

Q&A sheet

Questions posed in webinar “Ammonia as a shipping fuel – Safety concept of the NoGAPS vessel design”, December 12

This Q&A sheet gathers all the questions posed in the webinar chat. The questions that were addressed in the webinar can be found at the end of the document with answers provided in the following [recording](#). Questions that weren't covered in the webinar have been answered below.

1. What is the expected lifetime of the design?

Typical lifetime of a vessel is around 25 years, but depends on the type and owner.

2. Page 14, is double-wall piping used for all NH₃-containing process lines? What is the philosophy behind?

General philosophy for non-gas carriers is that any pipe outside of the fuel handling/preparation room is double-walled piping. On a gas carrier, it is not necessary for a pipe within the Cargo Area (hazardous zone) to be double-walled, although we are considering it for the NoGAPS project.

3. Is there still a specific reason for planning a boiler on board?

This is still a need for heat onboard, even though the amounts can be reduced relative to conventional gas carriers. This includes the potential need for pilot fuel tank heating depending on the final pilot fuel options selected. At the moment, we are planning to have a conventional boiler (not ammonia-fueled).

4. Is the risk overview on page 12 for bunker adjusted after the design has been shifted to semi-refrigerated tank system, or is it for the fully pressurised design option?

The bulker design assumes a fully pressurized tank system and the risk overview on Page 12 is based on this configuration.

5. How to ensure containers and bulker are fully refrigerated (liquid, no fully vaporized)?

For semi-refrigerated and refrigerated tank systems, boil-off management is needed, which is typically done using reliquification.

6. Human factors analysis: will it cover other than crew e.g. tech. management, shipyard, repair teams, COM and the effect over time?

Human factors address human factors, crew training and behavior. The objective is to improve understanding of human factors risks so that appropriate guidance can be developed. This includes an early human factors screening assessment, safety critical task analysis, working environment health risk assessment, and competency development to prepare high-level competency requirements.

7. Which safety standards have been used for setting the maximum allowable leak of Ammonia within any enclosed or open area?

Class Guidelines provide guidance on difference ammonia levels that trigger either alarms or emergency shutdown systems. DNV sets a 30 ppm limit for exhaust, gas alarms at 150ppm and safety systems activated at 350ppm, for example.

8. In terms of a local fire case, is NH₃ released to ambient through a safety valve?

Not necessarily. In case of fire the ammonia fuel system can be shut down, but intentional release is not currently being discussed or planned.

9. Is there an ammonia vapor detection system in place?

Yes, in multiple locations where ammonia equipment and piping is located.

10. How do you deal with a oil spill outside engine room if there's no double piping?

For NoGAPS, there is double-walled piping within the engine room. Within the cargo area (hazardous zone), it is not required to have piping double-walled, however, we are considering this as an option to potentially reduce risk.

11. Was the reaction time of emergency shutdown systems investigated?

See IGC Code.

12. Would LH₂ be an option, since it is cryogenic below -250°C ?

For the NoGAPS project we have considered ammonia as a fuel. There are other projects studying the use of hydrogen as a fuel onboard.

13. Slide 26, is CO₂ or dry chemicals better than water than H₂O for engine room? When water is used, how to do with NH₃ water solution?

The firefighting systems are currently under further investigation, but CO₂, for example, could be an option for the engine room as well. Treatment of ammonia water solutions as part of the bilge system is under investigation. For the fuel supply system, ammonia water solution is stored in a tank and currently treated as a hazardous waste to be offloaded.

14. Do you think ammonia as a bunker fuel will be only available in few ports only ?

The MMMCZCS is investigating the scaling and uptake of the various fuels. As a starting point, there are a number of green corridor projects that will ensure supply in key locations or on routes or regions.

15. The route from GoM to Norway, where in Norway is this? And what will be the cargo?

We are not able to be more specific at this time regarding the exact location planned, however, the initial cargo for the vessel is intended to be ammonia.

16. It is strange how DNV allows the use of Ammonia as fuel on Gas carriers on case by case basis, since the Equivalents section in the IGC code clearly states that equivalents can be applied only if the Code allows such equivalency. The current IGC Section 16.9 clearly

prohibits Ammonia as fuel, so the text needs to change/revised before we have any Ammonia as fuel application on Gas carriers.

As IGC Code does not accept exceptions, ammonia as a fuel on gas carriers needs to be treated as an equivalence. While IGC Code Ch.1.3.1 can be interpreted different ways, it is our position that it is possible to utilize 1.3.1 in combination with 16.9.1 to claim equivalent safety. This approach has already been discussed and agreed with some flag states. Ammonia as a fuel is allowed by IGF Code and it is sensible to start with ammonia as a fuel on gas carriers. A change proposal to IGC Code to allow ammonia as a fuel has been submitted to IMO CCC8 and CCC9.

Questions answered in [webinar](#):

1. What challenges do you anticipate when a vessel entering ship yards / repair yards if any?
2. Are there unresolved challenges in achieving an acceptable risk level?
3. Slide 22, what type of SCR system technology is available?
4. Slide16; Why the bi-lobe tank is selected as cargo tanks?
5. Slide26; How to dispose water reacted with ammonia?
6. How does the design tackle slip?
7. How likely is it that an ammonia catcher/chemical absorption solution will be incorporated by DNV in their requirements?
8. What are the benefits of using GCUs instead of water absorption systems? are GCUs for ammonia commercially available?
9. Based on which criteria we decide between fully refrigerated, fully pressurized or intermediate design for ammonia storage? Is it vessel dependent?
10. What sort of PPE is proposed for engineer/engine crew doing routine maintenances on the FO system? Is there an ammonia vapour detection system in place?
11. Has SOPEP equipment update / response procedures for internal loss and spill into environments been considered?
12. Can one conclude one may see a road through achieve an acceptable risk level? Or do we have unresolved challenges?
13. Slide 22, What is the current emission limit of NO_x and NH₃ to ambient under regulation?
14. As N₂O has a very high GHG factor what levels are generated and is there any effective exhaust treatment options?