Scientists enhance Mother Nature's carbon handling mechanism

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Taking a page from Nature herself, a team of researchers developed a method to enhance removal of carbon dioxide from the atmosphere and place it in the Earth's oceans for storage.

Unlike other proposed ocean sequestration processes, the new technology does not make the oceans more acid and may be beneficial to coral reefs. The process is a manipulation of the natural weathering of volcanic silicate rocks. Reporting in today's (Nov. 7) issue of *Environmental Science and Technology*, the Harvard and Penn State team explained their method.

"The technology involves selectively removing acid from the ocean in a way that might enable us to turn back the clock on global warming," says Kurt Zenz House, graduate student in Earth and planetary sciences, Harvard University. "Essentially, our technology dramatically accelerates a cleaning process that Nature herself uses for greenhouse gas accumulation."

In natural silicate weathering, carbon dioxide from the atmosphere dissolves in fresh water and forms weak carbonic acid. As the water percolates through the soil and rocks, the carbonic acid converts to a solution of alkaline carbonate salts. This water eventually flows into the ocean and increases its alkalinity. An alkaline ocean can hold dissolved carbon, while an acidic one will release the carbon back into the atmosphere. The more weathering, the more carbon is transferred to the ocean where some of it eventually becomes part of the sea bottom

sediments.

"In the engineered weathering process we have found a way to swap the weak carbonic acid with a much stronger one (hydrochloric acid) and thus accelerate the pace to industrial rates," says House.

The researchers minimize the potential for environmental problems by combining the acid removal with silicate rock weathering mimicking the natural process. The more alkaline ocean can store carbon as bicarbonate, the most plentiful and innocuous form of carbon in the oceans.

According to House, this would allow removal of excess carbon dioxide from the atmosphere in a matter of decades rather than millennia.

Besides removing the greenhouse gas carbon dioxide from the atmosphere, this technique would counteract the continuing acidification of the oceans that threatens coral reefs and their biological communities. The technique is adaptable to operation in remote areas on geothermal or natural gas and is global rather than local. Unlike carbon dioxide scrubbers on power plants, the process can as easily remove naturally generated carbon dioxide as that produced from burning fossil fuel for power.

The researchers, Kurt House; Daniel P. Schrag, director, Harvard University Center for the Environment and professor of Earth and planetary sciences; Michael J. Aziz, the Gordon McKay professor of material sciences, all at Harvard University and Kurt House's brother, Christopher H. House, associate professor of geosciences, Penn State, caution that while they believe their scheme for reducing global warming is achievable, implementation would be ambitious, costly and would carry some environmental risks that require further study. The process would involve building dozens of facilities similar to large chlorine gas

industrial plants, on volcanic rock coasts.

"This work shows how we can remove carbon dioxide on relevant timescales, but more work is be needed to bring down the cost and minimize other environmental effects," says Christopher H. House.

Source: Penn State