

Rose-Anne Hawkeswood

Sent: Tuesday, 26 February 2019 9:13 AM

Subject: Total Residual Chlorine

Dear Steve and Rose-Anne,

Grateful of you could urgently discuss with the EPA.

I have spoken to HoeghLNG overnight and we can provide the following information / advice on total residual chlorine from the regasification process and water discharge:

- 100% at 25ug/L using world best system will be do-able during normal operations (not initial commissioning phase). This will permit 5ug/L flex against the reliability of the test but Hoegh's operating experience with similar vessels is that they operate below 20ug/l consistently;
- Hoegh's Colombian records show that the FSRU has been able to maintain a total residual chlorine discharge of less than or equal to 20ug/L (noting the limits of the test is 20ugL) during normal operations, with very little variation.
- Water temperatures change tends to occur in 2 – 3 week patterns, so weekly testing should suffice to maintain levels. However, Hoegh have advised that manual testing every 3 days would also be fine, after the initial commissioning phase.
- They have also advised that if an elevated reading was received, it is a matter of hours for the changes in dosing to occur to return to the required levels and a follow-up test can be down to confirm the return to 20ug/L or less.
- They have also confirmed that if very elevated levels are recorded for some reason they turn off the MGPS which is producing the chlorine from the sea water by means of electrolysis. When turning this off, it is the marine growth protection system only that is turned off, the regasification process can continue as long as water is moving through the system.
- The MGPS could be turned off for 30 mins – 1 hour and the whole system would be back to normal seawater levels and the MGPS could be switched back on again and dosing re-commenced. This would not be long enough for marine growths to threaten the integrity of the piping.

I will separately respond re various scenarios re the possible use of MDO.



Kylie Hargreaves
Government & Stakeholder Relations

Rose-Anne Hawkeswood

Sent: Tuesday, 26 February 2019 10:45 AM

Subject: Other technology alternatives

Dear Steve and Rose-Anne,

Given the achievable results communicated this morning re residual chlorine, I am not sure if this is still required, but for completeness pls find below some additional information building on the info already provided in the Response to Submissions on the 4th of February in section 4.2 – Water Resources.

Possible Mitigation Measures investigated

1. Discharge to an alternative location – see Response, no feasible re-use of cold water nearby and delivery to marine environments beyond the Outer Harbour which are considered of higher value to inner harbour environments is not considered to lead to more favourable outcomes.
2. Manual Cleaning – not considered viable as requires the frequent stopping of operations, intensive manual labour, removal of marine growth and ultimately risks expensive damage to the ships systems.
3. Ultrasound via the use of transducers – not typically designed to deal with the volume of water coming from a FSRU in regasification mode, so cost of system at scale renders it economically unfeasible. The system would also require the supply of power from on-shore (not possible to power from the vessel), so would require reconfiguration of the vessel for on-shore power.
4. Use of diffusers – the current technology provider (Hoegh) has advised that any retrofit on the outlets which are designed to impede/redirect the current outflows will most likely result in built up / changed pressure within the piping system. These impacts would need to be modelled and their impacts on the functions of the systems assessed . They also advise that it would have zero impact on the concentrations at the outlet and most likely negligible impact on the mixing zone distances. Depending on the nature of the diffuser (eg. a vent in the outlet, a screen over the outlet, a unit attached to the side of the vessel and over the outlet, would all require different risk/impact assessments). Both Hoegh and Evoqua (MGPS tech provider) **have confirmed the use of diffusers on regasification outflows is NOT standard on any FSRU's they are aware of, hence the impacts would need to be assessed as described above before they could provide any advice on design, installation, operation and /or likelihood of any measurable efficacy .** Hoegh has re-iterated that the current MGPS they are using is world-leading technology and hence why Hoegh FSRU's are more expensive than other providers.
5. Dosing of regasification water with sodium sulphite – would require the retrofit of a holding /mixing tank to the current vessel, 140 kilograms of sodium sulphite to be added each day, throughout the day via a manual dumping of 25kg bags into the holding tank prior to discharge. Also requires transport/delivery/storage of large supplies of sodium sulphite – impacts which have not been modelled but given the current MPGS system does not add anything to the water and is below 2ug/L on the edge of the near-field mixing zone it is highly probable the impacts of this option would exceed the impacts of the current option. This is before the costs of the additional retro-fitting, manual opex and potential make-good costs are taken into consideration.

Given the above – the solution communicated earlier this morning around a more frequent manual testing of outflows is the most effective, reasonable and practicable option available.