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Statement regarding – Notification from Denmark according to ECE-Convention on Environmental Impact Assessment in a Transboundary Context (Espoo Convention) concerning a project for carbon dioxide storage in the North Sea

The Swedish Meteorological and Hydrological Institute (SMHI) acknowledges the opportunity given by the Ministry of Environment of Denmark to supply a view on the proposed plans.

The preliminary EIA shows that oil spills from the reservoir are likely to enter Skagerrak with currents (Figure 13-3 in Preliminary EIA), and may even impact the Swedish coastline in the summer season. This also gives a clue that in the unfortunate scenario of a blowout, waters with pH less than 8.1 typical for the North Sea are likely to enter Skagerrak and Kattegat as well. Furthermore, there is a misconception on the pH variability of the North Sea that results in erroneous conclusions on the impact of low pH-waters. Consequently, SMHI suggests that Sweden continues to contribute to the EIA.

Consequences to consider in the EIA

The preliminary EIA states that the surface pH in the North Sea fluctuates naturally between ~7.5-8.6 with a reference to Bolding (2016, doi:10.2788/336630). Apart from

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a citation error (doi:10.2788/336630 refers to Stips et al. 2016¹), it is also an inaccurate interpretation. The variability is much less, in fact, Stips et al. (2016, Table 1 Approximate properties of seawater) present a singular pH value of 8.1 for the North Sea. This needs to be updated in the EIA and any conclusions on pH need to be updated based on this fact.

Also, a general suggestion on how to present oceanic pH. The color scale in a number of figures (e.g. Figures 13-9 to 13-11, 13-14 to 13-16) that show the pH distribution does not differentiate between pH values above 7.85 units. This limit is 0.25 pH units below the natural pH of the North Sea. A reduction in pH of this size is comparable to model projections for the end of this century in a high-CO₂ emission scenario, which is expected to have consequences for marine ecosystems and society (e.g. Bindhoff et al., 2019²). This highlights the need to choose a color scale that clarifies the distribution of waters with a reduced pH as well as waters within the natural pH range.

Blowouts

Release of CO₂ to the water column from blowouts is considered in the preliminary EIA. As is mentioned, the duration of blowouts is most likely short-term (~15 days) but may last up to 90 days. Simulated surface water pH from a short-term blowout is on average 0.6 units lower than unaffected waters (Figures 13-9 to 13-11). Since pH is on a logarithmic scale, this corresponds to a change in the hydrogen ion concentration of about 300%, which will have consequences for the local marine ecosystem. The coming EIA needs to address the dispersion of these low-pH waters over a considerably longer period (e.g. 90 days or more) and on a transboundary scale.

To fully account for a worst-case scenario with respect to the marine environment, SMHI suggests that the EIA includes a modelling assessment of a 90 days blowout. The dispersion of the affected waters needs to be accounted, both during the event and after. The investigated area should include a transboundary scale, i.e. extend into Skagerrak and Kattegat. Any deviations from the natural pH, also in the bordering seas, should be discernible in the resulting figures and/or tables.

Furthermore, it is also of interest to evaluate the impacts on the partial pressure of CO₂ (pCO₂) and calcium carbonate saturation state in a similar approach, since these parameters may affect marine organisms as well.

¹ Stips, A., Bolding, K., Macias, D., Bruggeman, J., & Coughlan, C. (2016). Scoping report on the potential impact of on-board desulphurisation on the water quality in SO_x Emission Control Areas, EUR 27886 EN. doi:10.2788/336630

² Bindhoff, N.L., W.W.L. Cheung, J.G. Kairo, J. Arístegui, V.A. Guinder, R. Hallberg, N. Hilmi, N. Jiao, M.S. Karim, L. Levin, S. O'Donoghue, S.R. Purca Cuicapusa, B. Rinkevich, T. Suga, A. Tagliabue, and P. Williamson, 2019: Changing Ocean, Marine Ecosystems, and Dependent Communities. In: IPCC Special Report on the Ocean and Cryosphere in a Changing Climate [H.-O. Pörtner, D.C. Roberts, V. Masson-Delmotte, P. Zhai, M. Tignor, E. Poloczanska, K. Mintenbeck, A. Alegría, M. Nicolai, A. Okem, J. Petzold, B. Rama, N.M. Weyer (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA, pp. 447–587. <https://doi.org/10.1017/9781009157964.007>.

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Leakage from the reservoir

SMHI suggests that the EIA should include a model projection for a continuous leakage, including an assessment on the dispersion of the affected waters. This is important knowledge since the timescale of the storage is well beyond the human life span and infrastructure to mitigate potential leaks may not be present in the future.

Finally, leakage of gaseous CO₂ is considered in the EIA, but nothing is reported on the potential release of CO₂-enriched brine. It would be useful if the EIA clarifies if this also is a possible scenario.

Head of Department of Community Planning Services Magnus Rödin has decided on this matter prepared by Ylva Ericson.

For SMHI

Magnus Rödin
Head of Department of Community Planning Services