
T E R R A
CO2
Technology for
Sustainable Cement


TERRA
CO2
Introduction

What is Terra's Technology Capable of?

Global adoption of Terra's technology represents a solution to a $313.6bn problem.

A 70% reduction in CO2 emissions for every ton of OPUS replacing a ton of Portland Cement

A 1:1 replacement for Portland cement and Class F Fly Ash
No green premium. Cost advantaged. Capital efficient.

A solution to a $314bn global problem, growing to $458bn by 2028.

World class team lead by a former c-level executive of an international, building materials company

Terra CO2 Technology

Real Concrete Solutions for Building Sustainability

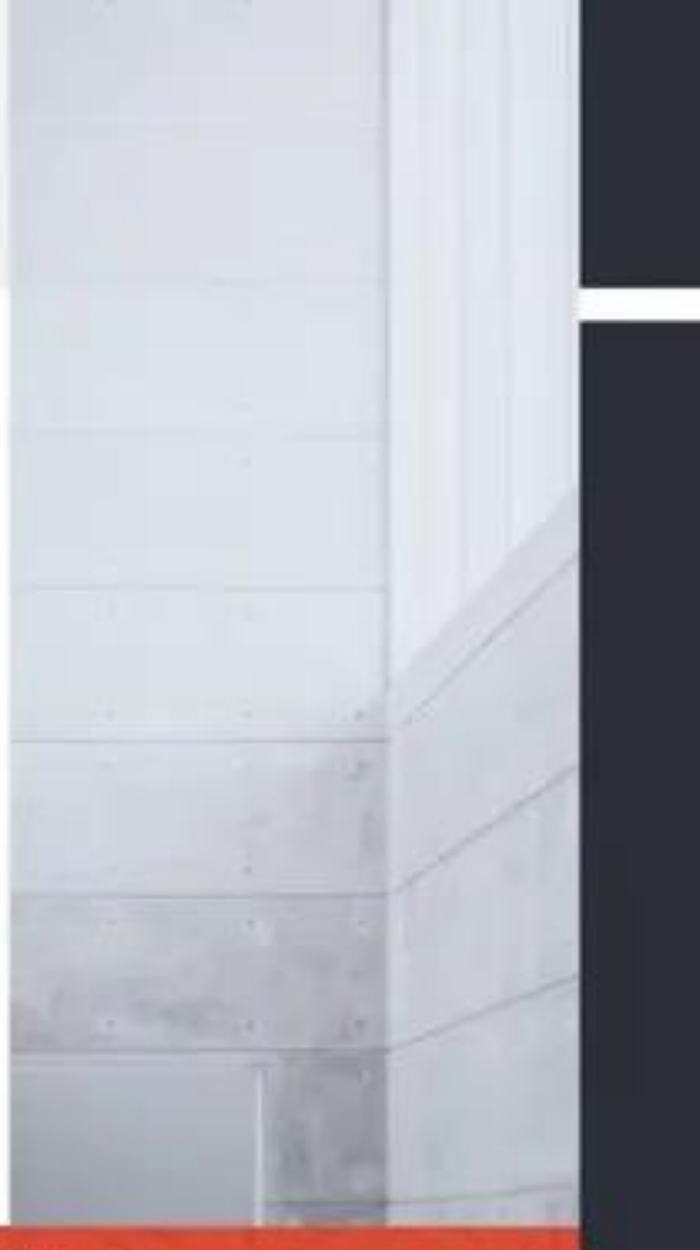
Who We Are: Terra CO2 Technology (the "Company" or "Terra") is an innovative construction materials company focused on decarbonizing the built environment. The Company is headquartered in Golden, Colorado with an R&D subsidiary located in Vancouver, Canada.

Terra CO2 has attracted several of the world's most forward-thinking investors who are focused on sustainability, including Breakthrough Energy Ventures, who invests in the innovations that will lead the world to net zero emissions.

Our Solution: Terra CO2 has invented a way to manufacture reliable and affordable cementitious substitutes using widely available silicate feedstocks, reducing the amount of high-carbon Portland cement needed to make concrete.

Every ton of OPUS cementitious material that is substituted for Portland cement will lower CO2 emissions by approximately 70% today, with the ability to go to a 100% reduction with zero-Co2 energy sources – a giant step toward decarbonizing the built environment.

While other companies boast about early-stage technology with limited validation, since 2015 Terra has been diligently third-party testing, proving every aspect of our technology via a multi-million-dollar validation program. Terra's CEO previously led one of the world's largest aggregate/construction materials companies, bringing deep insight into what is required to commercialize impactful, low-carbon cement technology that the industry will favor.



Terra CO_2 Leadership Team

High-Quality and Experienced Management Team Led by an Industry-Veteran CEO

Terra CO2 Management

Bill Yearsley, PhD – President & Chief Executive Officer

- 40+ years of experience in construction/building materials, mining, and industrial manufacturing
- Prior co-founder, chairman, and CEO of American Civil Constructors, prior chairman and CEO of a construction materials and nonmetallic mining group, and prior executive director of Redland PLC, a $4.2 billion publicly-traded FTSE 100 company

Donald "DJ" Lake, M.Sc. – Senior Vice President, Director of Research and Development

- Inventor of Terra's core technology
- Emerging expert in the field of alternative cementitious materials through his research in both the public and private sectors

Isaac Smeltzer – Vice President of Finance & Corporate Development

- 8+ years experience in private equity, investment banking and start-up corporate finance/development; and extensive experience in M&A, infrastructure investments, capital raising, strategic finance, business development and corporate development
- Entrepreneurial track record of leading companies supporting critical infrastructure and technology growth across the Midwest US

Advisory Board Members

- **Pat Walker**: Retired Martin Marietta Western Division President
- **Jane Everhart, CPA**: President & CFO of Brinkman Real Estate; former CFO of OtterBox
- **Randel Mercer**: CTO of CoorsTek
- **Eric Truslewicz**: Cement & Concrete Decarbonization Specialist, Entrepreneur in Residence at Breakthrough Energy Ventures

Select Terra CO2 Capital Partners

Breakthrough Energy VENTURES

CREATIVE VENTURES

Key Achievements

Terra's technology makes sense solely based on and attractive economics, before any consideration is given to the ability to significantly reduce the carbon footprint of concrete.

SCALABILITY

Growing menu of validated, globally available silicate feedstocks in lieu of limestone.

PARTNERS

Strategic processes underway with multiple major aggregate, ready-mix, cement and mining companies.

PERFORMANCE VALIDATION

Arsenal of third-party material testing confirming performance in everyday concrete mix designs & test pours.

DEPLOYMENT

Terra's base model commercial plant design will be complete late-summer 2022, with construction to commence shortly thereafter. Terra will offer strategic partners multiple options to deploy this technology.

INTELLECTUAL PROPERTY

Comprehensive US & International IP strategy with core technology methods and processes, patented and filings across 5 continents.

LOW-CARBON CEMENTS

Every ton of OPC replaced by an Opus product, drives a 70% reduction in CO_2

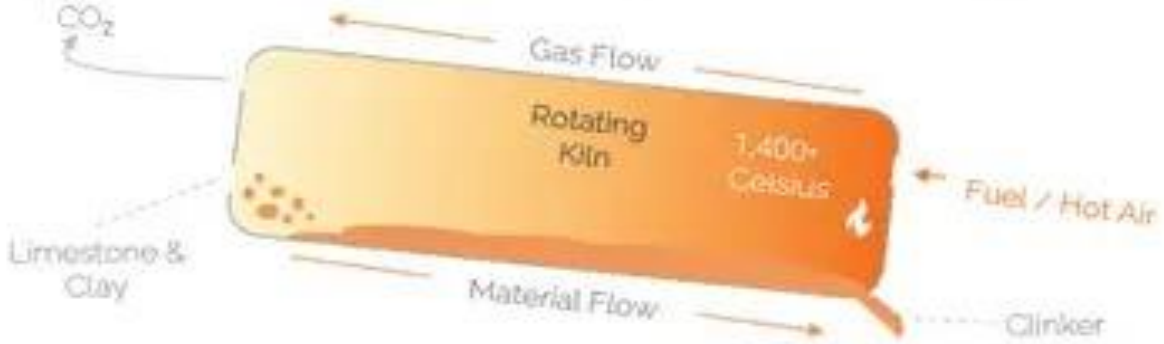
Cement & its CO_2 Problem

Limestone-caused CO_2 emissions make low-carbon Portland cement an expensive problem.

Clinker is produced by heating ground limestone and clay at a temperature of about 1,400–1,500 °C. Before clinker formation, a chemical reaction (calcination) turns limestone ($CaCO_3$) into lime (CaO), leading to release of CO_2.

$$CaCO_3 + \text{heat} \rightarrow CaO + CO_2$$

- The above reaction provides insight into why cement related CO_2 emissions are so difficult to reduce.
- **The majority of CO_2 emissions are process driven and released by decomposition of limestone, and a lot of energy goes into driving off CO_2 from limestone.**
- **<u>Meaningful CO_2 reduction cannot be achieved through increased efficiency or fuel substitution.</u>**



Globally, cement manufacturing accounts for 7-8% of the world's CO_2 emissions.

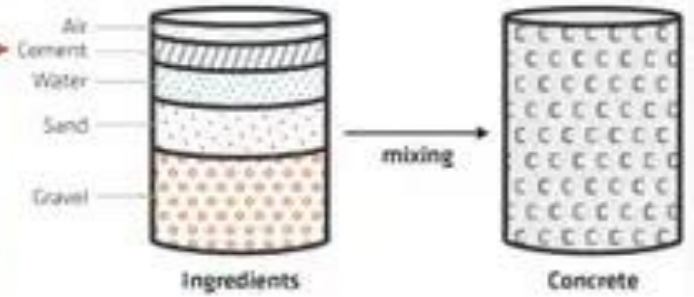
The Cement Emissions Opportunity

Though cement demand continues to grow, the industry must address its emissions problem

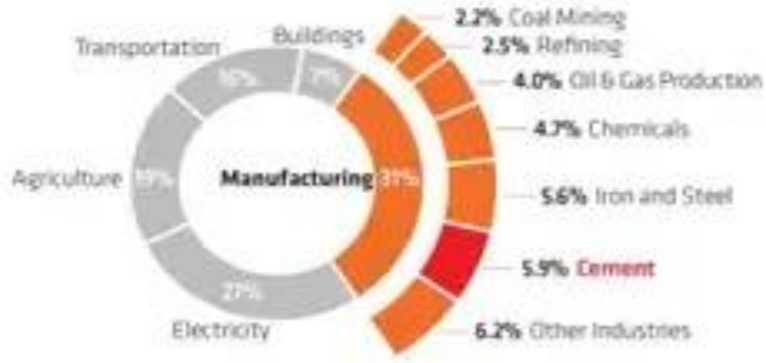
Concrete is the foundation of modern infrastructure and Cement is the key ingredient

- 2nd most consumed material in the world (after water)
- 30x more produced in volume and 10x more in mass than steel, its closest competitor
- Comprised of 10-15% cement which causes ~75% of concrete's emissions

Composition of concrete



Global CO_2 emissions by industry



What We're Initially Solving For

The problem with fly ash, a common substitute for Portland cement, and a byproduct of coal-burning power plants.

While fly ash is widely used today as a supplementary cementitious material, it has three major problems:

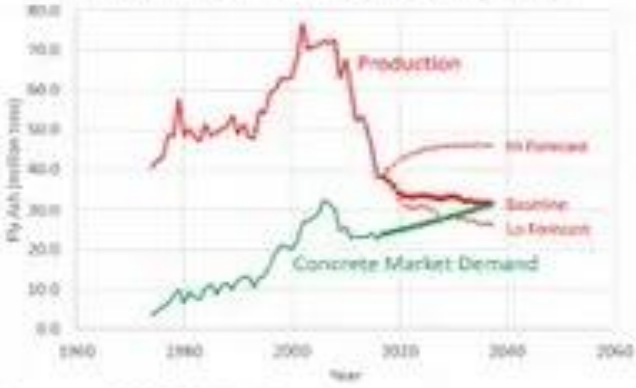
1. Although no carbon footprint is assigned to it because it is a waste product, it's made by burning coal, which has a high carbon footprint that contributes to climate change.
2. As more coal-burning power plants are closed or converted to natural gas, less fly ash will be available, and prices will increase.
3. As coal plants closed or are converted in many parts of the country, fly ash will need to be transported across great distances to reach job sites, adding higher transportation costs and a larger carbon footprint for the concrete. There already are fly ash shortages and performance issues across many U.S. regions.

Based on an in-depth market study analyzing coal-fired power plant closures and impacts on **Class F fly** ash supply, Terra CO2 projects that by 2031, the US will experience

a loss of ~50% of Class F fly ash supply.

Fly ash Production and Market Demand

Does not account for material quality, regional disparity, seasonal disparity or type disparity



Source: ACAA 2020 Study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Terra's Feedstock and the OPUS REAGENT

Creating a high-quality, consistent engineered SCM product

What feedstocks are the core ingredient to make all OPUS products?

- Silicate rocks, comprising 90% of the earth's rock-based crust, are the primary feedstock for all Opus products
- Commonly used for construction aggregates, silicate rocks come from existing mines typically located close major markets. No entitlement or new mining applications / permitting required.
- Silicates are the most abundant and accessible materials on earth, with granite and alluvial minerals as common examples.
- Terra CO2 has patented the process for manufacturing alternative and supplemental cementitious materials from silicates.

Does the plant technology change for each Terra product?

- The same plant technology is used to make the core ingredient for all OPUS products

How is OPUS SCM made?

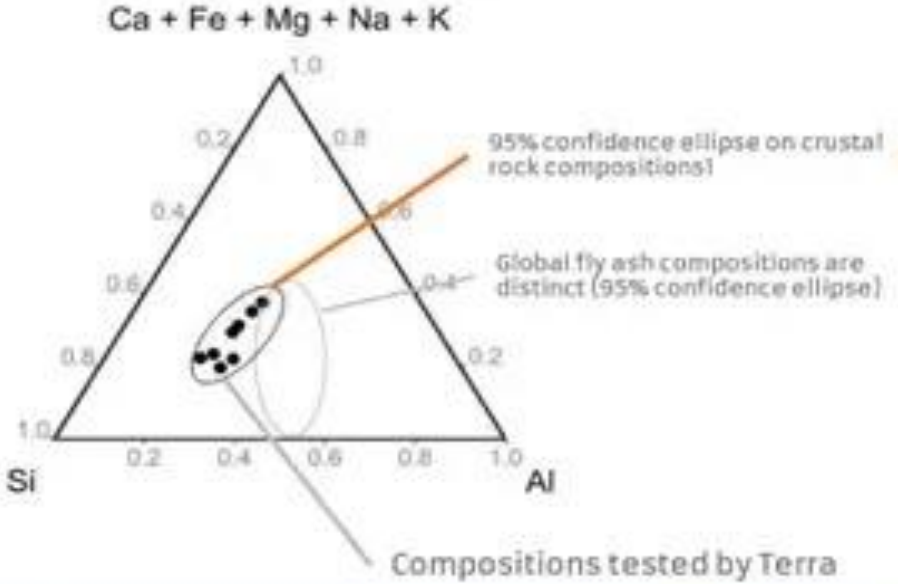
- OPUS SCM is made by milling silicate feedstocks and vitrifying them into a glassy powder using proprietary, low-carbon and low NOx, reactor technology.
- The result is a high-quality, consistent engineered product with a significantly lower carbon footprint than Portland cement that is cost-competitive, widely available and compliant with ASTM and ACI standards.

Terra Feedstock Composition

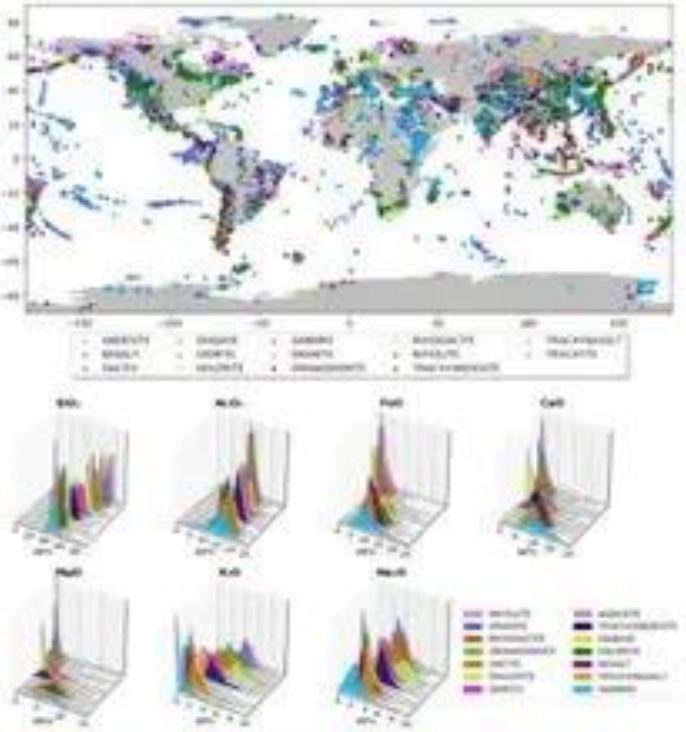
Compatible with the most abundant global geology

Terra feedstock composition requirements are easy to satisfy because there is little variability in Earth's most abundant rock types

- Most aggregate compositions satisfy requirements.
- Most aluminosilicate rock satisfies requirements.
- Limestone and carbonate rock is not suitable.



KEY INSIGHT:
There is little variability in global igneous rock compositions



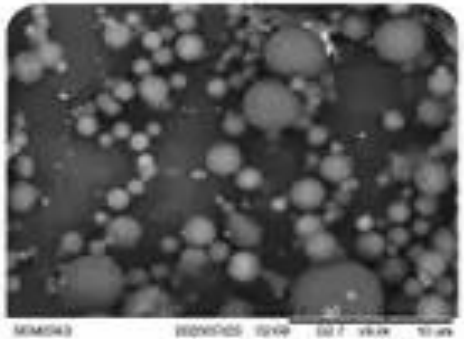
The OPUS Reagent

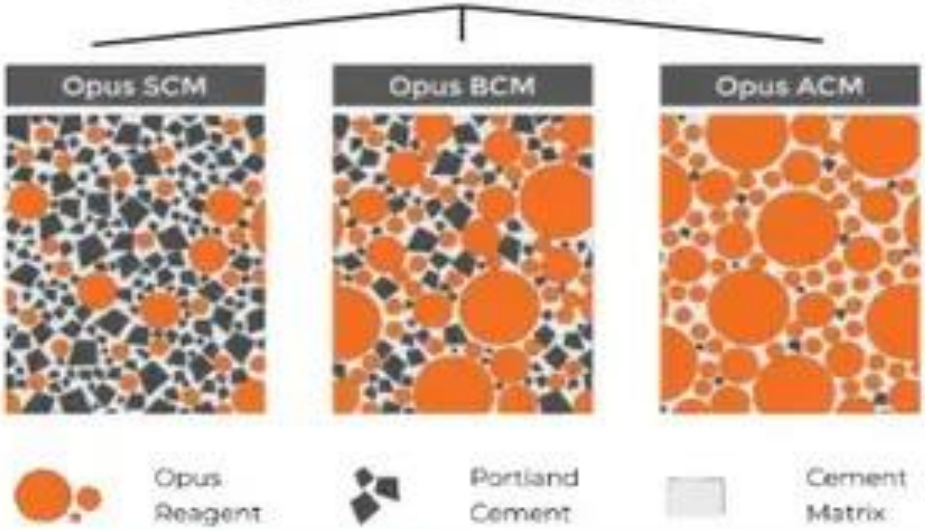
One Reagent that supports Terra's entire product road map

Shape: Spheroidal

Surface Area: >0.5m²/g

Composition: $SiO_2+Al_2O_3 > 50\%$





How We Get There

Terra CO2's OPUS Suite – Reducing Portland cement use in concrete step-by-step

OPUS SCM

OPUS SCM is a supplementary cementitious material that can be used to reduce the Portland cement content by 20% - 30% in concrete.

OPUS BCM

OPUS BCM is a blended cementitious material that can replace 30% to 50% of Portland cement in concrete.

Opus SCM & BCM are ready for commercial deployment, subject to the construction of Terra's first plant(s)

OPUS ACM

OPUS ACM is an alternative cementitious material using a proprietary geopolymer cement technology to replace Portland cement in comparable concrete applications, with no tradeoff in performance. OPUS ACM technology is expected to be commercially available in 2025.

Every ton of OPUS reagent used to offset a ton of Portland cement reduces CO2 emissions by 70%

Third-Party Material Testing

EXTENSIVE VALIDATION, BEYOND THE ASTM STANDARD

Terra engaged Atlas (ATC) one of the nations largest material testing and environmental firms for rigorous and independent third-party validation of all material product performance. In every case, test results are measured against applicable ASTM and ACI specifications along with control mix designs utilizing traditional materials.

- Ability to produce the same reliable end-product utilizing a variety of common silicate feedstocks. Terra's menu of fully tested and validated feedstocks grows each month as more potential customers submit their raw materials for testing.
- Terra products target every day broad spectrum concrete uses. As such, Terra's SCM has been exhaustively tested in a broad panel of common concrete mix designs.
- Comprehensive third-party laboratory test reports are available, documenting performance.
- Terra products perform comparable to historical incumbent's and, in many cases, outperform.
- Terra's common panel of concrete mix design incorporating OPUS SCM includes 5.5 sack, 6.5 sack and 7.5 sack concrete mixes. All of the adjacent ASTM tests are incorporated into the testing regiment for each mix design along with control mixes made with common Type F fly ash.

THIRD PARTY TESTING REGIMEN

ASTM C618-19 – Specification for pozzolans for use in concrete

- Chemical & Volatile Composition
- Strength Activity Index
- Water Requirement
- Soundness, Autoclave Expansion, Length Change
- Density
- Fineness
- Uniformity
- Available Alkalis
- Drying shrinkage

Comprehensive Concrete Testing

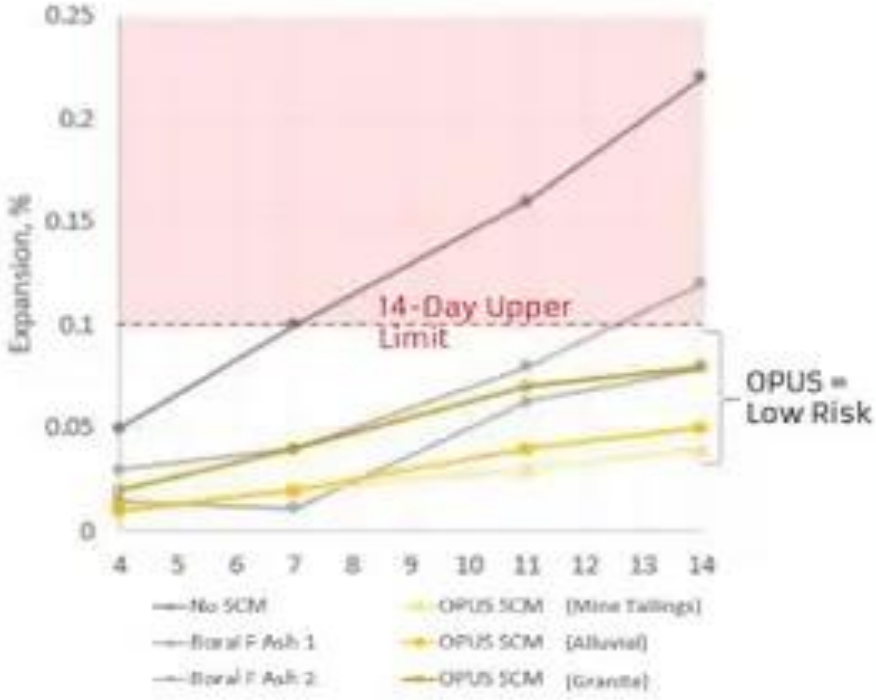
- Unit Weight of Concrete (ASTM C138)
- Slump (ASTM C143)
- Time of set (ASTM C403)
- Compressive Strength of Concrete Cylinder (ASTM C78)
- Bleeding of Concrete (ASTM C232)
- Temperature of Freshly Mixed Concrete (ASTM C1064)
- Air Content of Freshly Mixed Concrete (ASTM C231)
- Flexural Strength (ASTM C78)
- Length Change (ASTM C157)
- Air Void System Parameters (C457)
- Modulus of Elasticity (ASTM C469)
- Sulfate Resistance (ASTM C1012)
- Chloride Permeability (ASTM C1202)
- Length Change of Mortar Bars due to Alkali Silica Reaction (ASTM C1567)

OPUS SCM Validation & Progress

Compressive strength of OPUS is in range of Class F fly ash.

*6.5 Sack, 20% Replacement, Air-entrained, Water-reduced for all mixes.

ASR mitigation is comparable to commercial fly ash.



*Moderately reactive aggregate, ASTM C1567

Pilot Plant #3

Commissioned and operating, capable of producing tons per week

- Terra has erected and commissioned a third, formidable pilot plant to produce the Company's Opus Reagent at larger scale.
- Data off this pilot has been influential to completing the design of the commercial plant, providing guidance for equipment selection, thermal process design, energy consumption, operating costs and other key variables.
- The Pilot plant is currently producing 20 tons of material for an interstate highway demonstration project in summer 2022. Terra's material will be utilized for a 270 FT concrete roadway section.

Terra's Next Gen, Low-Carbon, Low NOX Reactor

Proprietary reactor with proven ability to test multiple operating conditions has significantly de-risked scaling to commercial capacity

The Commercial Plant

OPUS Advanced Processing Facility (APF): The Same Plant for all OPUS Products

Nameplate Capacity: 30 TPH (250,000 TPY)

Plant Footprint: 4-5 Acres

Plant Site: Located in or near mine sites (no or limited haul cost for raw material)

Product: The same plant can produce the entire OPUS product suite

Pricing: Competitive or cheaper than Class F fly ash, alternative SCMs and Portland cement

Construction Timeline: 12-14 months

Key Takeaways

- Terra's proprietary thermal reactor is the heart of the plant in creating a vitrified (glassy) powder resulting in a high performing cementitious reagent
- **Ninety percent (90%) of Terra's plant consists of off-the-shelf processing equipment** (mill, baghouse, silos, truck scales, pneumatic systems, building, etc.)
- The OPUS Reagent will be able to be used as OPUS SCM (20% - 30% replacement), OPUS BCM (40-50% replacement) and OPUS ACM (up to 100% replacement) with certain additional ingredients in each of BCM and ACM

Emission Comparison

Terra has developed an advanced processing facility capable of decreasing NO_x emissions by 90% and CO_2 emissions by 70% for every ton of OPC replaced by an OPUS product

While CO_2 emissions are the most widely discussed emissions across the commercial sector, cement manufacturers also emit significant amounts of Nitrous Oxides ("NO_x") under legacy, state and EPA permitting programs

NO_x are a family of highly reactive gases that form when fuel is burned at high temperatures and require mitigation technologies to meet regulatory limits. The EPA treats Portland cement kilns as a special class of emitter and sets a limit of NO_x emission per pound of clinker produced

- NO_x emissions react to form smog and acid rain that can significantly damage human lung tissue and cause breathing and respiratory problems
- Terra's OPUS plants will be heated with natural gas and oxygen enrichment that represents a significant step change towards low-NO_x compared to existing thermal processes
- Terra CO2 plans to eventually lower NOx (and CO_2) even further by switching to hydrogen or non-combustion electrification as alternatives become economically feasible

Pollutant *(LBS/ton)c*	Portland Clinker	OPUS	OPUS Impact
NO_x standards, new builds	1.5[6]	0.16[4]	-90%
NO_x uncontrolled	4.2 - 6[1]	1.1 -1.7[2]	-72 to -74%
NO_x controlled (SCR)	0.9 – 3.0+[3]	<0.16[4]	-82 to -95%
CO_2 (Current Grid Mix)	1,844[5]	566[6]	-70%
Zero-CO_2 Energy	960	~0	-100%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Commercialization

Customer Value Proposition

Delivering much more than a reliable supplementary & alternative cementitious materials

Terra will enter into a long-term takeoff agreement for the aggregate feedstock, providing recurring, long-term revenue stream for the Construction Material Partner

Terra's plants create demand for low value aggregates and waste streams: an attractive proposition for any aggregate mine

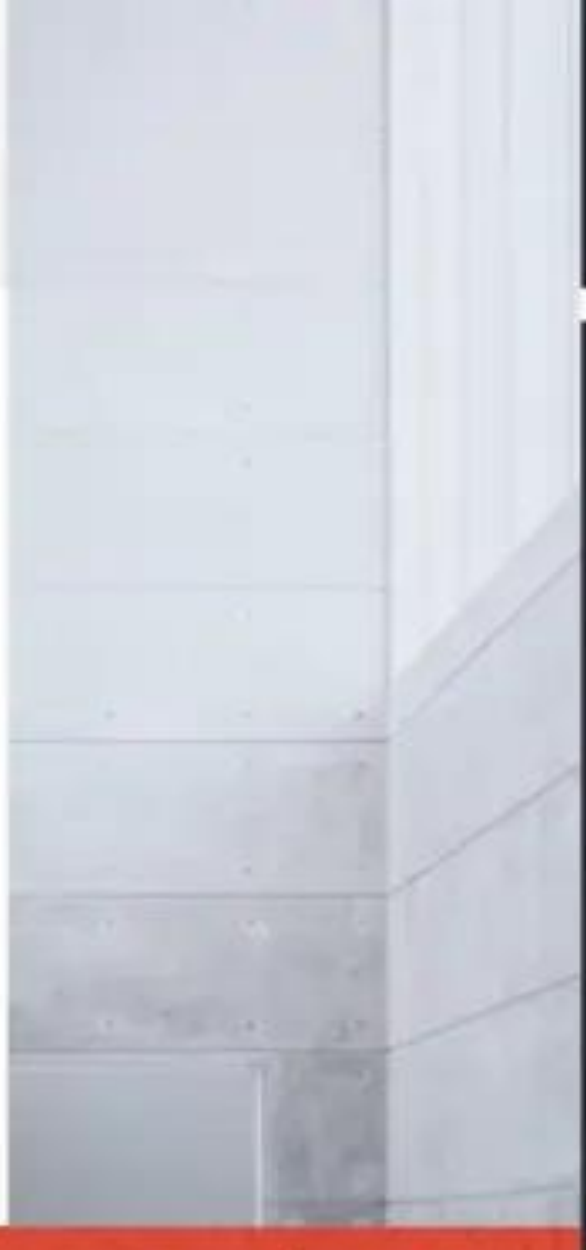
Simplify transportation logistics for core concrete ingredients

Drives significant ESG value as traditional construction material becomes key ingredient for decarbonizing concrete

Milestones Met for Active Sales

Validated, Tested, Proven, Commercial Ready

1. Finalize material testing validation of common sedimentary alluvial (Sand and gravel) & Granitic feedstocks - **Complete**
2. Major mining company mine tailing waste feedstock validation - **Complete**
3. Independent third-party lab certification of concrete material mix designs - **Complete**
4. Commissioning of pilot plant #3, **Complete January 2022**
5. Demonstration Interstate Highway Project **Complete** and LEED Platinum building project **Summer 2022**



Terra's Commercial Plant Program

The first commercial scale, low-carbon cement plant technology has arrived

The construction window for Terra's plants are approximately 12-14 months and is not a labor-intensive construction project; largely dominated by equipment procurement. Commissioning and first sales are expected in 2024, subject to final site selection, long-lead procurement and permitting timeline.

Across Terra's first 3 commercial plants, Terra is offering a limited program to select Construction Material Partners to have early access to the Company's technology.

Terra to provide:

- 30 TPH, low carbon Advanced Processing Facility ("APFs") fully funded, with Terra assuming all construction and commissioning risk
- Quality Control, site staffing and technology support *(site staffing should be influenced by best OPEX economics which may be best with CMP operatorship)*
- Exclusive technology license for Opus SCM and BCM for a defined geography
- Takeoff agreement with CMP for their aggregate feedstock

CMP to provide:

- Suitable site inside aggregate quarry (4-5 acres) for 30-year lease at agreed upon $ / acre
- Long-term offtake for finished product or a capital lease to own agreement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