THE AGGREGATES INDUSTRY GREENHOUSE GASES: LOW EMISSIONS, HIGH RESILIENCY

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April 26, 2021

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ACRONYMS

GWP	Global warming potential
NSSGA	National Stone Sand & Gravel Association
WRI	World Resources Institute

UNITS OF MEASURE

MT	Metric tons
MMT	Million metric tons
CO_2e	Total greenhouse gas emissions taking into account the four categories of emissions
HFCs	Halogenated fluorocarbons
PFCs	Perfluorinated hydrocarbons

GREENHOUSE GASES

CO_2	Carbon Dioxide
CH_4	Methane
N_2O	Nitrous Oxide (Not NO_x)
Fluorinated Compounds	Halogenated Fluorocarbons and Perfuorinated Hydrocarbons

THE AGGREGATES INDUSTRY
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1. EXECUTIVE SUMMARY

Aggregates are essential for roads, public transportation, housing, hospitals, environmental control, flood control, and other measures to increase national resiliency. Aggregates are becoming increasingly needed to support renewable energy development and innovative infrastructure projects that are essential for reducing greenhouse gas emissions and the impacts of climate change in our communities.

The aggregates industry is committed to taking all reasonable steps to reduce greenhouse gas emissions and to capture CO2 while supplying essential materials.

Aggregate industry greenhouse gas emissions are inherently low due to the characteristics of our processes and our products. The plants and facilities that produce these necessary construction materials use relatively little electrical energy or fossil fuels.

Despite low emissions, the aggregates industry continues to be a leader in responding to climate change. The industry is constantly evaluating ways to reduce our energy use. These measures include improvements in crushing and screening and new refrigerants with lower warming potentials for air-conditioned truck cabs and offices. Aggregate producers continue to be leaders in capturing carbon using techniques as simple as planting trees and other habitats in open areas and on berms along facilities' fence lines. Other initiatives are broad and include:

- conversion of traditional lighting systems to low energy LED, reducing energy consumption by up to 50 percent, and greatly reducing heat output compared to traditional systems,
- upgrading mobile fleets to Tier IV engines that are capable of burning 20% less fuel than the units being replaced while delivering up to 15% more output,
- replacing older fleet vehicles/equipment with newer units utilizing grants such as those provided in states such as Texas and Ohio that monitor reductions in environmental impacts. We are actively working to replace older fleet vehicles/equipment with newer units utilizing grants under these programs.
- continuing to work on new plant designs to reduce diesel powered haulage and installing more conveyors to move material,
- working with equipment manufacturers to use "right sizing" of mobile fleets. This process optimizes all equipment on site and eliminates bottlenecks. In most situations, smaller, more energy efficient trucks and loaders can handle the jobs done in the past by larger equipment using alternative fuels,
- implementing state-of-the-art emission monitoring equipment and real-time fleet management software, and
- using high-capacity rail cars to move material with less energy consumed.

The aggregates industry is driven to reduce greenhouse gas emissions—not only out of environmental concerns, but also because of the economic benefits provided by reduced energy consumption. There are shared interests between environmental stewardship, plant operating costs, and reduced greenhouse gas emissions.

This document summarizes (1) greenhouse gas emissions from typical plants and the inherent plant characteristics that limit these emissions, (2) the magnitude of industry total emissions as compared to major sources of greenhouse gas emissions, (3) the many facility design and operational changes that are being considered to reduce emissions and capture CO2, and (4) the beneficial impact of aggregate products on major sources taking steps to reduce their emissions.

2. THE INHERENTLY LOW EMISSIONS OF GREENHOUSE GASES FROM AGGREGATES INDUSTRY FACILITIES

2.1. A Brief Introduction to the Aggregates Industry

The aggregates industry provides three major products: (1) crushed stone, (2) construction sand, and (3) industrial sand. These products are essential for roads, homes, schools, businesses, and major infrastructure projects needed to sustain the U.S. economy. Stone and sand products are essential for both building construction and glass manufacturing. These products are major constituents of both concrete and asphalt. Without crushed stone and sand, the construction of roads and buildings would not be possible. More than 4 tons of crushed stone and 3 tons of sand are needed for each person in the U.S. each year. [1,2,3]

The crushed stone and sand products are mined and processed at more than 13,000 facilities located in almost every county and parish of every state, commonwealth, and territory. These include 3,748[1] crushed stone facilities, 9,350 construction sand and sand and gravel producing facilities, and 380 industrial sand plants. The industry collectively employees more than 100,000 people and generates revenues of more than 11 billion dollars per year.

State departments of transportation are the industry's biggest clients due to the high demand for crushed stone and sand in road construction and maintenance. Crushed stone and sand are essential raw materials to produce all types of glass and other materials required for the filtration of municipal water supplies. Limestone is used in the power generation industry for the capture and neutralization of acidic sulfur dioxide emissions. Dams and dikes for minimizing flood damage are constructed almost entirely from crushed stone and sand. Stone, sand and gravel are critical for improving community resiliency in times of flooding and storms.

Imports and exports comprise only a very small fraction of the production totals. There are more than fifteen major operating companies and hundreds of small-to-medium sized companies in the aggregates industry. Employment per plant ranges from less than 10 to more than 100. Many of the companies are small, family owned and operated businesses.

A brief introduction to the industry processes demonstrates why greenhouse gas emissions are low. The processes require relatively little energy.

The production of crushed stone, construction sand, and industrial sand are similar except for the means of raw material extraction from the quarry. Stone such as limestone, granite, and trap rock are extracted using explosives loaded into holes drilled into the quarry deposit. After each blast, conducted once per week or several times per week, fragmented rock is picked-up by large front-end loaders and placed in off-road haul trucks weighing 100 to 200 tons when loaded. The haul trucks deliver the rock to a primary crusher usually located within the quarry pit. Sand mining rarely requires the blasting step. Sand is recovered from dry deposits using excavators and from wet deposits using dredges.

The material processing steps needed to reduce the crushed stone to a set of products of varying sizes needed to meet customer specifications vary substantially depending primarily on the specific characteristics of the quarry deposits. Figure 2-1 illustrates the types of process equipment common to both crushed stone and construction sand producing facilities.

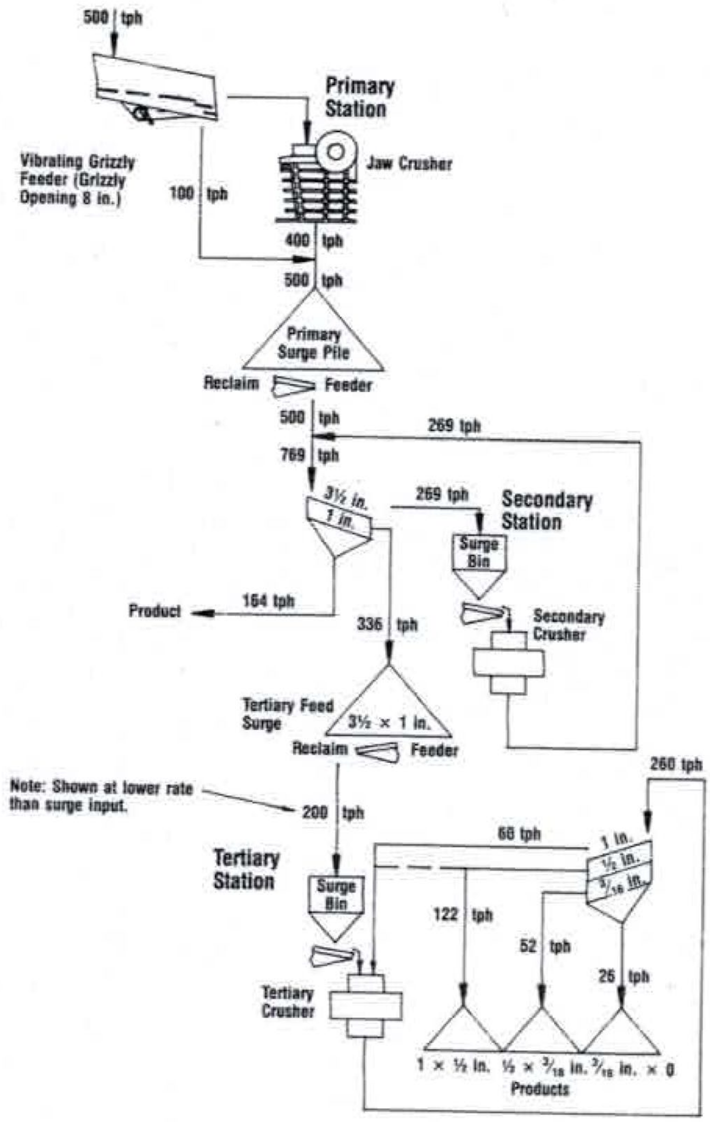

Figure 2-1. Typical flowchart of a 500 ton per hour crushed stone plant
(Source: NSSGA Aggregates Handbook 2013)

The primary crusher reduces fragmented rocks down to a size that can be handled by long belt conveyors. The primary crusher reduces the rock size by a factor of approximately 5.

A conveyor delivers the crushed stone to a secondary crushing loop that includes a crusher, a multi-deck sizing screen, and several conveyors to move stone in various size ranges. Most plants include another crusher loop consisting of another (tertiary) crusher, another multi-deck sizing screen, and additional conveyors. The secondary and tertiary crushers each reduce the rock size by a factor of 4 to 6. Many plants employ a wash circuit that produces washed stone, using a wash screen where fine particles are removed by high pressure water sprays. Conveyors transport the properly sized stone to radial stackers that deposit material in large storage piles for pick-up by customer trucks.

Compared to many other industrial processes, none of the typical crushers, screens or conveyors use high levels of energy. Construction sand-producing facilities require even less energy than crushed stone plants per ton of product. In some facilities, the primary crusher is not needed. The energy required for size reduction is relatively small.

Industrial sand plants have processing equipment that goes beyond the types of equipment included in Figure 2-1. Grinding, screening, filtering, and drying are often used to produce a sand product meeting very stringent size distribution and moisture content levels. The energy required per ton of industrial sand is higher than that for crushed stone and construction sand. The quantities of industrial sand produced and the number of industrial sand-producing plants are much lower than for construction sand.

2.2 The Reasons Why Greenhouse Gas Emissions are Low

Crushing, screening and conveying equipment do not require high energy consumption. Except for the small number of facilities producing industrial sand, the aggregates are not heated or otherwise thermally treated. As indicated in Figure 2-1, the rocks are simply crushed, screened, and separated into several size ranges to meet customer's requirements. The aggregates industry uses low energy processes.

Unlike many other types of mining operations, the extraction of stone and sand is conducted with a recovery ratio of more than 90 percent. That means that more than 90 percent of the material handled in the quarry becomes a salable product. This substantially reduces the amount of material that must be handled and thereby reduces the energy requirements. The amount of overburden material and stone not meeting the necessary specifications is typically small. This means there are not large amounts of excess material that must be stored or moved from a facility, therefore; lower energy is needed.

More than 96 percent of the crushed stone and sand producing quarries are above ground. Ventilation fans and special lighting are not needed for these quarries. Above ground operations have inherently lower energy requirements.

Greenhouse gas emission reduction is entirely consistent with aggregates industry environmental stewardship programs and good business practices. The following examples illustrate why the industry has long-standing interests that inherently reduce greenhouse gas emissions.

- Plant processing equipment design changes that minimize electrical energy costs also reduce greenhouse gas emissions.
- Plant road layout changes and improvements in fuel economy for off-road vehicles and customer trucks decrease fuel costs while also reducing greenhouse gas emissions.
- Preservation of trees and other vegetation around the quarries and processing areas reduces noise and light impacts on neighbors while providing habitats for wildlife and helping to capture carbon dioxide.

- Upgrading mobile fleets to Tier IV engines that are capable of burning 20% less fuel than the units that they are replacing while delivering up to 15% more output reduces greenhouse gas emissions.
- Participating in emission reduction programs such as those provided by states such as Texas and Ohio to replace older fleet vehicles/equipment with newer units.
- Continuing to work on new plant designs to reduce diesel powered haulage and using more conveyors to reduce energy consumption
- Working with equipment manufacturers to use "right sizing" of mobile fleets to enable smaller, more energy efficient trucks and loaders to handle the jobs previously done by larger equipment
- Using alternative fuels
- Implementing state-of-the-art emission monitoring equipment and real-time fleet management software
- Using high-capacity rail cars to move material with less energy consumed.

Reductions in greenhouse gas emissions have been a long-term part of the industry's business practices.

In 2009, NSSGA sponsored the development of one of the first industry-specific calculation programs to help aggregate operators calculate their emissions of CO2, methane, nitrous oxides, and fluorinated refrigerant emissions. Members use this tool to benchmark their emissions, determine areas of reduction, and track progress. This tool has been available online for any operation to use freely, not just NSSGA members.

2.3 Aggregates Industry Emissions

In this section, emissions of greenhouse gases from typical crushed stone, construction sand, and industrial sand plants are (1) estimated, (2) converted to an emission rate per ton of production, (3) scaled up to include total industry production, and (4) compared to other U.S. sources. These data and calculations demonstrate that the greenhouse emissions from the aggregates industry are low.

The aggregates industry's greenhouse gas emissions have been calculated using the NSSGA Greenhouse Gas Emission Calculation procedures, which are based on the emission factors and calculation procedures used by the World Resources Institute (WRI), the Climate Registry (TCR), and the California Climate Action Registry (CCAR). Greenhouse gas emission data calculated using the NSSGA calculator could be voluntarily submitted to EPA's reporting system. The calculated greenhouse gas emissions include both the direct contribution due to on-site fuel combustion and the indirect contribution due to electrical energy consumption.

Typical Crushed Stone Plant—The production capacities of crushed stone plants vary from less than 100,000 metric tons per year to approximately 10,000,000 metric tons per year. The typical plant used for calculating greenhouse gas emissions in this report has an annual capacity of 750,000 metric tons. The calculations assume an operating schedule of 10 hours per day for 300 days per year. The stationary processing equipment and the mobile equipment included in a typical crushed stone plant are summarized in Table 2-1.

Table 2-1. Energy Consuming Equipment at a Crushed Stone Plant Producing 750,000 Tons per Year

Source Category	Unit	Number	Size (HP)	Notes
Stationary Equipment, Electrically Powered	Primary Crusher	1	250	
	Secondary Crusher	1	250	
	Tertiary Crusher	1	250	
	Sloped, Vibrating Sizing Screens	3	40	
	Conveyors and Radial Stackers	20	50	
	Quarry Drill	1	475	
	Plant Lighting	39	N/A	300 watts/unit
	Plant Offices	2	N/A	2 kWh/hour
Mobile Equipment, Diesel, Propane, and Gas Powered	Quarry Haul Trucks	3	725	
	Yard Loaders	2	390	
	Bulldozers	1	250	
	Grader	1	300	
	Forklift and Mobile Lifts	4	N/A	
	Pick-up Trucks	5	N/A	
	Automobiles	5	N/A	
	Pit Loader	1	550	
	Water Truck	1	400	

The fuel consumption of non-highway vehicles, especially the heavy-duty quarry haul trucks, has been estimated based on the capacity of the trucks, an estimated load factor of 30 percent (moderately high), and the number of operating hours necessary to maintain the facility production rate. Hourly use and fuel consumption data have been applied to loaders, bulldozers, and scrapers.

The electrical requirements for a typical crushed stone plant are calculated based on the horsepower ratings shown in Table 2-1 along with the total annual operating hours.

These calculations for a typical crushed stone plant have been prepared using the NSSGA greenhouse gas emission calculation program, which is based on WRI emission factors. The results are shown in Table 2-2.

Table 2-2. Crushed Stone Plant Greenhouse Gas Emissions

Parameter	Value
Mt CO2e/year	4,632.4
Mt CO2e/ production ton	0.00618
Industry total production Mt/year	1,360,000,000
Industry total Mt CO2e/year	8,400,036
Industry MMT CO2e/year	8.40
kg/ton of production	6.18

These emissions are expressed in terms of carbon dioxide equivalent tons (CO2e), which include carbon dioxide, nitrous oxide, methane, and fluorinated refrigerants and their global warming potential factors. These estimates are accurate to within plus or minus 25 percent.

More than 98 percent of the CO2 equivalent emissions are CO2. Emissions of methane, nitrous oxide, and fluorinated compounds are extremely low. The greenhouse gas emissions in units of kg/ton of stone of 6.18 are very similar to values estimated by operators of a facility in Thailand.[4]

The overall greenhouse gas emissions expressed in million metric tons per year (MMT CO2e/Year) of 8.4 tons is low compared to most other industry sources and other community and natural sources.

Fuel consumption of non-highway vehicles is the dominant source of greenhouse gas emissions from crushed stone operations.

Typical Construction Sand Plant—There are 9,350 construction sand producing plants in the U.S.[2] The procedures used to estimate greenhouse gas emissions for construction sand plants are similar to those used for crushed stone facilities. A typical sand plant capacity of 250,000 tons per year has been assumed. Table 2-3 provides the list of stationary and mobile equipment in a typical sand plant.

Table 2-3. Energy Consuming Process Units at a Construction Sand Plant Producing 250,000 Tons/Year

Source Category	Unit	Number	Size (HP)	Notes
Stationary Equipment, Electrically Powered	Primary Crusher	1	100	
	Sizing Screens	2	40	
	Conveyors	20	40	
	Lighting	30	N/A	0.3 kwh
	Plant Offices	2		1 kwh
Mobile Equipment, Diesel and Gas Powered	Excavator	1	420	
	Loader	2	390	
	Bulldozer	2	250	
	Grader	1	300	
	Forklifts and Mobile Lifts	4	N/A	
	Pick-up Trucks	3	N/A	
	Automobiles	10	N/A	

An excavator is used at construction sand plants instead of the blasting, loading, and quarry haul trucks needed at crushed stone plants. The typical plant also has fewer conveyors and radial stackers. The primary crusher has a lower horsepower rating than those in a crushed stone plant. Secondary and tertiary crushers are not included in the energy calculations for a construction sand producing plant.

The electrical requirements for a typical sand plant are prepared based on the horsepower ratings shown in Table 2-3 along with the total annual operating hours.

These calculations summarized in Table 2-4 for a typical sand plant have been prepared using the NSSGA greenhouse gas emission calculation program, which is based on WRI factors.

The greenhouse gas emissions are 5.51 kg CO2e per ton of sand. The total greenhouse gas emissions from construction sand production are 5.34 MMt CO2e per year.

Table 2-4. Construction Sand Plant Greenhouse Gas Emissions

Parameter	Value
Mt CO2e/year	1,376.9
Mt CO2e/ production ton	.00551
Industry total production Mt/year	970,000,000
Industry total Mt CO2e/year	5,342,290
Industry MMT CO2e/year	5.34
kg CO2e/ton of product	5.51

Typical Industrial Sand Plant—An industrial sand plant has similarities to a construction sand plant with regards to the quarry operations and crushing/screening operations. There are additional process steps to screen and dry the sand. A general summary of the additional equipment is provided in Table 2-5.

Table 2-5. Additional Energy Consuming Process Units at an Industrial Sand Plant Producing 250,000 Tons/Year

Source Category	Unit	Number	Size (HP)	Notes
Processing and Rail Loadout	Sand Dryer	1		45 MMBTU/hour
	Sand Dryer Fabric Filter	1	25	
	Sizing Screens	20	40	
	Conveyors	20	40	
	Bucket Elevators	6	10	
	Silo Bag Filters	6	2	
	Rail Loadout System	1	50	
	Processing Buildings	1		4 kWh/hour
	Lighting	30		0.3 kWh/U
Mobile Equipment, Diesel and Gas Powered	Excavator	1	420	
	Loader	2	390	
	Bulldozer	2	250	
	Grader	1	300	
	Forklifts and Mobile Lifts	4	N/A	
	Pick-up Trucks + Auto.	11	N/A	15mpg

The greenhouse gas calculations are based on a 30 MMBTU/hour average natural gas firing rate for the sand dryer.

The greenhouse gas emissions for industrial sand plants that include a sand dryer are higher than the emissions for both the crushed stone and construction sand plants. These emissions are summarized in Table 2-6.

Table 2-6. Industrial Sand Plant Greenhouse Gas Emissions

Parameter	Value
Mt CO2e/year	2,187.3
Mt CO2e/ production ton	0.00875
Industry total production Mt/year	95,000,000
Industry total Mt CO2e/year	831,186
Industry MMT CO2e/year	0.831
kg CO2e/ton of product	8.749

Table 2-7 summarizes the total aggregates industry annual greenhouse gas emissions in the U.S. These estimates are accurate to approximately plus or minus 25 percent. The emissions include carbon dioxide, nitrous oxide, methane, and fluorinated compounds.

Table 2-7. Aggregate Industry Total Greenhouse Gas Emissions

Industrial Sector	Number of Plants	Emissions, MMT CO2e/Year
Crushed Stone	3,748	8.40
Construction Sand	9,350	5.34
Industrial Sand	380	0.83
TOTALS	13,479	14.57

2.4 Putting Aggregates Industry Emissions into Perspective

The total U.S. greenhouse gas emission quantities for the previous 28 years are summarized in Figure 2-2. The 2018 total U.S. emission quantity was 6,677.8 MMT CO2e per year.

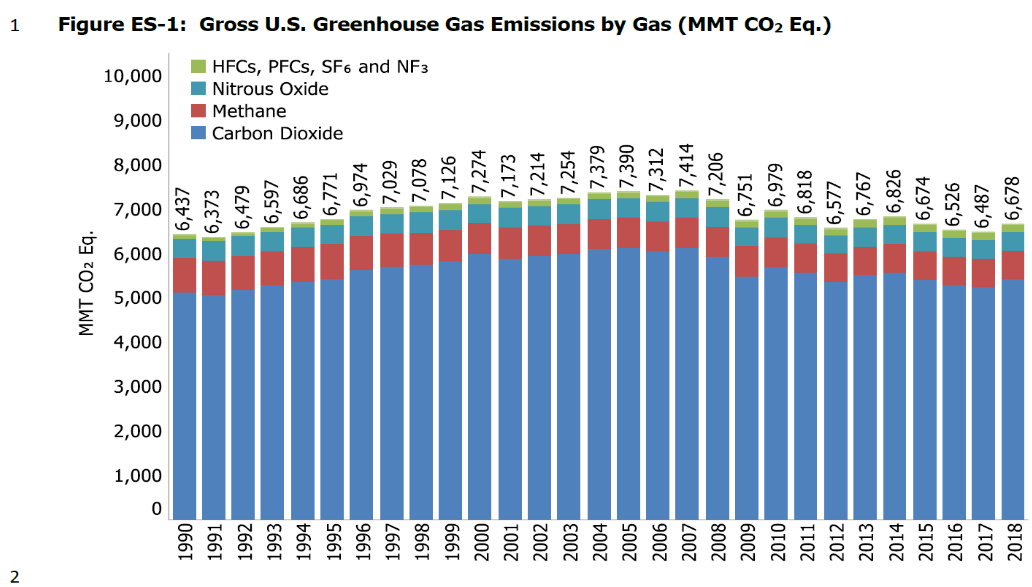

Figure 2-2. Total U.S. greenhouse gas emissions in MMt CO2e/Year. Source: EPA[5]

As indicated in Table 2-8, the aggregates industry is emitting approximately 0.22 percent of the total U.S. emissions of 6,677.8 MMT CO2e per year. Some of the major industrial sources include electrical power generation at 1820 MMT CO2e per year (27.25 percent of U.S. total) and transportation at 1,469.1 MMT CO2e (22.0 percent of U.S. total).

Table 2-8. Comparison of Aggregate Industry Greenhouse Gas Emissions in the U.S. with Other U.S. U.S. Source Categories[1]

Source		2018 Emissions, MMT CO2e/year	Percent of U.S. Total
Major	Electric Power Sector	1820.0	27.25
	Transportation	1469.1	22.00
	Industrial Power Generation	1177.8	17.64
	Residential Fuel Combustion	338.2	5.06
	Commercial Fuel Combustion	228.2	3.42
	Wood Biomass, Ethanol, Biodiesel	219.4	3.29
	Non-Energy Fuel Combustion	119.5	1.79
	Iron, Steel, Coke Production	104.7	1.57
Major Sources (>1% Contribution each), Total		5476.9	82.02
Minor	Cement Production	33.5	0.50
	Natural Gas Heating	32.2	0.48
	U.S. Territory Fuel Use	27.6	0.41
	Petrochemical Production	21.6	0.32
	Aggregates Production	14.6	0.22
	Ammonia Production	13.0	0.19
	Lime Production	11.7	0.18
	Petroleum	09.6	0.14
	Waste Incineration	08.0	0.12
	Other Industrial, Community, and Natural Sources	1029.11	15.42
Minor Sources (<1% Contribution each), Total		1200.91	17.98
U.S. Total		6,677.8	100.0

1. Note: All data except the aggregates industry values are from EPA reference 6, Table ES-2, with the approximate total MMT CO2 emission for 2018 sourced from Table 3-17 and ES.2 of the EPA Greenhouse Gas Inventory Report.

Despite the fact that emissions of greenhouse gases from aggregates industry sources are on the low end of U.S. sources, the industry continues to evaluate ways to reduce emissions as part of environmental stewardship commitments and good business management.

3. AGGREGATES INDUSTRY EMISSION MITIGATIONS

The aggregates industry continues to evaluate existing and new approaches for further reducing greenhouse gas emissions that are practical and consistent with environmental requirements. The industry continues to evaluate new science and research to apply to aggregates production.

3.1 Aggregates Crucial for Infrastructure Improvements

Aggregates are critical for all manner of transportation including roads, subways, light rail systems, airports, ports, sidewalks, and bike trails. The aggregates industry can contribute to road improvements that help reduce these emissions. Crushed stone and sand are the largest constituents of both the concrete and asphalt pavement materials used for highway construction and repair.

Traffic jams, accidents due to unsafe roads, and other problems lead to increased emissions. Proper road maintenance and improvements such as more efficient interchanges help reduce emissions. Aggregates are required for construction of improved roads, bridges, and other transportation systems that reduce congestion and reduces emissions from the trasportation sector.

The deteriorating condition of the nation's bridges is well known. Re-routing traffic around bridges found to be structurally deficient will contribute to substantially increased fuel consumption for the thousands of automobiles and trucks that are forced to take long detours. Crushed stone and sand are essential raw materials needed for the repair and replacement of deteriorated bridges. Aggregates are the major components of bridge foundations and pavements.

Crushed stone and sand for water resources-related construction projects are important for resiliency to protect communities from droughts and floods.

3.2 Revised Concrete Specifications to Reduce Greenhouse Gas Emissions from Portland Cement Plants

Crushed stone and sand are major constituents of both concrete and asphaltic concrete. They comprise up to 80 percent of Portland concrete and up to 95 percent of asphaltic concrete. Changes to the various concrete and asphaltic concrete specifications demanded by transportation agencies and other customers would allow increased stone and sand content.

As indicated in Table 2-8, cement production is responsible for more than 33 MMT/year of greenhouse gas emissions, which is more than two times the total emissions of aggregate industry sources. Reduction in the quantity of Portland cement coupled with the increased quantity of stone could have a beneficial impact on the greenhouse emissions from Portland cement plants. In a similar way, a slight reduction in the quantity of asphaltic material used in making asphaltic concrete would reduce the emission of greenhouse gases from hot mix and drum mix asphalt plants. Work underway in the aggregate and cement industries suggests that increased use of crushed stone and sand in these basic construction materials will not adversely affect strength and durability.

3.3 Possible Use of Product Distribution Centers to Reduce Truck Fuel Consumption

The greenhouse gas emission calculations summarized in Section 2 indicate the largest source of greenhouse gas emissions is the shipment of crushed stone and sand by truck to customer destinations. That is why it is imperative that communities have access to local aggregates sources, because reducing hauling of material from plant to project (even by five miles) can lead to significant emission reductions. When planning for infrastructure projects and new development, communities should plan to ensure that they have continued access to a sustainable supply of aggregates.

Furthermore, the use of railroad shipping to centralized distribution centers in metropolitan areas would substantially reduce emissions, while also reducing truck traffic near the plant sites. There are numerous potential obstacles to this option. Relatively few crushed stone plants are now sufficiently close to rail lines to provide this option. The cost of installing a siding for loading stone or sand is often high. The cost for the railcar loading at the quarry and unloading at a distribution center is also high. It is unlikely that the option of shipping product to a centralized distribution center will be practical and economically viable for most plants. However, for those plants having existing rail service or plants where rail service could be added relatively easily, this approach would have a very favorable impact on greenhouse gas emissions.

3.4 Enhanced Blasting Practices to Reduce Electrical Energy Consumption

The aggregates industry continues to evaluate the possible benefits of enhanced blasting practices.[6] The primary objective is to modify the fragmented rock size distribution following the blast to minimize the primary and secondary crusher energy requirements. This would help reduce indirect CO2e due to electrical energy purchases. However, additional data are needed to determine if these changes have a positive or negative impact on (1) the quantity of ANFO needed per ton of fractured stone, (2) the fuel oil content of the ANFO used, and (3) the reproducibility of the fragmented rock size distributions. Obviously, there is also the paramount importance of safe blasting conditions with minimum impact on adjacent properties.

The potential impact on greenhouse gas emissions will be relatively small because indirect emissions due to purchased electrical power are small at crushed stone and sand producing plants.

3.5 Recycled Aggregates

Recycled aggregates can provide emission benefits, but only if the material is locally available and can be used locally. At the present time, approximately 195 crushed stone facilities process primarily recycled aggregates.[7] Recycling these materials can reduce landfill requirements and reduce greenhouse emissions for the production of new aggregate materials. When locally available, the industry processes the demolition materials through a primary crusher and subsequent processing equipment to yield a recycled aggregate material having the necessary size distribution for the intended application. The removal of reinforcing steel, glass, and other construction materials prior to processing can add effort and emissions.

3.6 Other Small Changes That Add Up

The aggregates industry continues to evaluate a variety of small improvements to minimize greenhouse gas emissions. These changes will be made with the expectation that small changes made at numerous facilities will have a beneficial effect.

Some operators are converting the commonly used air conditioning refrigerant with a high global warming potential to refrigerants with a lower GWP. For example, H134a having a GWP of 1,300 can often be replaced with R152a having a GWP of only 130. Accordingly, any refrigerant loss during vehicle maintenance will have only one-tenth the impact on greenhouse gas emissions.

Office buildings can be constructed with increased insulation to reduce heating energy needed. Double pane windows can be installed to further reduce heat loss. Building roofing materials can be constructed with white roofing granules to reflect heat.

To further reduce the indirect emissions related to purchased electrical power, industrial facilities will evaluate the technical and economic feasibility of installing solar and/or wind turbines to supply the electrical power to buildings, plant lighting, and equipment such as truck wash stations.

Companies employ methodologies such as thermography to identify energy or heat leaks, ensuring that their equipment is operating with utmost efficiency. Programs like these not only save downtime and wear and tear or damage to equipment but can quickly add up to saving large amounts of power leaking through faulty equipment.

Hybrid vehicles are also being used throughout the industry for loaders, which are proving to be just as, if not more effective methods of moving rock from place to place. These loaders reduce emissions, (the metrics vary depending on the company and models used) and are also quieter.

Many companies are now using conveyor belts to move rock longer distances, eliminating the need for loaders to move piles of rock. Some of these conveyor systems move rocks for very long distances, and significantly reduce the number of loaders and dump trucks needed to move rock from place to place.

4. AGGREGATES INDUSTRY CONTRIBUTIONS TO CAPTURE CO2

Reforestation of open land at aggregate industry plants continues to be a core element of environmental stewardship. Trees, such as those shown in Figures 4-1 and 4-2, provide significant environmental benefits by reducing noise and light from affecting nearby neighbors. Trees provide habitat for wildlife and improve aesthetics.

Figure 4-1. Crushed stone plant surrounded by reforested area, 1997.

Figure 4-2. Trees surround a quarry pit and quarry haul road, 1997

Even in semi-arid climates such as the Southwest, aggregate producers encourage the growth of indigenous vegetation that can tolerate the rainfall levels, temperatures, and soil conditions.

An increased emphasis on reforestation at aggregate plants provides further benefits for carbon capture. Tree planting in conventional locations such as facility berms and plant entrances can be expanded. Many facilities have large buffer areas as shown in Figure 4-3 between the processing equipment and adjacent neighbors. As long as the area is not above future reserves, more trees can be planted for CO2 capture.

Figure 4-3. Open area between the processing area and the plant berm

There are also reclaimed areas that could support more vegetation, including trees. The only areas not available for plantings include: (1) the reserves to be mined in the next five to ten years, (2) the processing areas, and (3) in plant roads. Because these areas can move as mining progresses, a company considering vegetation planting for CO2 capture will have to consider their long-range mining plan.

The potential CO2 capture per year in planted open areas could reach from 0.4 to more than 2.0 tons CO2 per year except in the arid west and southwest. In some aggregate industry plants, as much as two acres could be reforested. In the arid Southwest, reforestation will be in the form of vegetation compatible with the low rainfall levels. In areas such as California, it will take the form of fire-resistant vegetation in a form that helps in forest fire control.

There are costs associated with planting trees and other forms of vegetation in open areas. The operating companies will often need to consult horticulturists to determine the most appropriate species for the local climate and soil characteristics. It will be important to determine planting densities. Costs will include the seedlings, fertilizer, and occasional treatments to increase resistance to insect infestations.

Aggregates industry facilities will continue to reforest open land to extent possible. Aggregates operatorsb plant trees for many purposes: shielding neighbors from plant light and noise, community/employee engagement, local partnerships/alignments, flood/erosion mitigation, biodiversity conservation, sustainability, and land stewardship.

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