Bridging Science and Practice: A Certification Protocol for CO_2 Uptake in Enhanced Rock Weathering

by *Oncra* – Open Natural Carbon Removal Accounting
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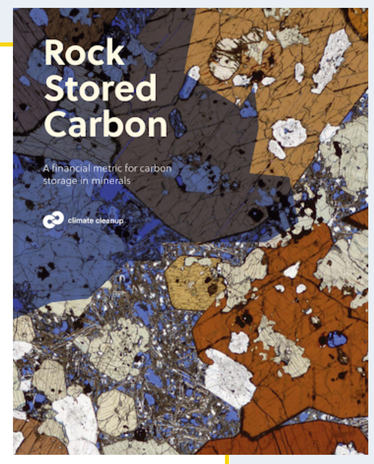
THE NEED FOR SCALABLE, TRUSTWORTHY CDR

Problem: **Scaling** the Carbon Dioxide Removal (CDR) industry is **critical,** yet, current certification methods are often **costly, complex** and **lack transparency**.

Solution? **Oncra's Rock Stored Carbon (RSC) protocol**:

- **Conservative, validated** method for quantifying CO_2 sequestration via **Enhanced Rock Weathering** (ERW)
- Addresses limitations of traditional certification systems
- Aligned with EU Carbon Removal and Carbon Farming (CRCF) Regulations[1]
- Built on Oncra's experience with land, construction, ocean, and rock-based protocols, all **developed for real-world implementation**



QU.A.L.ITY CRITERIA: ENSURING TRUSTWORTHY CERTIFICATES

QUANTIFY

Direct field measurements often lack clear signals: **predictive modeling** required. Oncra uses the **conservative**, **experimentally validated** Vink & Knops[2] Shrinking Core Model for mineral dissolution
→ **0.7-1.0** kg CO_2 per kg olivine, adjusted for MgO%

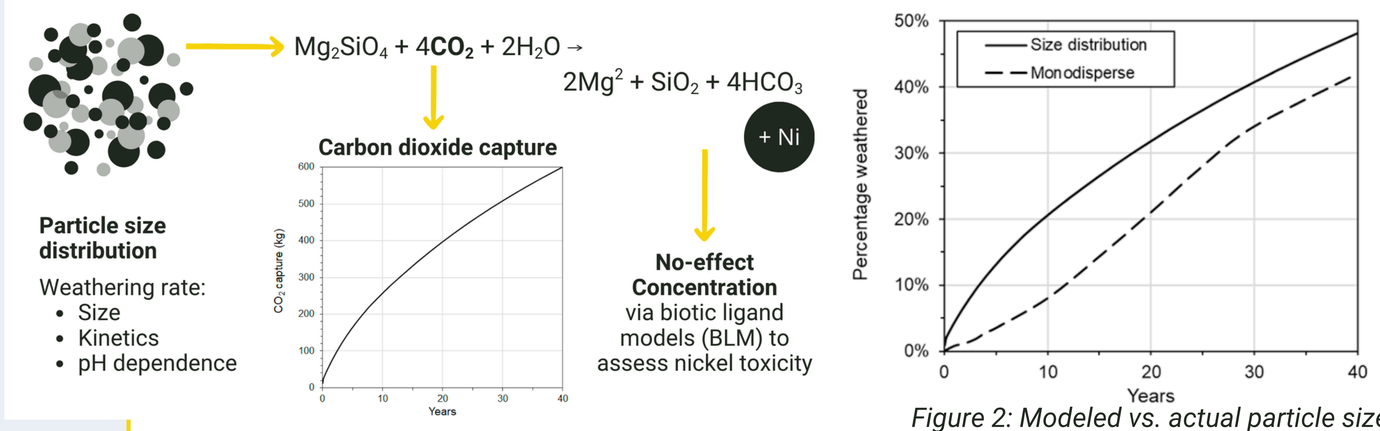


Figure 1: Graphical abstract, adapted from Vink & Knops (2023)

Figure 2: Modeled vs. actual particle size distribution effects on weathering[2]

ADDITIONALITY

- Ensures projects **only occur** due to carbon certificate revenue's **incentive**
- Revenue must fund additional carbon removal (**transition financing**)
- There is **no double counting**

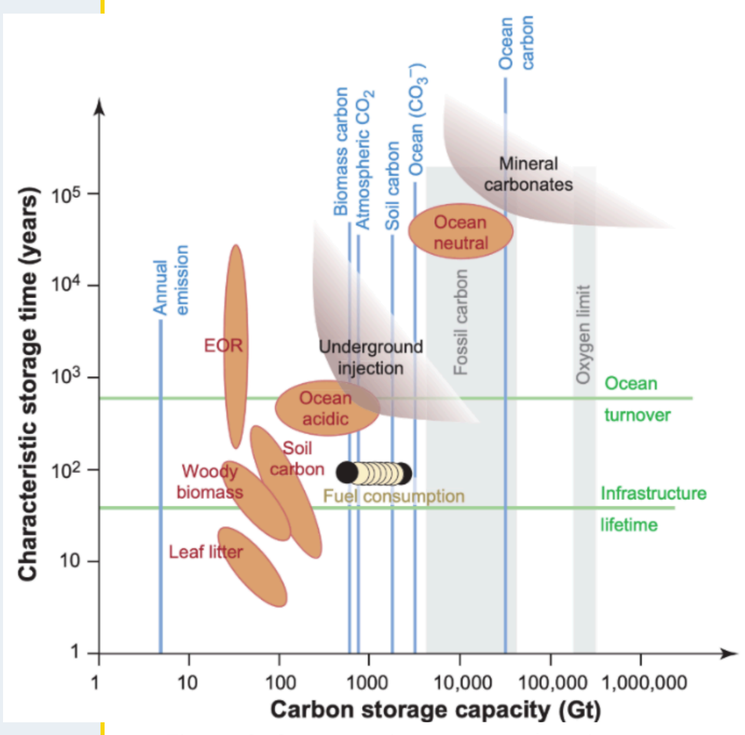


Figure 3: Comparative storage duration across methods[3]

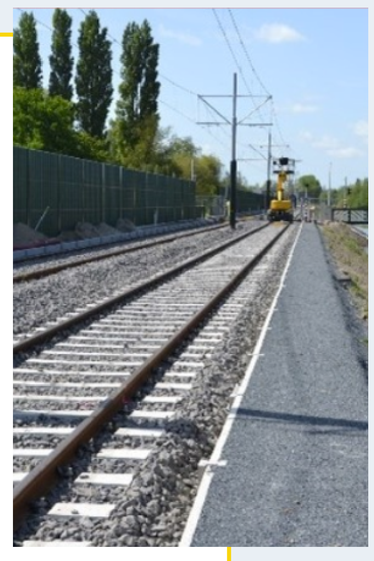
LONG-TERM STORAGE

- ERW stores CO_2 for **≥10,000 years**[3]
- Minimal risk of reversal

SUSTAINABILITY

- Projects must meet "**No Net Harm**": **neutral (or positive!) impact** on key area -biodiversity, water resources, and pollution prevention.
- Monitoring requirements scaled by project size and risk level (**proportionality principle**)

ERW IN PRACTICE: UITHOORNLIJN



Supplier: **GreenSand**
Client: **Amsterdam Transport Authority**

Many applications combine **CO_2 removal** with the **replacement of conventional civil materials** (e.g., inspection paths near railways). **Carbon credit revenue** helps bridge the **cost gap** between olivine and traditional materials.

CHALLENGES & CONSIDERATIONS

ENVIRONMENTAL RISKS

- **Trace metals**, especially nickel, are released during olivine weathering
- Higher doses increase the **risk** of Mg/Ca imbalance and metal uptake in crops
- Rising pH and Mg release can **mitigate nickel toxicity**[2]

→ Emphasizes the need for **responsible application** and **monitoring**

WEATHERING UNCERTAINTY

- Weathering rates remain uncertain in ERW

→ However, biological activity accelerates weathering[4,5], suggesting that current models are rather conservative

DATA LIMITATIONS

- ERW is nascent, with limited long-term data
- Startups face funding constraints

→ Predictive modeling is essential, but ongoing data collection and validation are critical

CONCLUSION

While some uncertainties remain, the **climate potential of Enhanced Rock Weathering is undeniable**. With **science-based** yet **practical** protocols like Oncra's, we have a clear path to scale this powerful solution.
By **acting now**, we become part of a meaningful solution.

References: **1.**Climate.ec.europa.eu/eu-action/carbon-removals-and-carbon-farming_en; **2.** Vink, J. P. M., & Knops, P. (2023). Size-Fractionated Weathering of Olivine, Its CO2-Sequestration Rate, and Ecotoxicological Risk Assessment of Nickel Release. Minerals, 13(2), 235; **3.** Lackner, K. S. (2003). CLIMATE CHANGE: A Guide to CO2 Sequestration. Science, 300(5626), 1677–1678; **4.** Schuiling, R. D., & De Boer, P. L. (2011). Rolling stones; fast weathering of olivine in shallow seas for cost-effective CO2 capture and mitigation of global warming and ocean acidification. Earth System Dynamics Discussions, 2, 551–568; **5.** Wilson, M. J. (2004). Weathering of the primary rock-forming minerals: processes, products and rates. Clay Minerals, 39(3), 233–266.