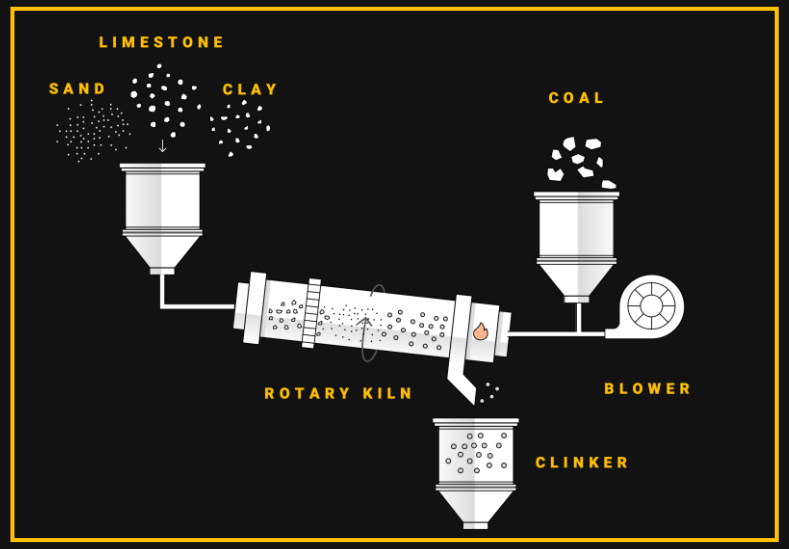
Sublime Systems

Electrochemically-Activated Silicates

ACI Spring 2025 – Emerging Technologies in Pozzolan

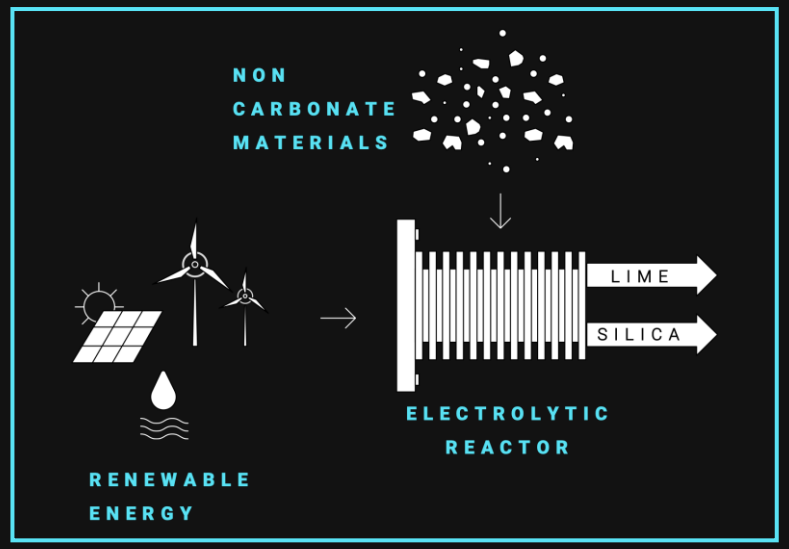
Sublime Systems eliminates fossil and limestone CO2 emissions while making the same hardened concrete



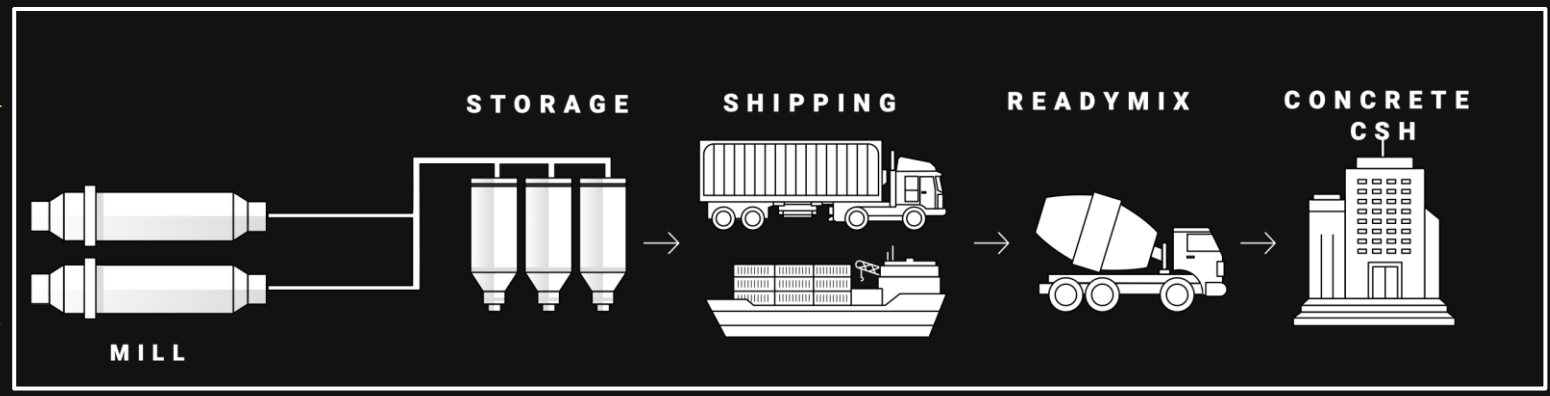
OPC Process

Coal + limestone = CO_2

1 tonne OPC = ~1 tonne CO_2



Downstream process



Drop-in replacement

Sublime Systems

Electricity + non-carbonate rocks = CO_2 avoided

Product

Sublime Process Overview

Sublime's process dissolves rocks into constituent minerals, so that we can assemble the ideal cement composition from pure components.

Feedstocks

Ca-Mg-Al-Fe- silicate rocks and industrial wastes (eg. Slag)

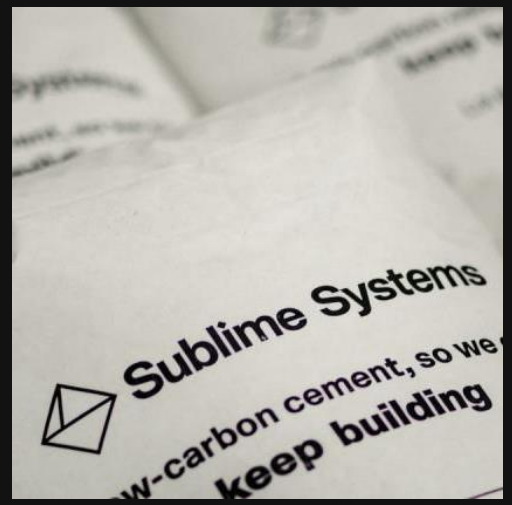
Sublime's Process

Intermediate Products

Reactive Silicates
SiO_2

Lime
$Ca(OH)_2$

Sublime Cement & SCMs

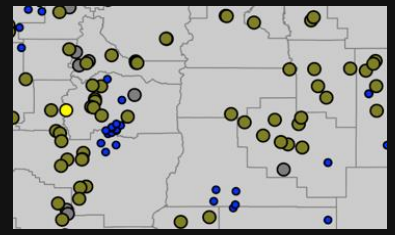


High-value co-products

Iron oxide pigments
Aluminum oxide
$Mg(OH)_2$

We've worked ***hard and fast*** to set up for scale

We are here

	2020	2023	2027	2030
Capacity	R&D Lab **1g** *Proof of concept* 	Pilot **250t/y** *Precursor to FOAK* 	1st Commercial **22kt/y** *Holyoke, MA* 	MegaPlant **1Mt/y** *Full-scale* 
Technology Readiness Level (TRL)	TRL 4	TRL 6 ✓ *1000+ hours of operations* ✓ *ASTM C1157 achieved* ✓ *Preliminary EPD*	TRL 7 ✓ *Lease activated* ✓ *DD complete* ✓ *State & local incentives obtained*	TRL 8-9 ✓ *Siting underway* ✓ *Early diligence complete on top pick*
Objective	Proof of Concept	Product / Process Validation	Build Full-Scale Production Customer Pipeline	Full Scale Deployment

How We Develop and Validate New Products

Sublime uses an iterative methodology: pilot production, test, validate, test with industry partners and incorporate feedback to continually improve our products

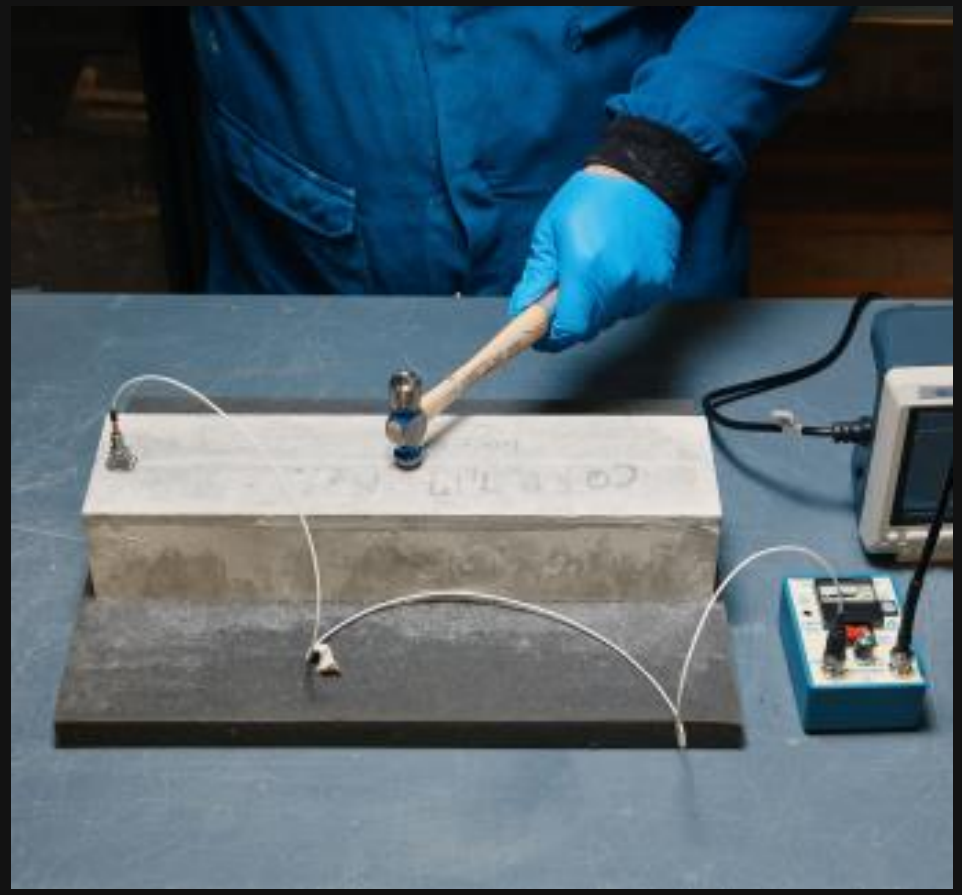
	Internal			External			
Phase	Process R&D	Calorimetry & Mortar Testing	Concrete Testing	Certified 3rd Party	Ready-Mix Lab Testing	Truck Trials & Mockups	Field Pours
Attributes Evaluated	- Particle size distribution - Morphology	- Reactivity - Workability - Water Demand	- Workability - Durability - Compatibility	- ASTM Compliance - SDS - LCA Analysis	- Trial Batching - Fresh & Hardened properties - Admixture Compatibility	- Plant Validation - Finishability - Impact of larger volume batching	- Pumpability - Finishability - Environmental Impacts

SEQUENCE

Sublime Cement™ shows **superior durability** to portland cement

When benchmarked against OPC, Sublime Cement outperforms in most key durability categories*

Property	Rating vs OPC
Alkali-Silica Reaction	Much Better
Chloride Permeability	Much Better
Electrical Surface Resistivity	Much Better
Drying Shrinkage	Better
Sulfate Attack	Better
Scaling Resistance	Comparable
Freeze-Thaw Resistance	Comparable



*Based on Sublime testing per ASTM and AASHTO

Sublime Cement: Validated by 3rd-Parties

ASTM C1157 compliance

October 12, 2023

AMERICAN ENGINEERING TESTING

To: Ms. Leslie Buzzell
CCed: Dr. Jesse Benck
Sublime Systems, Inc.
444 Somerville Avenue
Somerville, MA 02143

Subj.: Interim Report on Sublime Cement V1.0 Physical Testing
AET Project No. P-0021696

Dear Ms. Buzzell,

Attached are the referenced test results. You submitted a sample of "Sublime Cement V1.0" which arrived at AET on April 7, 2023.

At your request, the sample was tested in accordance with the referenced test methods of ASTM C1157/C1157M-23, "Standard Performance Specification for Cement". We understand this material is a proprietary formulation. However, test results obtained to date indicate that the material meets the performance requirements for Type GU, HS and MS cements, given in Table 1 of ASTM C1157/C1157M-23. Sulfate expansion testing is still in progress.

For further information, please contact me at the number listed below.

Sincerely,
American Engineering Testing, Inc.
An AASHTO Accredited Laboratory – Aggregates, Cement & Concrete

Report Prepared by:

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Principal Engineer
Concrete Materials Laboratories
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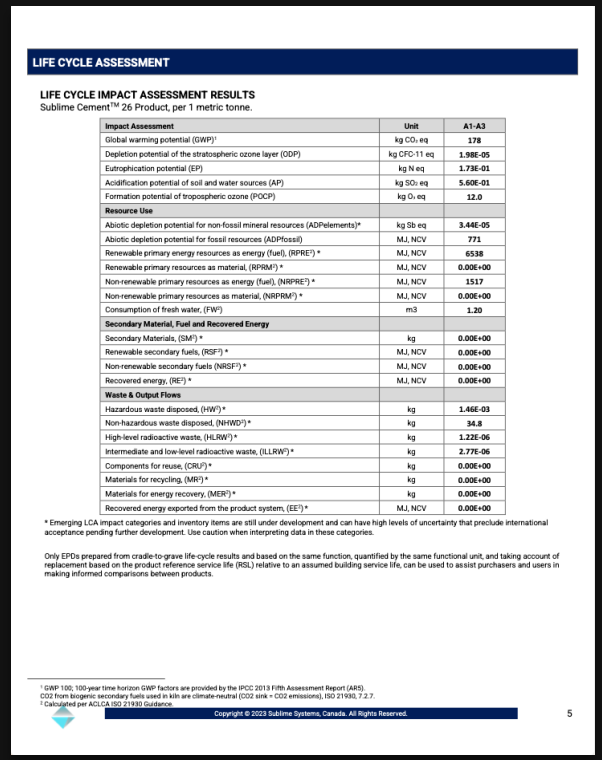
jtanesi@teamAET.com

Report Reviewed by:

Patrick Barnhouse, PE
Manager
Concrete Materials Laboratories
Phone: 651-999-1772
pbarnhouse@teamAET.com

Environmental LCA



LIFE CYCLE ASSESSMENT

LIFE CYCLE IMPACT ASSESSMENT RESULTS
Sublime Cement™ 26 Product, per 1 metric tonne.

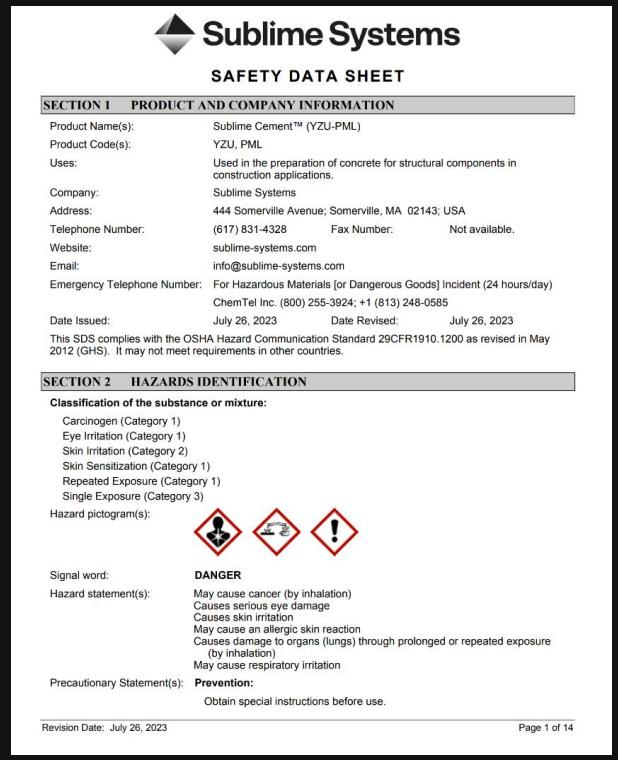
Impact Assessment	Unit	A1-A3
Global warming potential (GWP)[1]	kg CO_2 eq	178
Depletion potential of the stratospheric ozone layer (ODP)	kg CFC-11 eq	1.98E-05
Eutrophication potential (EP)	kg N eq	1.73E-01
Acidification potential of soil and water sources (AP)	kg SO_2 eq	5.60E-01
Formation potential of tropospheric ozone (POCP)	kg O_3 eq	12.0
Resource Use		
Abiotic depletion potential for non-fossil mineral resources (ADPelements)*	kg Sb eq	3.44E-05
Abiotic depletion potential for fossil resources (ADPfossil)	MJ, NCV	771
Renewable primary energy resources as energy (fuel), (RPRE[2]) *	MJ, NCV	6538
Renewable primary resources as material, (RPRM[2]) *	MJ, NCV	0.00E+00
Non-renewable primary resources as energy (fuel), (NRPRE[2]) *	MJ, NCV	1517
Non-renewable primary resources as material, (NRPRM[2]) *	MJ, NCV	0.00E+00
Consumption of fresh water, (FW[2])	m3	1.20
Secondary Material, Fuel and Recovered Energy		
Secondary Materials, (SM[2]) *	kg	0.00E+00
Renewable secondary fuels, (RSF[2]) *	MJ, NCV	0.00E+00
Non-renewable secondary fuels (NRSF[2]) *	MJ, NCV	0.00E+00
Recovered energy, (RE[2]) *	MJ, NCV	0.00E+00
Waste & Output Flows		
Hazardous waste disposed, (HWD[2]) *	kg	1.46E-03
Non-hazardous waste disposed, (NHWD[2]) *	kg	34.8
High-level radioactive waste, (HLRW[2]) *	kg	1.22E-06
Intermediate and low-level radioactive waste, (ILLRW[2]) *	kg	2.77E-06
Components for reuse, (CRU[2]) *	kg	0.00E+00
Materials for recycling, (MR[2]) *	kg	0.00E+00
Materials for energy recovery, (MER[2]) *	kg	0.00E+00
Recovered energy exported from the product system, (EE[2]) *	MJ, NCV	0.00E+00

* Emerging LCA impact categories and inventory items are still under development and can have high levels of uncertainty that preclude international acceptance pending further development. Use caution when interpreting data in these categories.

Only EPDs prepared from cradle-to-grave life-cycle results and based on the same function, quantified by the same functional unit, and taking account of replacement based on the product reference service life (RSL) relative to an assumed building service life, can be used to assist purchasers and users in making informed comparisons between products.

[1] GWP 100, 100-year time horizon GWP factors are provided by the IPCC 2013 Fifth Assessment Report (AR5).
CO2 from biogenic secondary fuels used in kiln are climate-neutral (CO2 sink = CO2 emissions), ISO 21930, 7.2.7.
[2] Calculated per ACLCA ISO 21930 Guidance.

Safety Data Sheet



Sublime Systems

SAFETY DATA SHEET

SECTION 1 PRODUCT AND COMPANY INFORMATION

Product Name(s):	Sublime Cement™ (YZU-PML)
Product Code(s):	YZU, PML
Uses:	Used in the preparation of concrete for structural components in construction applications.
Company:	Sublime Systems
Address:	444 Somerville Avenue; Somerville, MA 02143; USA
Telephone Number:	(617) 831-4328 Fax Number: Not available.
Website:	sublime-systems.com
Email:	info@sublime-systems.com
Emergency Telephone Number:	For Hazardous Materials [or Dangerous Goods] Incident (24 hours/day) ChemTel Inc. (800) 255-3924; +1 (813) 248-0585
Date Issued:	July 26, 2023 Date Revised: July 26, 2023

This SDS complies with the OSHA Hazard Communication Standard 29CFR1910.1200 as revised in May 2012 (GHS). It may not meet requirements in other countries.

SECTION 2 HAZARDS IDENTIFICATION

Classification of the substance or mixture:

Carcinogen (Category 1)
Eye Irritation (Category 1)
Skin Irritation (Category 2)
Skin Sensitization (Category 1)
Repeated Exposure (Category 1)
Single Exposure (Category 3)

Hazard pictogram(s):

Signal word: **DANGER**

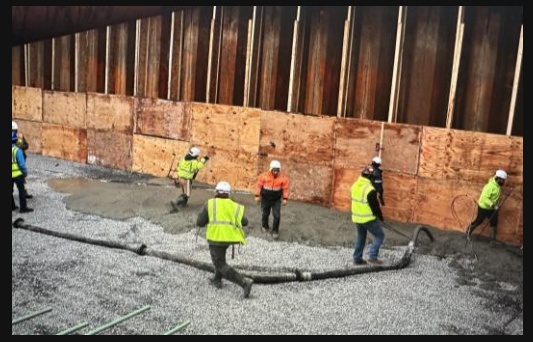
Hazard statement(s):
May cause cancer (by inhalation)
Causes serious eye damage
Causes skin irritation
May cause an allergic skin reaction
Causes damage to organs (lungs) through prolonged or repeated exposure (by inhalation)
May cause respiratory irritation

Precautionary Statement(s): **Prevention:**
Obtain special instructions before use.

Revision Date: July 26, 2023 Page 1 of 14

Field Deployment Progress Thus Far…

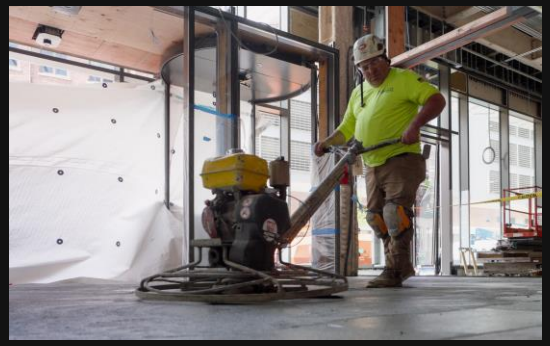
Mud Slab



Date: 1/19/24
Location: Boston
Conditions: 28°F / windy
Volume: 6 yds

Highlights:
- Pumped ~250 ft
- Set in cold weather conditions

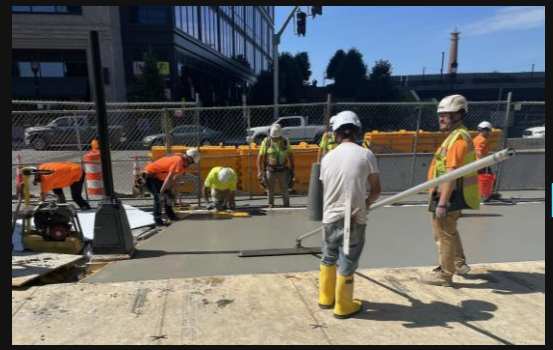
Lobby Topping Slab



Date: 4/22/24
Location: Boston
Conditions: Interior
Volume: 12 yds

Highlights:
- Eggshell finished and polished
- Batch-to-batch variability negligible (2x6 yard loads)

Sidewalk



Date: 7/03/24
Location: Boston
Conditions: 80°F, humid
Volume: 7 yds

Highlights:
- Entrained air
- Place & finish completed in typical 4-hour window

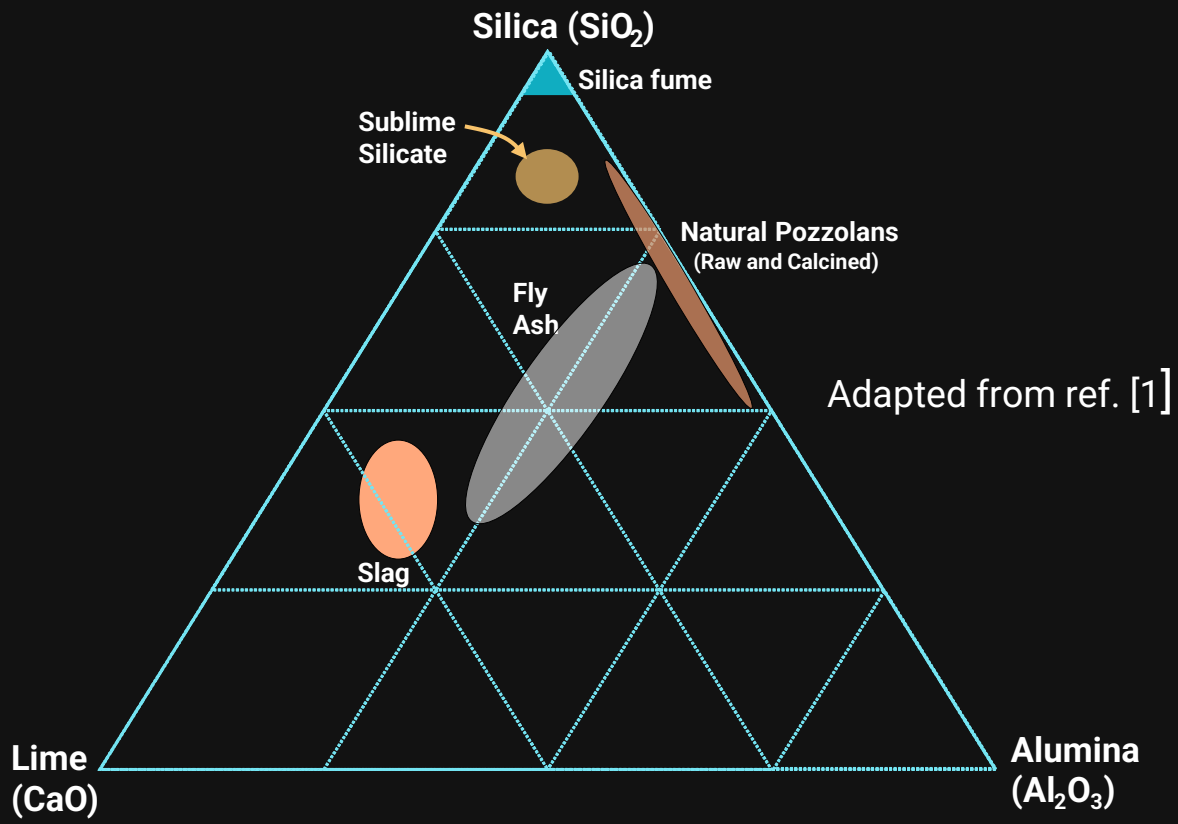
External SOG

Date: 12/20/24
Location: VA Beach
Conditions: 40°F / windy
Volume: 7 yds

Highlights:
- Entrained air
- Broom finish/sawcut

Sublime's Electrochemically-Activated Silicates

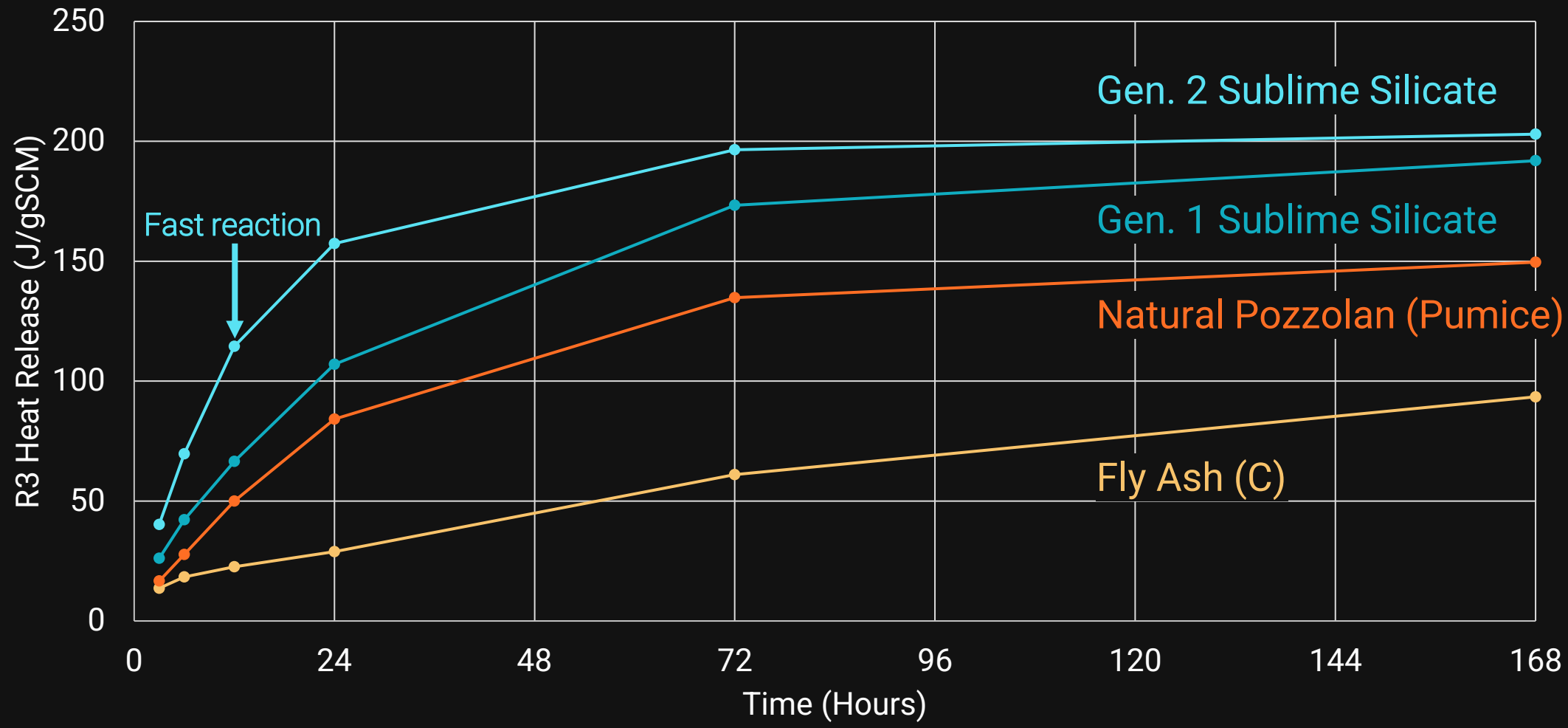
- Engineered for enhanced durability, strength, and reactivity
- Meets or exceeds the durability of fly ash:
  - Mitigates ASR
  - Reduces permeability
  - Improves sulfate resistance
- Provides predictable and repeatable results
- Light and consistent color that are ideal for cosmetic applications



Adapted from ref. [1]

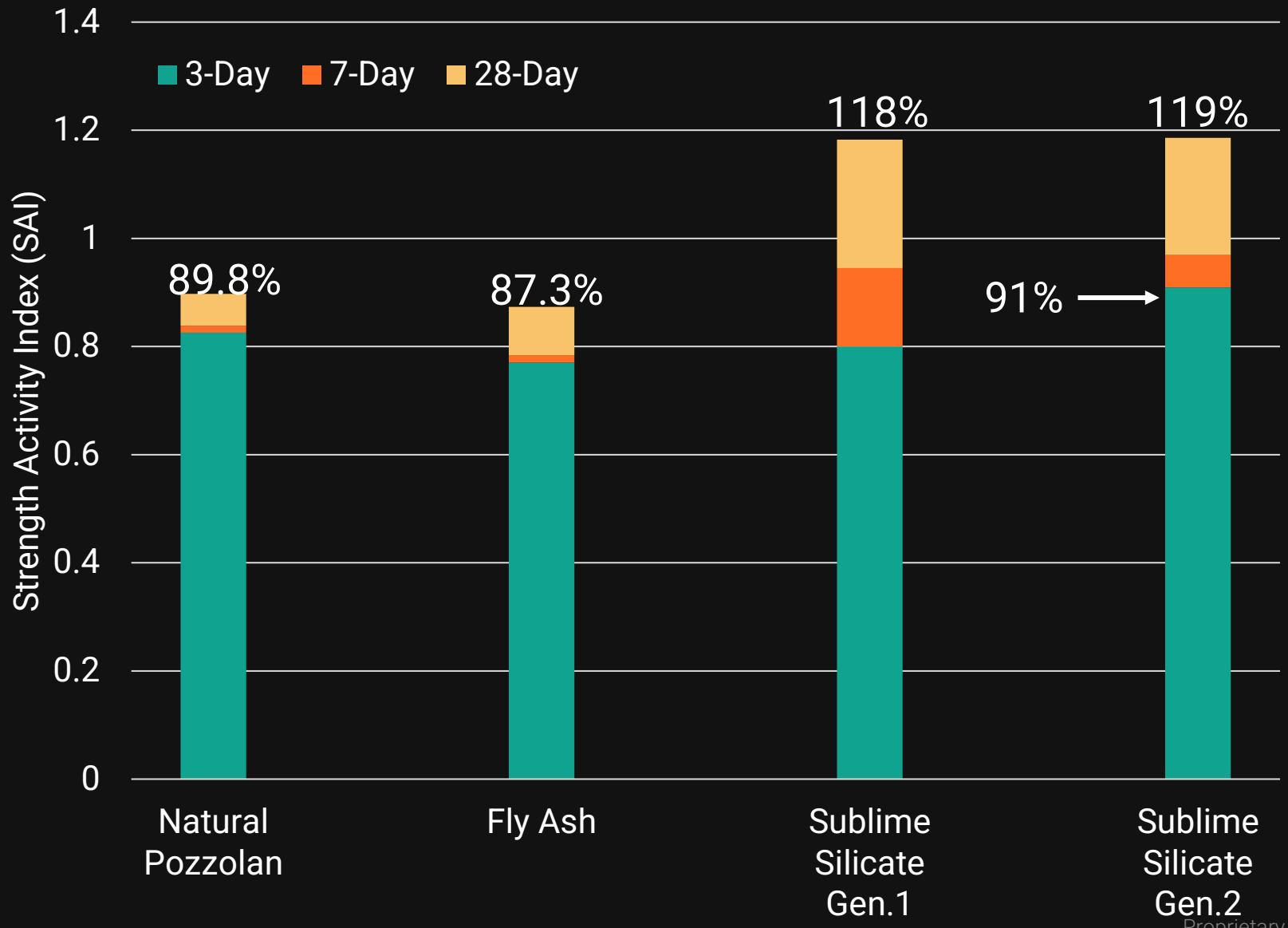
1. Suraneni, P.; Hajibabaee, A.; Ramanathan, S.; Wang, Y.; Weiss, J. New Insights from Reactivity Testing of Supplementary Cementitious Materials. *Cement and Concrete Composites* **2019**, *103*, 331–338. https://doi.org/10.1016/j.cemconcomp.2019.05.017.

Sublime Silicates have faster initial heat release than other pozzolans in R3 isothermal calorimetry testing



Our silicates outperform other pozzolans in ASTM C618 SAI testing

- Sublime Silicates maintain set times, reach strength faster, and obtain 28-day strengths in excess of other pozzolans
- No retardation of set times allows for high-replacement in binary and ternary mixes.
- At 20% replacement, 3-day strengths of >90% are possible with Sublime Silicates.



Sublime Systems

Brandon Williams
Product Success Manager
Brandon@Sublime-Systems.com

Keep building