

Mark Rice Environment Agency

Sue Sayer The Seal Research Trust

Mark and Sue -

This note responds to the letter from Sue Sayer of the Seal Research Group Trust, addressed to Mark Rice, which we received on May 27, 2023.

First of all, thank you very much to Sue for her continued involvement in the proposed project, and thank you for including us in the distribution. Having an open dialog is important and we appreciate her transparency.

We share a common desire with the Seal Research Trust: to maintain the health of the waters around Cornwall so that all marine animals can thrive. We have proposed addressing the tremendous ongoing harm of climate change in two main ways. First, to neutralise the carbon dioxide pollution that is increasing in the ocean every day, which is caused by excess atmospheric carbon dioxide and which is dangerous to all living animals in St. Ives Bay. Second, to slow the increase in carbon dioxide in the air so that the sea can heal and return to the abundance of previous generations.

We would like to respond to the points made in her note.

Baselining

There is extensive information already available on the chemical and biological properties of coastal waters in Cornwall. Planetary and PML Applications has collected some of that data, but most of it has already been recorded and catalogued in a number of locations. For example, the pH of St Ives Bay is known to vary significantly over the course of a year. The change in pH related to the proposed alkalinity addition even immediately adjacent to the outfall is many many times smaller than this natural variability.

Given strong natural variability across both space and time, and the very small chemical changes we expect to induce, we propose to monitor directly above the outfall and at stations located within the mid-field mixing zone suggested by our modelling work. We will also monitor at a control site located some kilometres away. By collecting data from all of these areas before,

during, and after the trial, we expect to learn a great deal more about both the natural variability in the system, and any detectable changes due to our trial (at areas very near the outfall).

We completed the two days of baselining referred to in the letter; they are only one part of our plan to conduct a detailed environmental survey of the seabed adjacent to the outfalls, within the mid-field mixing zone and at a control location. To our knowledge, this is the first study of the seabed of this type in the area in some time, and is an example of the additional data that our project will gather. We are committed to sharing this data with the public, local academics and important local groups like the Seal Research Trust.

Regarding additional projects

The waters around Cornwall are subject to increasing ocean carbon dioxide pollution, just like all ocean waters around the world. We are confident that our proposed project will provide evidence of safety, as well as efficacy in increasing the pH of the effluent so that it more closely matches the receiving waters.

In the letter, the Seal Research Trust indicates support for exploring ocean alkalinity enhancement as a potential solution. We agree. Safety and effectiveness has been clearly demonstrated in the lab. The next step in exploration is through small, highly controlled field studies. We have proposed a small short term trial, with very small and transient risks that are well understood and closely monitored. Further, we agree that the exploration must be carefully regulated by the Environment Agency with active input from the community.

We hope that we will be able to expand our projects in the future to increase their positive benefits. However, it is important to note that our current proposal is for only a small and very limited scope. Only after we see encouraging results would we seek to conduct follow on studies, and only with the full support and approval of the Environment Agency and after additional appropriate public comment. Additionally, we hope that we will be able to re-engage with the local communities in a fruitful and positive way in which they feel they have a real voice regarding whether we scale the projects toward full deployment and if so, under what conditions.

Regarding the <u>paper</u> (Liu, et. al. 2020) *Research progress in the environmental application of magnesium hydroxide nanomaterials*, we believe that we have already responded. The 'nanoscale solid waste' in this paper refers to solid sludge generated when large

volumes of synthetic nanoscale Mg(OH)2 is used within untreated, heavily polluted wastewater. The proposed trial here aims to add a very small amount of micron-scale Mg(OH)2 to treated effluent (solid sludge having been removed upstream).

For this reason, the paper is more relevant to industrial processing techniques and not to our work, which may explain why it has not been cited by any of the subsequent academic literature that discusses the use of Mg(OH)2 as a CDR technique. There is little reason to believe that the micron-scale Mg(OH)2 we propose to use will behave in the same way as the synthetic nanomaterial discussed by Liu et al., who specifically

highlight in their paper the limited propensity of traditional Mg(OH)2 to bind to pollutants due to its comparatively lower surface area and limited reactivity.

Nevertheless, we are acutely aware of the potential concerns regarding metals addition into the oceans. Trace metals testing, alongside monitoring for total suspended solids, form a core component of our safety monitoring.

Finally, it is worth noting that the existing widespread use of Mg(OH)2 to treat wastewater is further evidence for the safety of our process.

Regarding the <u>paper</u> (Hartmann et. al. 2023) *Stability of alkalinity in ocean alkalinity enhancement (OAE) approaches – consequences for durability of CO*₂ *storage,* the paper is essentially a study of what happens when different amounts and types of alkalinity are added to beakers of seawater.

In summary, the study concludes that at high concentrations, alkalinity can be lost due to precipitation. This would create results that are opposite of the goals of the Planetary project. For that reason, the addition that we are planning stays far below the amounts that are shown to cause precipitation.

Specifically, the study suggests that precipitation begins when alkalinity additions exceed 600 umol/kgsw. It's worth noting that our own laboratory work has led to similar results. The alkalinity additions we will generate in any part of St. Ives bay for the proposed trial are less than 10 umol/kgsw - more than 60 times less. Even if the project were to 'scale' in St.Ives over time, the alkalinity additions in the bay would remain far below this 600 umol/kgsw figure.

The research group who published this study continues to look closely at the potential inefficiencies in using products like Mg(OH)2 for mCDR. We are in contact with this group (like many of the top research groups), to share any new findings and discuss our company's next steps. It is our belief that this group, like the vast majority of the scientific community, feel that well-controlled and cautious field trials are a critical step to advance our understanding of this process. The passage highlighted in the letter - "Overall, the side effects of OAE on organisms, and more importantly on ecosystems, is largely unknown and deserves research at the experimental level to provide a better knowledge in order to make informed decisions on whether or not alkalinity enhancement is a feasible mitigation strategy" - is one that we whole-heartedly align with.

The overarching objective of this proposed trial is to advance scientific research, in order to allow for more informed decisions on whether or not this remains a feasible mitigation strategy.

Further, we believe that implementing this project now is well in line with the precautionary principle. The ocean generally, including St Ives Bay, is already

undergoing extensive change due to carbon dioxide pollution through the huge uptake of anthropogenic CO_2 as it equilibrates with the atmosphere. Without action soon, rising sea temperatures and increasing ocean acidification pose a very real threat to all local ecosystems. Precaution urges us to study this approach now so that we can validate safety and efficacy in advance of when the approach is required to be deployed at scale.

Our responses to the other items included, although they are not scientific questions, are as follows.

Regarding a request for a delay: the process that we propose is nearly identical to a process that is very well understood because it happens at many wastewater treatment plants all over the world. The only way to understand more about the potential impact in St Ives Bay specifically is to conduct the study which we propose. We fully support allowing all stakeholders the time to evaluate this project before moving to a full-scale deployment. Small trials like the one proposed here are necessary to inform these stakeholders in their evaluation of an eventual deployment. and assuming that they are properly permitted by the EA, should not be delayed.

Regarding the completion of an independent assessment, and public consultation by a statutory agency, we will follow the guidance of the Environment Agency.

Regarding the request to place a limit on the types of companies that are allowed to purchase carbon credits: we believe that this is unnecessary as well as out of scope at this time. While our reasoning is laid out in detail in the blog post <u>The Moral Question of</u> <u>Carbon Removal</u>, in essence all purchases of carbon credits at this time are essentially grants. Purchasers of carbon credits at this scale are kickstarting the carbon removal industry, not greenwashing. Nonetheless, we are happy to follow the guidance of the EA on this topic to assure the community that the primary purpose of this trial is a scientific endeavour.

Regarding the requests to create a greater carbon efficiency, and the viability of scaling, it should be noted that while the activity of adding alkalinity to wastewater is mature and well understood, the field of OAE is still early. As the purpose of this trial is research, it could be argued that a requirement for any net carbon benefit should not be necessary: regardless of the carbon intensity of the product, the same scientific aims would be accomplished. Despite this, Planetary has managed to develop a pathway that provides significant net carbon benefit that we intend to demonstrate through extensive 3rd party verification.

The carbon efficiency of a long term project in this area would be much higher due to local sourcing. Additionally, every tonne of CO_2 removed from the atmosphere is a tonne that will not acidify the ocean and the bay, so we consider all tonnes removed to be beneficial to the area. The viability of scaling is high as we continue to make progress on

our portfolio strategy of alkalinity sourcing. Finally, an additional peer-reviewed paper was recently published and describes the huge potential of exactly the process that we propose (Yang, et. al, 2023^{1}): "We conservatively estimate that $44.4 \times 10^{**9}$ tonnes of CO2 (~ 3.3 times the current annual CO2 sink in the ocean) could be removed from the atmosphere..."

We are happy to discuss further with the Seal Research Trust, other members of the community, and the Environment Agency. We reiterate our commitment to our <u>code of</u> <u>conduct</u> which requires us to strive for positive climate impact, follow the science, and communicate proactively, and to comply with the Agency's requirements and recommendations.

Sincerely,

Pete Chargin Vice President, Commercialization and Community Relations

¹ Seawater alkalinity enhancement with magnesium hydroxide and its implication for carbon dioxide removal, see here: <u>https://www.sciencedirect.com/science/article/abs/pii/S0304420323000476?via%3Dihub</u>