Transportation of Silica Sand in Minnesota

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Minnesota Department of Transportation
U.S. could soon overtake Saudi Arabia as world's top oil producer

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NEW YORK - U.S. oil output is surging so fast that the United States could soon overtake Saudi Arabia as the world's biggest producer.

Driven by high prices and new drilling methods, U.S. production of crude and other liquid hydrocarbons is on track to rise 7 percent this year to an average of 10.9 million barrels per day. This will be the fourth straight year of crude increases and the biggest single-year gain since 1951.

The boom has surprised even the experts.

“Five years ago, if I or anyone had predicted today’s production growth, people would have thought we were crazy,” said Burkhard, head of oil markets research at IHS CERA, an energy consulting firm.

The Energy Department forecasts that U.S. production of crude and other liquid hydrocarbons, which includes biofuels, average 11.4 million barrels per day next year. That would be a record for the U.S. and just below Saudi Arabia's output of 11.6 million barrels. Citibank forecasts U.S. production could reach 13 million to 15 million barrels per day by 2020, help make North America "the new Middle East."
Roughly 200 tanker trucks deliver water for the fracturing process. A pumper truck injects a mix of sand, water and chemicals into the well. Natural gas flows out of the well. Recovered water is stored in open pits, then taken to a treatment plant. Natural gas is piped to market.

**Hydraulic Fracturing**

Hydraulic fracturing, or “fracing,” involves the injection of more than a million gallons of water, sand and chemicals at high pressure down and across into horizontally drilled wells as far as 10,000 feet below the surface. The pressurized mixture causes the rock layer, in this case the Marcellus Shale, to crack. These fissures are held open by the sand particles so that natural gas from the shale can flow up the well.

The shale is fractured by the pressure inside the well.
HYDROFRACKING A WELL

Fluid pressure fractures the rock, sand grains keep the fractures open.
Lower 48 states shale plays

Source: Energy Information Administration based on data from various published studies.
Updated: May 9, 2011
THE BEST FRAC SAND IS WELL ROUNDED AND NEARLY PURE QUARTZ

Many younger sands are too angular or contain other minerals or rock fragments.
WHERE THE BEST FRAC SAND IS (RED)
The district’s sandbox
Existing and proposed frac sand mine operations

Sources:
Mine locations: State and county permitting records; industry contacts / Sand deposits: U.S. Geological Survey / Rail data: Minnesota and Wisconsin departments of transportation
Projected Frac Sand Demand

- Current Wisconsin & Minnesota production at 28-30 Million tons/year (90% Wisconsin)
- Estimated long-term demand, 34-50 MMT/Yr
- Estimated production if all prospective WI mines brought on line, 60-70 MMT/Yr
- Life of current Shale Oil & Gas exploration trend, 25-35 Years (?)
- Volume of sand resources – 100+ Years or more
Non-Metallic Minerals Mining

• Sand, Gravel, Clay, Potash, Limestone, etc.
  widespread – literally every county in state
• Silica sand in Minnesota a mature, legacy industry for many purposes
• 150 year history of sand extraction
• National leader for glass sand, foundry sand, pure silicon (electronic boards and wafers) production
• Same sources/ formations as frac sand
Silica Sand as a Transportation Commodity

• Considered a common non-metallic mineral
• Normally handled as a dry bulk commodity, easily transferred by mechanical means including bucket loaders, clamshells, and conveyors
• Chemically inert, non-hazardous material (USDOT hazmat classification, i.e., no placards required)
• Transported packaged and in bulk by all modes; truck, rail, barge, and intermodal container
• Low-value, high-volume commodity; transportation a major cost component
Occupational Health Considerations

- Mining and Processing workers identified at risk for dust inhalation & silicosis; Federal and state standards apply (OSHA, NIOSH, MSHA, etc.)
- Limited data on ambient/public exposure risk
- Documented industry success at managing inhalation risk, consistent reductions over time
- CDC notes mortality rate of 0.66 per million persons (2002 stats, 12-64 age group)
- Dust control is key – silica a minor fraction of transportation-generated dust (CA, St. Paul tests)
- Counterpoint; Commercial trucking of sand included in trucker mortality rate of 250 per million
Trucking

- Maximum weight for 5-axle semi-tractor-trailer is 80,000 pounds GVW – Approx. 25 ton payload
- No exceptions or allowances for overloads for silica sand, unlike agriculture or forest products
- All loads required to be covered on Interstates or over 30 mph on other roads; no dusting or leakage allowed, compliant with EPA regulations
- Due to wide use of scales and load devices, sand haulers have very low incidence of weight violations
Rail

• Silica sand normally hauled long-distance in unit trains of 100-125 100-ton cars; 12,500 tons/train

• Two types of equipment and handling used in rail transport per accepted practice: wet raw sand may be loaded in open hoppers or gondolas without appreciable drying and dusting during hauls; washed/graded/dried sand is transported in covered hoppers to prevent loss or contamination of cargo, and potential for dust

• All rail transport of any commodity must comply with EPA regulations for air quality (particulate contamination)

• Twin Cities a major gateway to Bakken fields
Barge

- Silica sand is hauled by barge in applications similar to rail, open or closed depending on condition of sand, EPA air and water rules apply
- Normal payload of bulk river barge is 1,500 tons per barge
- River tow (collection of barges under control of a single towboat) may carry 22,500 tons or more
- River transport a relatively small percentage of total movements
Frac Sand Development – Impacted Minnesota Sites

- Port of Winona and Winona bridge
- Port of Red Wing and Red Wing bridge
- Wabasha Bridge and CP Rail Yard transloads
- St. Charles Processing Plant & rail loading
- Southwest Winona County township mines
- Cannon Falls mine, plant, loading
- Le Seur County mines & plants
- Scott County mines & plants
- Washington County mine, Ramsey County loading
Industry Guidelines (Canadian Sand & Proppants)

• “Air

Crystalline silica is a dangerous substance, and long-term exposure to it has been shown to cause silicosis, a potentially deadly condition. However, crystalline silica is formed by the crushing of sand grains, most commonly in sandblasting operations. At CSP, we need the sand to maintain its grain structure... any crushing of the sand makes our product unusable. Therefore, we go to great lengths to avoid any creation of the airborne crystalline silica particles in question.

We have multiple plans for controlling emissions at the plant. These include bag-house dust collectors on conveyors, bins, and elevators; paving selected areas of the plant; and using water to control dust on unpaved sections and stockpiles at the plant and mine sites. Records will be kept of all maintenance of the dust collection/suppression equipment.

Our emissions will be monitored using an ambient air quality monitor located on the plant site in conjunction with opacity monitoring on the stacks themselves. Reports from this monitor will be delivered to and analyzed by the DNR.

Employees will periodically wear monitoring devices that will measure their exposure to particulate matter. Reports from these devices are gathered and analyzed by the Mining Health and Safety Administration (MSHA).”

• “Water

CSP’s projected water usage is 125 million gallons annually. Most of this water is lost due to evaporation during our washing process. The rest is used in the dust suppression equipment. At the request of the city council we will be using water from the city water supply, as another local business recently upgraded their facility and reduced their annual water usage by 400 million gallons. There will be no hazardous chemical usage at any point in our process. During our scrubbing process, a flocculant is added to the sand and water mixture. This flocculant is an inert polymer which causes the dissolved and suspended fine material (silts, clays, and organics) to bind together. By doing this, we can separate the fines from the wash water and then recycle the water back into the wash process, saving millions of gallons annually.”
Counties with Industrial Silica Sand Bedrock: Jordan, Wonewoc, and St. Peter Sandstone

- Current silica sand producers
- Significant deposits at or near the surface
- Significant deposits exposed along river corridors
- Limited or deeply buried deposits
- Passed silica sand mining moratorium

Winona expires 04/2012
Wabasha expires 08/2012
Goodhue expires 09/2012
Houston expires 02/2013
Fillmore expires 02/2013
Conditional Use Permit – Road Use Fee Structure ‘Best Practices’

- Develop open negotiations with sand companies (trucking, rail firms not financially capable of absorbing fees)
- Determine most efficient/high-capacity routes
- Identify improvements needed and costs
- Open sharing of costs if multiple operators
- Charge fees only for directly-incurred costs; limit fees to what is needed, audit as agreed
C.U.P.’s & Road Use Fees - Peer County Examples

- Up-Front negotiated lump sum plus M&R, or
- Negotiated fee per ton by site
- Private funding of added road crews
- Time-and–project-specific road construction
- Annual mine output caps, specified routes
- Shared information on inspections, detours, other problems
- Regular communications
Response to Frac Sand Issues

• Environmental issues can be met in Conditional Use Permits; Road use negotiation, land reclamation could be enhanced by statutory actions and added authority for local jurisdictions
• Wear on local roads addressed in C.U.P.; Best practices employed for solutions
• Due consideration given to job creation, tax base, local traffic and safety issues during moratoriums; lead by County and City jurisdictions in negotiations
• Road safety is a major local and state concern—non-motorized vehicles must share many roads
MN Silica Sand Accommodations

- MnDOT working on transport capacity improvements with rail and trucking firms at this and other alternate sites to minimize transport impacts
- Cities, Towns, Ports pro-actively responding to dust-creating issues; Improvements to unpaved road areas, turning and loading pads, intersections, bulk handling.
- Counties considering extraction or ton/mile fees, and extraction limits, to offset local road deterioration and traffic impacts. Most sand producers have been responsive to protect their business opportunities
- Noise, intersection geometrics, queue lanes, traffic and grade crossing safety, shoulder width, non-motorized vehicle conflicts are being responded to as appropriate
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