the intended application.

The LR Guidance Notes for Appraisal of Flexible Pipe Systems is reflecting these requirements and can provide additional guidance. Regardless of the existing design for these double walled flexible piping components, the application-specific requirements must be determined and proven, or the technology qualification process must be carried out and completed.

3.2 Fuel tanks

As a measure to avoid holding an ignitable atmosphere tanks are often inerted. This is required, for example, for fuel tanks for ships according to [2] and [4]. For inland water ships that want to use methanol as fuel, an approach was chosen that allows non-inerted tanks under certain conditions. With the limited capacity of cargo tank and with the assumption that a static charge would not be considered as a source of ignition [21], cargo tanks may not be inerted either. The "Vicuna" accident report [23] lists a faulty charge pump as a possible source of ignition within a non-inerted tank.

Driven by the current regulations under certain regulations non-inerted tanks might be acceptable. The required risk assessment in the applicable regulations shall demonstrate that alternative fuelled ships still have a sufficient or even the same level of safety as conventional fuelled ships. It is recommended that all potential source of ignition will be carefully considered in the applicable risk assessments for low flashpoint applications on ships. While inerting is a suitable method to mitigate the risk of the presence of an ignitable atmosphere.

3.3 Fuel piping simplification

New technologies and developments are generally more expensive than existing, established and optimized systems and applications. In order to enable adoption and acceptance of new developments and technologies with equivalent safety, regulations can be formulated goal-oriented so as not to exclude later, cheaper and equivalent technical solutions.

If prescriptive requirements are applied, they should, if possible, achieve the specifically necessary afety level. Piping systems and external pipelines are subject to specific requirements regarding production and inspection depending on their risk. Pipes for toxic media are generally classified in the highest pipe class. Reducing the substances only to the properties of toxic and non-toxic means that, for example, the same requirements exist for methanol and ammonia. The individual limit values for these substances and their impact on the human body are significantly different. Adapting these requirements, taking the individual hazardous substances into account, could enable cheaper and equivalent technically safe solutions depending on the medium. And thus support early market acceptance.

3.4 Detection simplification

A release of methanol must be prevented due to its flammability but also due to its impact on the human body. With regard to flammability, there are secondary barrier concepts or classification as hazardous areas. There are maximum workplace concentration values for people in the respective countries. These regulations, for example the Occupational and Safety Act and Hazardous Substances Ordinance, require monitoring and limiting the atmosphere with regard to vapor concentration in the workplace. Currently the interim rules for inland waterway vessels require an alarm at 250 ppm for ventilated engine rooms.

Detection systems must be arranged in such a way that they can also detect relevant concentrations. Room layout and mandatory ventilation can make the actual detection more difficult and affect the quality of the results. Compared to other known low-flashpoint fuels and conventional fuels, methanol has different physical properties in terms of flammability and vapor formation. The current rules are prescriptive regarding the detection of methanol.

In the case of potential leaks, one could assume that these values would quickly be exceeded. On the other hand, a detectable gas phase must be able to form at all, which requires a corresponding energy input into the liquid if the hull is also cool. In addition, in piping systems with low-flashpoint fuels, flange connections should be reduced as much as possible in order to reduce potential sources of leakage.

In-depth knowledge of the expected leaks or continuous release, both during normal operation and in the event of damage with the potentially forming methanol vapours, would be helpful in order to achieve an optimized detection system for leak monitoring, taking into account the limit values for ignitability and maximum exposure levels for people[25].

3.5 Safety system standardization

Ships and their onboard systems are built in small numbers. Although ships and their systems have to meet the same regulatory requirements, the fuel systems can differ in scope and detail. This then also affects the associated monitoring and alarm system of the fuel supply system and energy converter. Alarm messages can, for example, be triggered by the following events:

- High, high-level
- Loss of ventilation
- Gas detection
- Shutdown
- Liquid methyl/ethyl alcohol detection
- Vapour detection
- Pressure high
- Temperature high
- Communication failure
- Pressure low
- Valve actuating medium failure
- Fire detection
- Automatic shutdown
- Emergency shutdown
- Fuel vapour concentration high
- Ignition failure
- purging failure
- misfire

To train the crew regulatory requirements are provided for drills and Emergency exercises. But also, operational procedures for the loading, storage, operation, maintenance, and inspection of systems for gas or low-flashpoint fuels shall be developed. These procedures shall minimize the risk to personnel, the ship and the environment that are consistent with practices for a conventional oil fuelled ship whilst taking into account the nature of the liquid or gaseous fuel.

Different people can work with such systems in everyday business life. The ship's crew during normal operation or special maintenance personnel for special systems such as the combustion engines or fuel cells. In order to promote the acceptance of such new systems and to operate them safely, this broader group of people must also be taken into account. Here, standardization of systems, alarms and types of alarms as well as training of personnel normally not on board of ships could support safety and the acceptance of new systems.

3.6 Release scenarios and hazardous atmospheres

In the currently developed regulations for ocean-going ships and inland waterway ships, the safety level should be at least as high as that in ships with conventional fuels. The main challenges are the knowledge about potential leaks and releases of the new fuels and the potentially dangerous atmospheres that can form. And thus also the necessary knowledge of effective measures to prevent the formation of these atmospheres if the release cannot already be constructively avoided. This is reflected in the regulations through appropriate prescriptive or goal-oriented regulations. Furthermore, risk assessments are required, which are required and described to varying degrees and in detail in the respective rules for inland and ocean-going ships in order to achieve the equivalent level of safety.

These risk assessments are carried out with facilitators and subject matter experts to identify the risks and assess the frequency of occurrence and consequences. The result of this working group may be that existing protective measures or known technical solutions are considered sufficient or that further studies are required to achieve the required level of safety. Existing solutions are often preferred as a consequence. Further time- and cost-intensive studies are often not preferred for these reasons, although they might support to identify alternative solutions. Reference is made to chapter 3.3.

Both in practical tests carried out by individual engineering offices involved in the development of ship concepts as well as studies by various institutes [18] regarding knowledge gaps as well as, for example, the discussions in the IMO and IACS committees regarding the functional requirements of cofferdams or requirements regarding exceptions to their necessity indicate a need for further clarification and, if necessary, research.

Please also refer to Chapter 3.8 of this report. For example, the study CCC 9/INF.23 points out that most regulations for methanol in MSC.1/Circ.2 are based on those for LNG [5] and the requirement for a 30 air changes per hour or ventilation rate for the fuel preparation room is questioned. A finding of this study is that a ventilation rate of 15 ACH may be sufficient for a conventional leak scenario to keep the vapor concentration below 20% LEL. However, liquid surface areas and air change numbers were also identified, which can lead to an increase in the methanol concentration. A corresponding proposal to revise MSC.1/Circ.621 was submitted to IMO.

The regulatory requirements for tanks and their bunkering facilities for inland vessels and ocean-going vessels differ with regard to the safety distance to the ship's outer skin, inerting, bunker hose and hose coupling. Please also refer to Chapters 3.2 and 3.8 of this report. Type-tested bunker hoses are required for ocean-going ships. Dry break away couplings on inland vessels only if they are identified as necessary in the risk assessment or required by local regulation.

The need for further studies is justified in [18] as follows:

- The hazardous event has the potential of being unacceptable from a risk point of view but knowledge, know-how and tools currently available are insufficient to enable a proper analysis of this event. As a consequence the probability of occurrence of the event and/or the consequences following the event cannot be determined with sufficient confidence [18].
- Prescriptive regulations, intended to cover an event or set of events, are too restrictive from a design point of view, while it is believed that alternative safety measures may be less restrictive while still providing sufficient safety, equivalent to the safety attained by complying with the prescriptive regulation [18].

Furthermore, the lower evaporation rate of methanol was highlighted, which is disadvantageous in the combustion process of engines, but advantageous in case of unintentional release and therefore potential slower formation of flammable and toxic vapour. The possibility of vapor release below waterline and if vapor will break through the waterline is highlighted as a knowledge gap to be closed using under water venting tests. The prescriptive requirement for cofferdams has been considered as restrictive as the volumetric energy density of methanol is half the density of marine diesel oil. The additional space required for these tanks and cofferdams indicate the worth for investigating cofferdams with reduced width or other arrangements which don't require a cofferdams. For cofferdams typical research questions have been provided in [18] with:

- What is the likelihood of a (double) breach?
- What is the environmental effect of a methanol spill?
- Is a cofferdam surrounding the fuel tank necessary? If yes, what are the minimum physical layout requirements of the cofferdam and steel plating?
- How to contain the risk of an explosive and flammable atmosphere at the location of the tank rupture?
- When spilling the methanol into the surrounding water, is there a methanol and air mixture at the surface of the water which is flammable, considering the leaking rate and pressure drop?
- How quickly does the methanol dissolve in the water?
- How quickly does the vapour dilute and spread?

The following recommendations have been given in [18] for the identified knowledge gaps:

- Acquire statistics on bulkhead fire exposure in terms of probability of occurrence and thermal load.
- Develop a simple calculation model on heat transfer towards methanol fuel tank when subjected to fire or sun radiation, in conjunction with fuel evaporation and vapour pressure build up.
- Develop a research project aiming at exploring the concept of ship structural crashworthiness with regard to protecting fuel tanks against collision and grounding.
- Investigate the severity of loss of containment of methanol following a ship collision, with special attention for LOC above the WL of liquid and vapour simultaneously.
- Develop a validated calculation model for methanol vapour venting below the waterline, predicting methanol vapour concentrations on deck, to be compared with allowable toxicity levels.

- Conduct an extensive quantitative risk analysis on a conventional fossil fuel system in order to determine the locus of such a system in the risk matrix, to be used as a reference for equivalent safety as stipulated by IMO.

The low evaporation rate compared to other fuels or LNG could also be considered in relation to leakage scenarios during bunkering. On the one hand, the free surface of escaped methanol should be kept small in order to limit the released vapor and quickly dilute it below LEL. On the other hand, released methanol could be diluted by a water spray system so that no ignitable vapor can be formed. Further studies would be necessary to detail these concepts and to demonstrate that these concepts have at least the same level of safety as ships powered by conventional fuels.

3.7 Airlocks

Airlocks preventing a hazardous area will be extended to an attached non-hazardous room by opening a common door. Therefore, for direct access from non-hazardous areas to hazardous areas airlocks shall be provided. Regulations for airlocks typically addressing requirements for gas tightness, minimum door spacing, ventilation and alarm. It can be assumed that typical airlock regulations are based on horizontal accessible locks. Current ships with space limitations and low-flashpoint installations might require airlocks where horizontal access might not always be possible. Guidance for vertically accessed airlocks meeting applicable regulations for ocean going or inland water ships might allow the installation of fuel equipment on ships with space restrictions.

3.8 Tank concept

IMO regulations and LR Rules require that integrated fuel tanks shall be surrounded by protective cofferdams. An exception is made for tank surfaces bound by ship shell plating below the possible water line. For Methanol fuel tanks on inland water ships a different approach has been proposed. This proposal considers a concept of inerted and non-inerted tanks with potential single barrier at tank top and at the outer shell. Reference is made to the specific rule proposal for inland water ships.

Current ship projects indicate the challenge to incorporate tanks with cofferdams due to on one side the given space restriction and on the other side the required increased tank capacity. In addition, inland water cargo ships might have no significant draft if empty. On regulatory level as well in current methanol fuelled ship concepts discussions are taking place under which condition cofferdams might not be required. These discussions are taking place for example if tanks can be attached to other tanks (cargo tanks, ballast tanks), if tanks can be attached to dry cargo space which is considered as hazardous and if a tank top is attaching the open deck. Further interpretation on tank arrangement will be expected from the classification societies.

Potential concepts for inherent safe single barrier tank might be investigated and developed comparable to cargo tanks for gas carrier. Inland water ships are typically not subjected to the dynamic loads as ocean going ships are subjected. The tank design and fabrication might be improved in respect to weld design and potential crack size and growth. Corrosion mechanism need to be identified and controlled. Review and confirmation of successful fuel tank operation experience needs to be provided.

3.9 Secondary barrier fuel pipes

Fuel pipes run through enclosed spaces in ships or below deck should be enclosed in a secondary barrier. For low flashpoint fuels the secondary barrier is typically ventilated with 30 ACH. However, according to the regulations for gas-fuelled ships, inerting the annular space is also permitted as an alternative to ventilation. While CESNI requires a secondary barrier for leakage limitation and detection. As an alternative, annular spaces with vacuum have been used for low flashpoint fuels. Liquid detectors could also be used as a method for leak detection. Due to the liquid state of methanol and the necessary vapour formation in the event of a liquid leak, detection with gas sensor can be difficult or detect the leak quite late. Taking goal-based requirements into account would keep these regulations technically open and enable alternative solutions.

3.10 Hazardous area concept

Requirements for hazardous areas are e.g. listed in the Rules and Regulations for Gas-fuelled Ships and the European Standard laying down Technical Requirements for Inland Navigation Vessels. The requirements can be based on both prescriptive and IEC standards. While prescriptive zones and their sizes allow a quick and easy assessment of the ship specific concept, the assessment using IEC standards is more ship specific.

Both methods are based on first determining the appropriate type and size of the zones. For ship designs for which these zones are not a restriction, this may be sufficient as this process is quick and cost-effective. In many cases, however, potential zones are either not desirable at all or should be as small as possible. This applies for example to the large zones around the ventilation masts, zones in the area of cargo operations, zones that can spread to other ships, zones affecting other ships in locks or affecting the lock operation in general, the potential existing zones on ships with public on board.

The existing regulations are conceptually structured in such a way that these hazardous area dimensions are calculated. Especially with the prescriptive requirements an improved regulatory detail with the aim of reducing these zones as much as possible would be helpful.

Active dilution concepts can be used to reduce the extend of hazardous areas. Potentially released flammable gases can be actively diluted so that no dangerous hazardous areas remain or will be reduced as much as necessary. It would be beneficial for users in the conceptual design of methanol-fuelled ships if supporting rules are developed which enable a simple, quick and cost-effective hazardous area concept.

4 REFERENCES

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5 ANNEXES

5.1 Annex A: Public summary

This report covers relevant safety regulations relevant to methanol fuel available to the time the report was prepared. Due to the current status of rule development on IMO or CESNI level different regulations and standards were identified. Based on the current status the following high level regulations were identified.

- Lloyd's Register, Rules and Regulations for the Classification of Ships, July 2023
- Lloyd's Register, Rules and Regulations for the Classification of Ships using Gases or other Low-flashpoint Fuels, July 2023
- Lloyd's Register, Ship Right, Additional Design Procedures, Risk Based Certification (RBC), September 2021
- IMO, MSC.1/Circ. 1621, INTERIM GUIDELINES FOR THE SAFETY OF SHIPS USING METHYL/ETHYL ALCOHOL AS FUEL, 7 December 2020
- European Committee for drawing up Standards in the field of Inland Navigation (CESNI), European Standard laying down Technical Requirements for Inland Navigation vessels (ES-TRIN), Edition 2023/1
- European Committee for drawing up Standards in the field of Inland Navigation (CESNI), LEAFLET ON DELIBERATION ON DEROGATIONS AND EQUIVALENCES OF TECHNICAL REQUIREMENTS OF THE ES-TRIN FOR SPECIFIC CRAFT, March 2019

Regulations for Methanol have been developed and released by IMO, CESNI and classification societies. Developed rules and regulations represent the agreed safety-related state of the art at the time these rules were created. Depending on how the rules are designed, whether they are goal-oriented or prescriptive, new technical solutions or applications cannot be incorporated into the design of methanol-fuelled ships, or it may be difficult to do so. Additionally, further testing may be required to qualify other or novel technical solution.

In this report possible recommendations on rules and regulations, components and equipment and further area for investigation that emerged during the FASTWATER project have been captured. These components, regulatory aspects or technical alternatives have been identified in technical discussions and interviews held with the individual project members. Recommendations addressing fuel piping systems, fuel tanks, fuel detection, safety system, release scenarios and hazardous atmospheres are provided in this report.

Name of responsible partner: Lloyd's Register EMEA

Name of responsible person: Torsten Hacker

Contact info (e-mail address etc.): torsten.hacker@lr.org