MBK International Services Inc.
Sugar Land, Texas, USA
Telephone: +1 (281) 798-3882
Email: infor@mbkinternational.com
Website: www.mbkinternational.com

Title: The Unintended Consequences of Ocean Alkalinity Enhancement: A Cautionary White Paper

Executive Summary: As the climate crisis accelerates, interest in carbon dioxide removal (CDR) technologies is growing. One emerging technique, Ocean Alkalinity Enhancement (OAE), proposes adding alkaline materials to the ocean or discharging bicarbonate-rich wastewater to increase carbon storage. However, early studies like Delacroix et al. (2024), while suggesting short-term recovery of microalgae, are being misrepresented as evidence of long-term safety. This white paper advocates for a more rigorous, precautionary approach. It contrasts OAE's uncertain marine impacts with the terrestrial, traceable, and regenerative benefits of biochar.

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1. **Introduction: What is Ocean Alkalinity Enhancement (OAE)?** OAE involves introducing alkaline substances (e.g., $Ca(OH)_2$, $Mg(OH)_2$) into marine environments to enhance the ocean's capacity to absorb and store atmospheric CO_2 by converting it into bicarbonate (HCO_3^-). One proposed method repurposes treated industrial or municipal wastewater made alkaline by minerals, which is subsequently discharged into the ocean.

2. **Emerging Research and Misinterpretation of Findings:** A frequently cited study by Delacroix et al. (2024) explored microalgae responses to acute OAE exposure. Their findings showed initial stress followed by regrowth (especially with $Mg(OH)_2$), under highly controlled, short-term conditions. However, this has been inaccurately extrapolated to imply safety for long-term, large-scale OAE operations.

"The study examined algal regrowth after a single, brief exposure to alkaline conditions... it did not simulate long-term or cumulative ecological exposure."

Importantly, these experiments were performed in closed systems and did not account for dynamic ocean currents, trophic-level interactions, or repeated discharge scenarios.

3. **Key Environmental Concerns**

a. **Alteration of Ocean Chemistry:** The long-term and spatially widespread introduction of bicarbonate may disrupt the carbonate equilibrium, reducing the availability of carbonate ions (BCO_3), which are critical for calcifying organisms such as corals, shellfish, and certain plankton.

b. **Ecotoxicological Unknowns:** Elevated alkalinity and mineral concentrations can impair physiological processes in marine species. Long-term bioaccumulation and chronic toxicity studies are severely lacking. Toxicity profiles of dissolved metals (e.g., Ca, Mg, trace Fe) released in waste-derived OAE have not been adequately assessed.

c. **Ecosystem Disruption:** OAE may shift phytoplankton community structure, alter nutrient uptake, and cascade through the food web, ultimately affecting fisheries and marine biodiversity. Species adapted to narrow pH ranges are particularly vulnerable.

4. Regulatory and Ethical Considerations: OAE deployment is currently under-regulated. If adopted prematurely:

- Dumping practices could violate marine protection conventions (e.g., London Protocol).
- Data transparency and environmental liability may be elusive.
- A moral hazard emerges treating oceans as dumping grounds without full ecological accounting.

5. **The Biochar Alternative: A Land-Based, Verified Solution** In contrast, biochar:

- Permanently stores carbon in terrestrial soils.
- Enhances water retention, nutrient cycling, and crop productivity.
- Is verifiable and MRV-compatible.
- Avoids oceanic risks and strengthens food systems.

MBK's biochar production from FSC-certified biomass fosters a circular carbon economy. It restores land while providing verifiable carbon removal, with no unintended marine impacts.

6. **Conclusion and Recommendations**

Ocean Alkalinity Enhancement remains an experimental practice with many unanswered questions. While the climate crisis requires urgency, it should not justify environmental recklessness. We recommend:

- A moratorium on full-scale OAE deployments until long-term ecological data becomes available.
- Independent evaluations of alkaline discharge plans.
- A focus on established, low-risk solutions like biochar.

Disclaimer: This white paper is intended for educational purposes and to engage stakeholders. All data is sourced from publicly available research as of the publication date. MBK

International endorses transparent, science-based carbon removal methods that maintain ecosystem integrity.

References:

- Delacroix, F. et al. (2024). Ocean alkalinity enhancement impacts regrowth of marine microalgae...
- Ocean Visions (2023). Ocean Alkalinity Enhancement Initiative.
- IPCC Special Report on the Ocean and Cryosphere (2019).
- National Academies of Sciences (2022). A Research Strategy for Ocean-based Carbon Dioxide Removal.