

RUNNING TIDE

Deployment Summary

Sample 2023 Iceland Deployment

Abstract

This document was created at the completion of a Running Tide intervention and contains a Deployment Summary and Net Removals Statement.

This report demonstrates the net impact of our project on Earth's carbon cycle through the placement of passively drifting carbon buoys in the ocean. Biomass sinking in this ocean region accelerates the natural biological pump, while ocean alkalinity enhancement amplifies the solubility pump: both pathways provide durable carbon removal with a low risk of reversal.

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1. Deployment Summary

1.1. Overview

Deployment Overview	
Project	RT0001: Icelandic Pilot Project
Activity	IS-CD-10: Deployment 10
Departure Date	July 28, 2023
Project Proponent	Running Tide Technologies, Inc.
Others Involved in Deployment	[Redacted for privacy in sample report]
Permit(s) and/or Documents Indicating Permission To Operate	Permit for Scientific Research issued 07/08/22 by the Icelandic Ministry for Foreign Affairs
Prepared By	Running Tide Technologies, Inc.
Contact	reporting@runningtide.com
Date of Report	XX/YY/ZZ
Net CO ₂ e Removed	1,851.46

Documents Referenced	
Protocol	Framework Protocol for multi-pathway biological and chemical carbon removal in the ocean, v2.0 - Link
Quantification Methodology	Quantification Methodology v1.6.0 - [See docs.runningtide.com]
Environmental Considerations	Running Tide's Catalog of Environmental Exposures - Link

1.2. Description

This deployment was part of Running Tide’s 2023 Icelandic Pilot Operations: a joint commercial, applied science, and ocean modeling undertaking to activate, evaluate, and evolve Running Tide’s ocean carbon removal platform.

This deployment was a success. 90% of the carbon sank below 1,000 meters with a 95% confidence interval, durably moving carbon from the fast cycle to the slow cycle.


1.3. Deployment Details

1.3.1. Deployment Location

The vessel began placing the carbon buoys on July 30th, 2023, at 63.24667° N, 30.09333° W, and completed the deployment after 5 hours. The vessel operators used the tug’s onboard firefighting equipment at the deployment site to spray seawater onto the carbon buoys to fluidize them and push them into contact with the surface ocean.

1.3.2. Carbon Buoys Deployed

These carbon buoys are mixtures of sustainably sourced forestry residues, lime kiln dust, and water. All materials are mixed in Iceland.

Carbon Buoy Recipe		Metric Tonnes Deployed
Wood Coated with Alkaline Minerals	Lime kiln dust mixed with wood and water and passively cured	3,037.30
		
<p>Figure 1: The carbon buoys on the barge, composed of wood with alkaline minerals.</p>		

Carbon Buoy Materials	
Wood biomass	<p>The biomass for buoy production was sourced from Great Northern Timber in Nova Scotia, Canada, and consists of the following three categories:</p> <ul style="list-style-type: none"> • 92% by weight sawmill residues. This biomass is a residue by-product of existing operations and would have remained as fast-cycle carbon through combustion or decay. • 6% by weight excess pulp and paper chip production. This biomass was overproduction from a previous order and would have contributed to fast cycle carbon through combustion or decay. • 2% by weight low-grade pulpwood. This material is also a residue by-product and had to be removed from the forest and further processed, as opposed to the pre-processed materials described above. This biomass was considered “unmerchantable” – i.e., unsuitable for traditional harvesting or economic use – and was the by-product of existing lumber forestry operations, which is typically left in the woods as no regional market currently exists. Additional collection and processing emissions for this wood are taken into account within the project boundaries.
Lime Kiln Dust (LKD)	<ul style="list-style-type: none"> • Sourced from [European supplier redacted for privacy in sample report], LKD is a waste by-product of quicklime production. It is a mixture of CaO and CaCO₃ with small particle size, resulting in rapid dissolution in the surface ocean on the order of hours, effectively raising alkalinity in the area of application.

1.3.3. Verification Hardware Deployed

Carbon buoys were accompanied by verification hardware, designed and manufactured by Running Tide, to provide in-situ measurement of our deployment progress. The verification hardware has been designed to passively drift in the ocean currents. Therefore, these verification buoys may eventually be recovered either with an additional vessel or after drifting into coastal waters. As of this report, they continue to float in the North Atlantic, sending oceanographic data to Running Tide’s servers.

Verification Hardware	Model(s)	Qty	Data Collected
Camera Buoys	CB3	2	Photos of Cage Contents GPS Location Temperature Humidity of the electronics enclosure
Trajectory Buoys	TB3	25	GPS Location

1.4. Ocean Transport Observations

1.4.1. Observed Trajectories

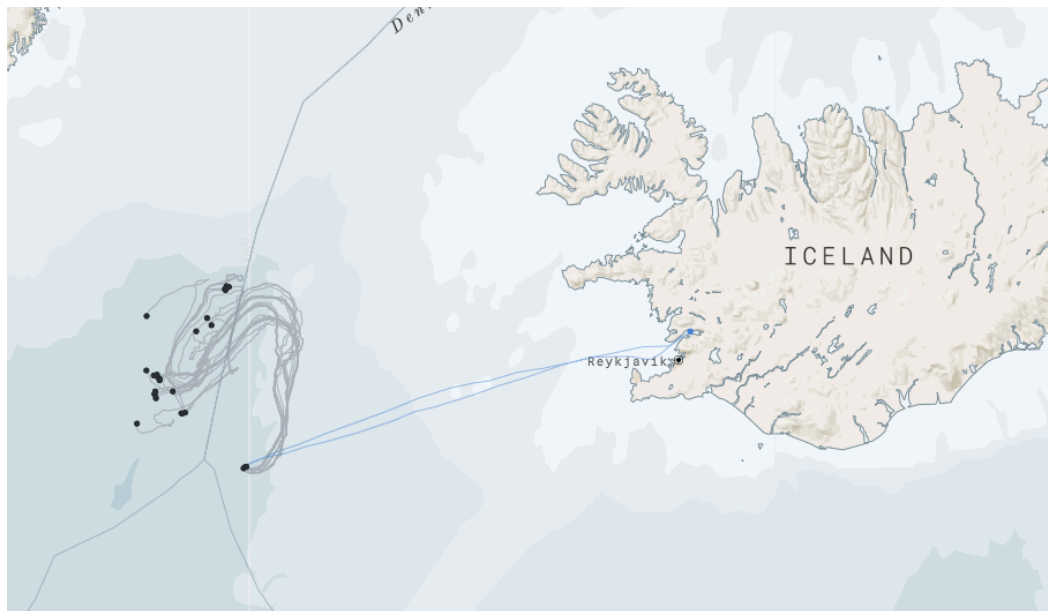


Figure 2: The approximate trajectories of the carbon buoy plume after being deployed. Each dot represents one verification buoy that sends Running Tide GPS coordinates to model the carbon buoys' terminal sinking location. The blue line represents the deployment vessel route.

1.5. Deployment Images



Figure 3: The tug sailing to the deployment location with carbon buoys in tow.



Figure 4: The empty barge after deployment.



Figure 5: A subset of photos from Camera Buoy CB3.4 on July 30th, 2023.



Figure 6: A subset of photos from Camera Buoy CB3.4 on August 22nd, 2023.

2. Net Removals Statement

The following section details the net removals of this deployment.

Net Removals	
Gross Tonnes CO ₂ e Moved Fast → Slow	2,222.11
Gross Tonnes CO ₂ e Emitted	370.65
Net Tonnes CO ₂ e Moved Fast → Slow	1,851.46

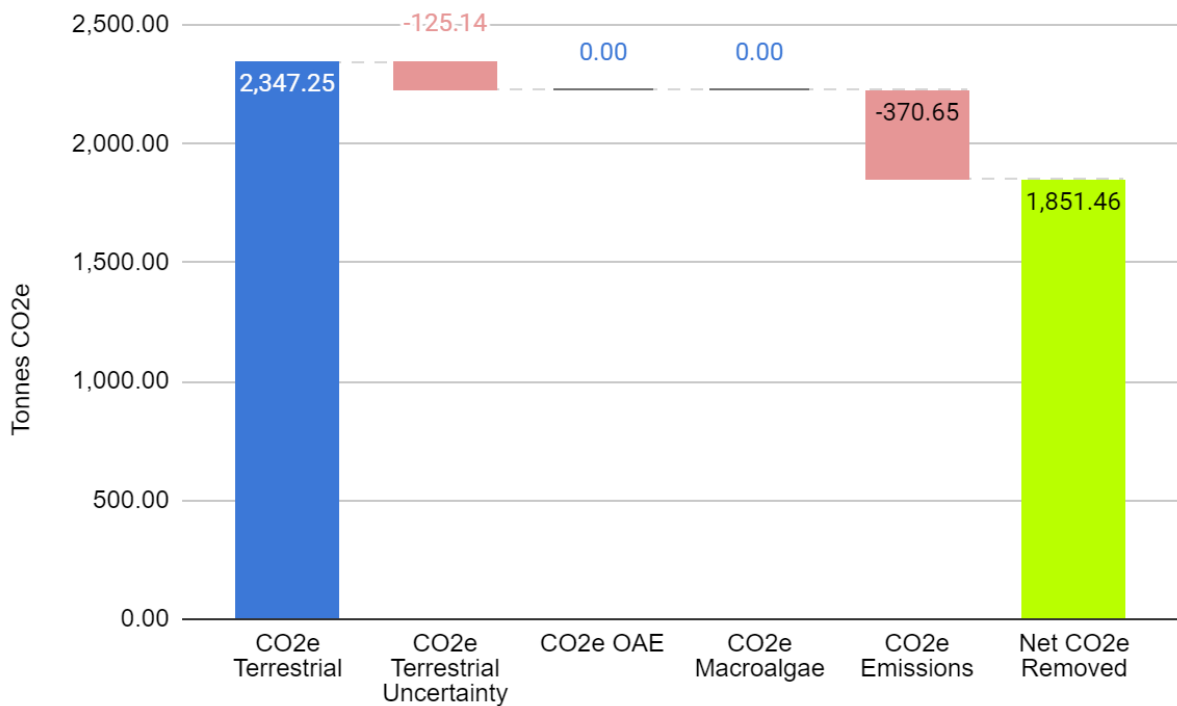


Figure 7: Net carbon removal histogram.

- CO₂eTerrestrial = CO₂ Removal by Sinking of Terrestrial Biomass
- CO₂eOAE = CO₂ Removal by Alkaline Mineral Dissolution
- CO₂eMacroalgae = CO₂ Removal by Macroalgae
- CO₂eEmissions = End-to-End System Emissions