



WORKSHOP

Measurement, Monitoring and Controlling Potential Environmental Impacts from the Installation of Point Source Capture

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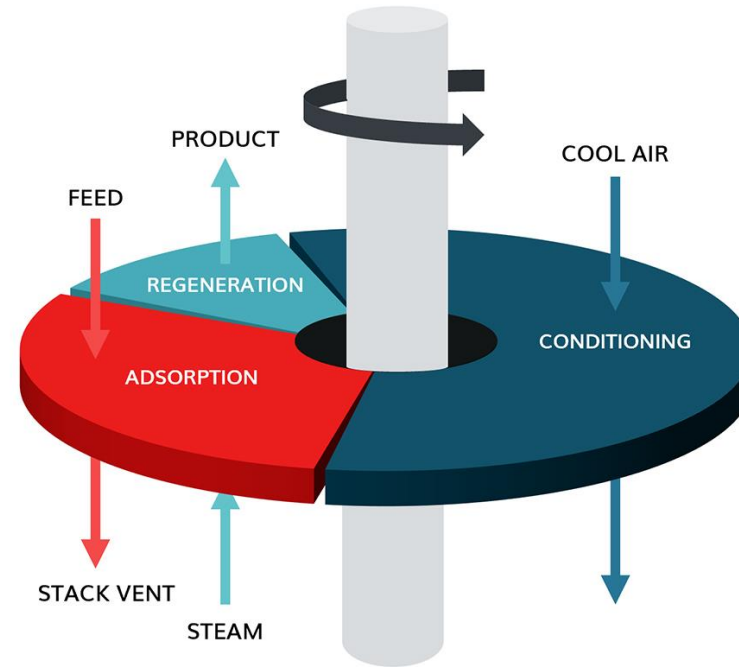
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Svante VeloxoTherm™ Process

- Svante's technology uses low-grade steam to directly regenerate the adsorbent due to a fast temperature increase of the bed
- Short cycle time increases the productivity of the process and makes CO₂ capture more economical



PROCESS	CYCLE STEP	PURPOSE
ADSORPTION	FEED	Adsorb CO ₂ from the flue-gas.
	STACK	Gases, primarily N ₂ , O ₂ and H ₂ O, are exhausted to the stack after CO ₂ has been adsorbed from the Feed.
REGENERATION	STEAM	Steam is introduced to regenerate the adsorbent and pushes out the high purity CO ₂ product.
	PRODUCT	CO ₂ product and moisture are produced.
CONDITIONING	CONDITIONING	Ambient air is used to remove the moisture and cool down the bed for adsorption.

Lafarge Richmond CO₂MENT Pilot Plant

Overview

Capacity

- 250 tpa

Source

- Cement Kiln

Partners

- Lafarge Canada
- TotalEnergies

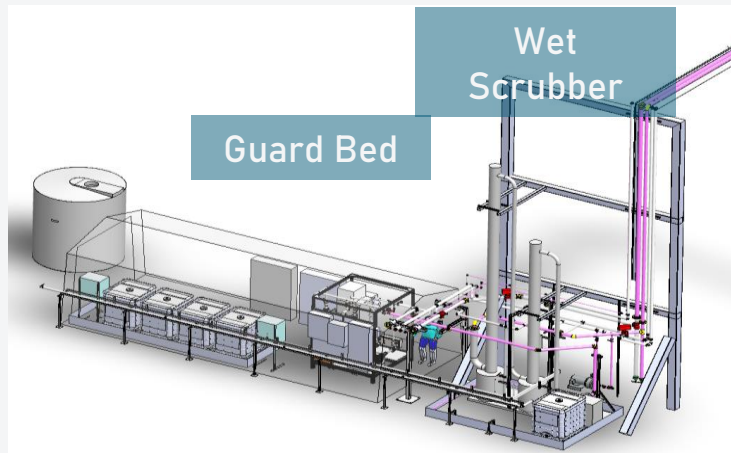
Status

- In Operation

PHASE 1

Pre-treatment

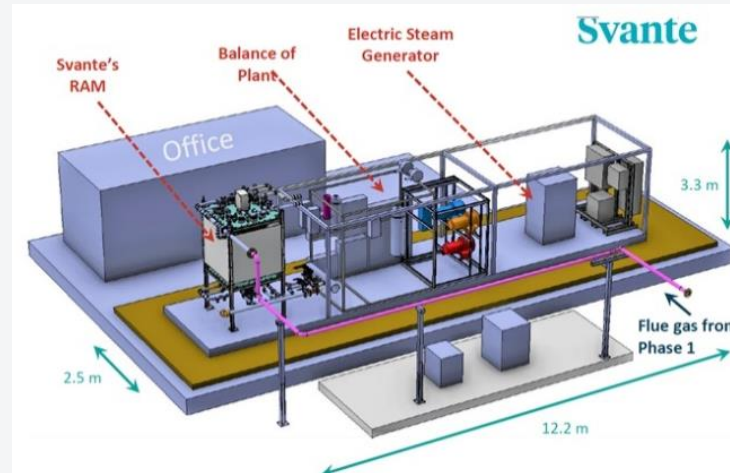
Manage harmful organic and inorganic substances in the cement flue gas by measuring and qualifying the effect of a contaminant mitigation system.



PHASE 2 - CURRENT

CO₂ Capture

Separate the CO₂ from the flue gas using a customized-for-cement version of Svante's carbon capture technology. Three major components: RAM, BOP and Boiler



PHASE 3

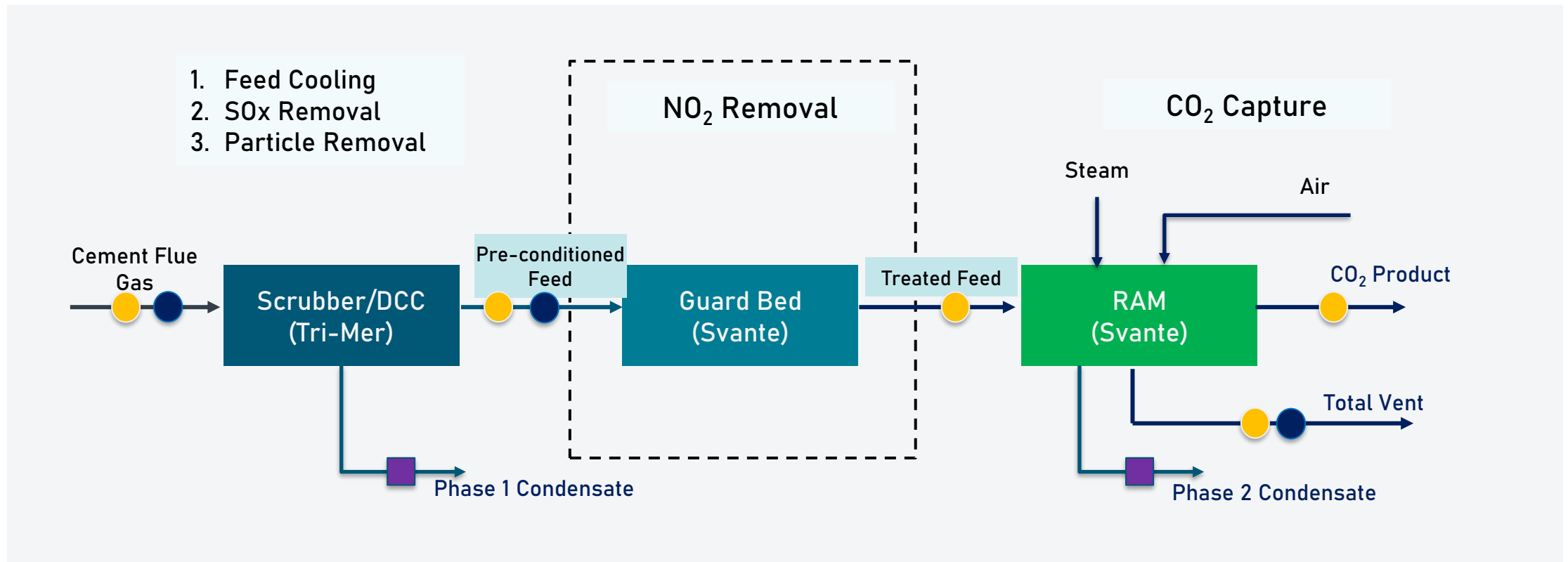
CO₂ Utilization

Prepare CO₂ for reuse and support the demonstration of CO₂ conversion technologies on-site such as low-carbon fuels and CO₂-injected concrete and fly ash



Project CO₂MENT – Flue Gas Pre-treatment & CO₂ Capture

Emission Analysis for MOF adsorbent for Cement flue gas



Gaseous Component



FTIR

Particles



Opacity Particulate Monitor
Portable Particle Analyzer

Condensate



External Lab

Project CO₂MENT – Gas Analysis

Gasmet CX4000 FTIR Gas Analyzer

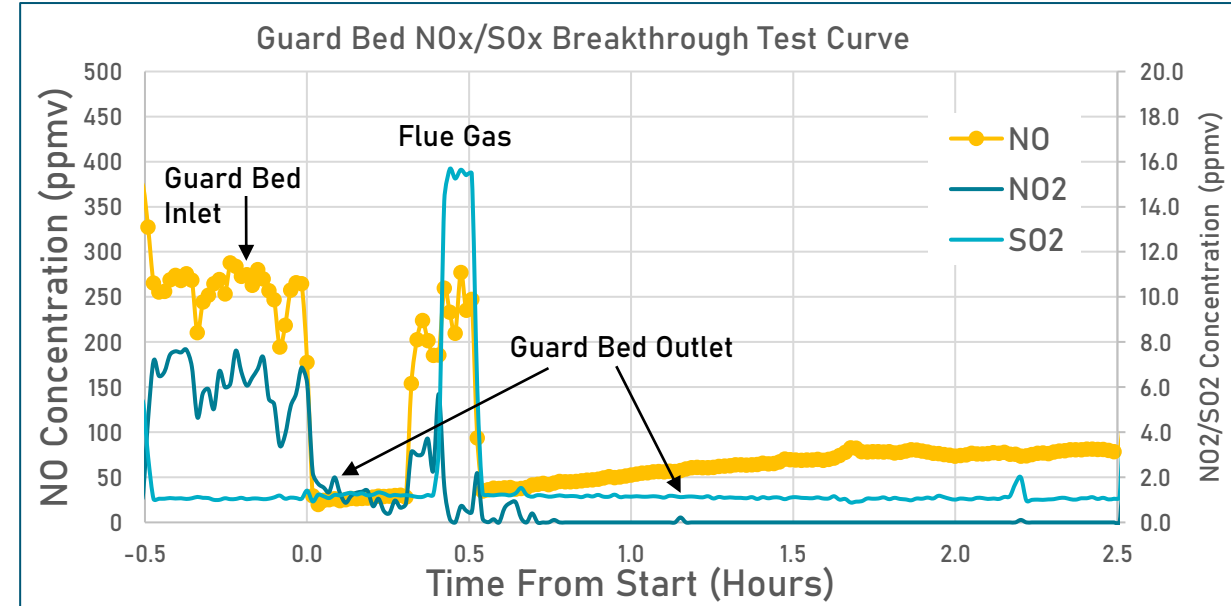
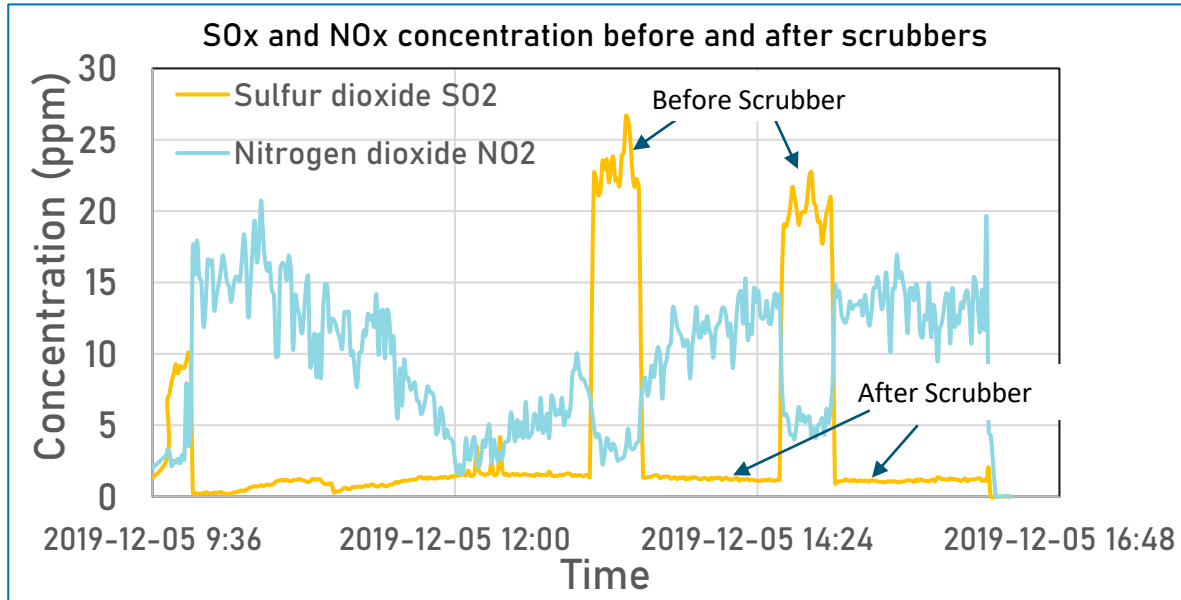


Gasmet Oxygen Analyzer



- The Gasmet CEMS FTIR measuring system is designed for continuous emissions monitoring (CEM) measurements.
- Typical application is H₂O, CO₂, CO, N₂O, NO, NO₂, SO₂, HCl, HF, NH₃, CH₄, C₂H₆, C₃H₈, C₂H₄ and CH₂O monitoring various streams.
- Separate O₂ analyzer is used to measure O₂ content.
- Measured components and calibration ranges can be changed according to application.
- Svante utilized similar analyzer system for Chevron pilot unit (~25TPD) and is investigating feasibility for commercial plants.

Project CO2MENT – SO₂ and NO₂ Before & After Liquid Scrubber



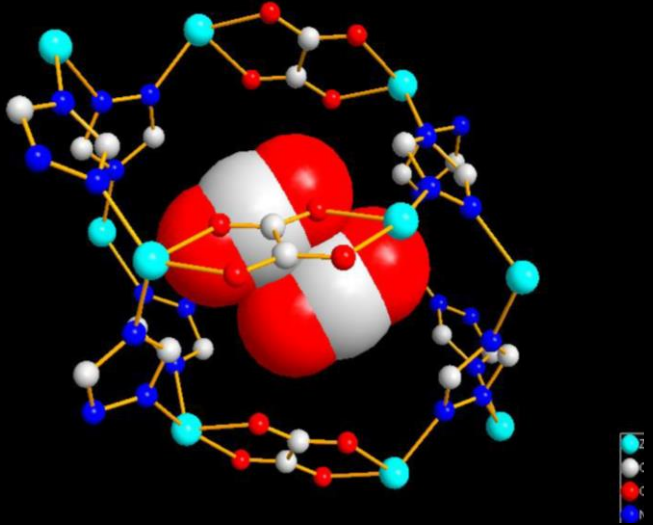
- The scrubbers are capable of decreasing the SO₂ to < 2 PPM and NO₂ to 5 –15 PPM
- Svante's proprietary guard beds were effective in controlling the amount of NO and NO₂ going to the capture plant

- Particle content (PM₁₀) was found to be reduced by 90% after scrubbers

Svante's MOF Technology and Emissions

CALF-20 MOF

Metal framework (Zn)
Organic ligand (oxalate)
Not amine based (physisorption)



At 1.00 atm pressure, the main CO₂ binding site is between the oxalate groups.

- Svante's CALF-20 MOF is completely stable in air, water, and steam
- Process doesn't involve additional chemicals or hazardous material; only steam and ambient air are used
 - No new components detected in the CO₂ product or total vent streams
- Svante's MOF is much more tolerable with contaminants (e.g. SO_x and NO_x) than conventional Amine based material
- Svante's adsorption filters can allow fine particles to pass through without damaging or degrading CO₂ capture process. Further characterization is ongoing.

Svante has partnered with BASF to successfully scale up and manufacture CALF-20 MOF