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Comparative Carbon Footprint between STEMGEL™ and Conventional Aggregate Stemming Processes

SUMMARY REPORT FOR THE
DRILL AND BLAST INDUSTRY

This excerpt is published with the client's consent. It has been extracted and adapted from a real client engagement for illustrative purposes.

Climate Change Impacts of STEMGEL™ on Stemming and Blast Preparation Processes

Compared to crushed aggregate, STEMGEL™ reduces direct mine site emissions during the stemming process.

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Commissioned by:



Transport to Stemming Site

Externally sourced crushed aggregates were found to emit significantly higher amounts of greenhouse gases (550.6 kgCO₂e) compared to STEMGEL™ (11.2 kgCO₂e) during transportation to stemming site. Overall, the data shows that transportation of aggregates to the mine and then to the stemming site is a significant contributor to its global warming potential (GWP), accounting for 56% of its overall lifecycle impacts. Aggregate production is also significant with 26% of the GHG emissions coming from crushing the aggregate in the first place. The transport emissions are based on a 180 km distance.



Stemming Process

Stemming with externally sourced crushed aggregates emits over 14 times more greenhouse gases (172.7 kgCO₂e) compared to STEMGEL™ (12.9 kgCO₂e) during the stemming process alone. Overall, the data shows that compared to externally sourced crushed aggregate, the direct emissions associated with the transport and use of STEMGEL™ produces 30x less CO₂e.

It should be noted that the GWP associated with STEMGEL™ will depend on the actual distance between the manufacturing site and the mine site.

Replacing externally crushed aggregate with STEMGEL™ on a mine site could lead to up to nearly

97%

reduction in Direct Emissions generated during the stemming process.

The Direct Emissions associated with the use and transport of STEMGEL™ on a mine site are

30x

less CO₂e than crushed aggregate.

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Compliant with ISO14067:2018 - Carbon Footprint of Products and ISO 14040:2006 and ISO 14044:2006 - Life Cycle Assessment



Also consistent with the principles of the Product Life Cycle Accounting and Reporting Standard

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Scope of Assessment

Drill and blast operators are the intended audience for this summary report. Using ISO 14067, ISO 14040 and ISO 14044 frameworks, ThinkZero's LCA and Carbon Footprint Experts undertook a comparative carbon footprint between two stemming products and processes: conventional externally sourced aggregate vs. the STEMGEL™ product. For comparison purposes, we compared the CO2e emissions caused by stemming 224 holes with either product (functional unit). It takes 804 kg of STEMGEL™ LRC and 38,304 kg of crushed aggregate to stem 224 holes of the tested blast pattern.

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Blast Pattern Information	Quantity
No. Holes (functional unit)	224
Hole Diameter	166mm
Stemming Height	4.0m
Required STEMGEL™ LRC (reference flow)	804kg
Required Externally Sourced Aggregate (reference flow)	38,304kg

ThinkZero calculated the CO2e associated with three key processes in the lifecycle of both products, resulting in an assessment of all emission scopes, up to the point at which the products enter the stemming process. In essence, Cradle to Gate + Use Phase. The three key processes assessed were: Raw Materials & Manufacturing; Transport from Manufacturing to Stemming Site; and the Stemming Process itself.

Overview of Results

GHG Emissions pre-Mine Site (Raw Materials and STEMGEL™ Manufacturing - Indirect Emissions)

The Cradle to Gate + Use Phase climate change impacts of STEMGEL™ can be almost 3 times higher than those of crushed aggregate, with most of these impacts being offsite Indirect Emissions, originating from the Raw Materials and Manufacturing processes. Approximately 90% of the emissions from the resin production stage can be attributed to the use of canola oil and sodium polyacrylate. Emission reduction actions in the canola industry, agriculture, and road and air freight value chains - including exploring options to manufacture locally - would significantly reduce these offsite impacts.

However, only about 1% of the STEMGEL™ emissions profile is associated with activities on site (Direct Emissions), meaning STEMGEL™ significantly outperforms crushed aggregate on its Direct Emissions.

Process	Stemgel GWP 100a	Externally Sourced Aggregate GWP 100a	Units
Offsite Raw Materials & Manufacturing	2556.22	251.78	kgCO2 e
Onsite Transport to Mine Site and Blast Bench	11.23	550.60	kgCO2 e
Onsite Stemming Process	12.87	172.69	kgCO2 e
Total	2,580.32	975.08	kgCO2 e

GHG Emissions on a Mine Site (Transportation and Stemming Processes - Direct Emissions)

Using the assumptions of this assessment, the Direct Emissions associated with the use of STEMGEL™ on a mine site are up to 30 times lower than stemming with externally sourced crushed aggregate. These results mean that switching from externally sourced crushed aggregate to STEMGEL™ on a mine site could lead to up to a 97% reduction in Direct Emissions during the stemming process.

Please Note: This Summary Report is an excerpt of a more detailed technical report, prepared specifically for stakeholders in the drill and blast industry. While the analysis confirms on-site stemming emissions are comparatively low, total climate impact is dominated by off-site emissions from international supply chains. Localising raw material sourcing for stemming products like STEMGEL™ could significantly reduce overall emissions and strengthen supply chain resilience.

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