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Neighbors Diverge: An Explanation for the Differences in Silica Sand Mining Activity in Wisconsin and Minnesota

Introduction

As contiguous states, Wisconsin and Minnesota share similar demographics and economic characteristics (see *Table 1*). However, the silica sand industry has developed much more quickly in Wisconsin than in Minnesota. Wisconsin holds 75 percent of the silica sand market in the United States.[1] Wisconsin produced approximately 26 million tons of silica sand per year as of 2014, with a proposed capability of 60 to 70 million tons.[2] Wisconsin had 121 mines, 74 processing sites, and 34 sand rail facilities in May 2014.[3] By contrast, Minnesota produced approximately three million tons of silica sand per year as of 2014.[4] By the end of 2013, Minnesota had nine silica sand mining operations.[5]

Table 1
Demographic Summary for Wisconsin and Minnesota, 2013 (unless noted)

	Wisconsin	Minnesota
Population	5,742,713	5,420,380
Persons per square mile	87.6	62.3
Median household income	$51,467	$60,702
Unemployment	4.3%	3.8%
Annual payroll, thousands (2012)	$99,665,591	$116,324,440
Mining, quarrying, and oil and gas extraction payroll, thousands (2012)	$160,036	$523,169
Annual silica sand production (2014)	25-27 million tons[6]	3 million tons[7]

Sources for demographic and economic data: U.S. Census Bureau, 2013 American Community Survey (1-Year Estimates), 2012 County Business Patterns

Author

Alison Carey
Policy Analyst
Center for Local, State, and Urban Policy
Gerald R. Ford School of Public Policy
University of Michigan
aecarey@umich.edu

CLOSUP
Center for Local, State, and Urban Policy
Gerald R. Ford School of Public Policy

GERALD R. FORD SCHOOL
OF PUBLIC POLICY
UNIVERSITY OF MICHIGAN

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This paper provides a brief discussion on the demand for silica sand mining in Wisconsin and Minnesota and explores the reasons for different levels of industry development in the two states. These reasons include geology, rail transportation capacity, and community type, although the most significant difference is the orientation of state leadership and the resulting regulatory environment. This paper also discusses the similarities in local responses to sand mining, including actions by local governments, advocacy organizations, and citizen activists, both in opposition to and in support of further industry development.

This comparative case study illustrates the implications of regulatory decentralization in the United States. Two neighboring states share a natural resource with value to the national economy and relevance for national energy policy. Moreover, extraction of this resource has implications for the economy, environment, and culture of local communities. The divergent approaches to regulating silica sand mining in Wisconsin and Minnesota demonstrate how decentralization can result in different outcomes in state- and local-level responses.

Key Findings

- Reasons for different levels of silica sand industry development in Wisconsin and Minnesota include greater abundance of accessible silica sand deposits in Wisconsin, greater rail capacity for sand transport in Wisconsin, joint business and environmental interests creating a less welcoming climate in tourism-dependent cities in Minnesota compared to in farming communities in Wisconsin, and pro-industry state leadership in Wisconsin.
- The Wisconsin governor has expressed support for mining, whereas the Minnesota governor has expressed support for local bans on mining.
- In Wisconsin, one state agency engages with the silica sand mining industry, whereas five state agencies play a role in shaping industry development in Minnesota.
- The Wisconsin state legislature passed legislation that supports industry growth and did not pass several bills that would have imposed additional requirements on industry. By contrast, the Minnesota state legislature passed legislation that institutes additional environmental protections and facilitates local regulation. Failed bills in Minnesota would have placed even greater restrictions on mining activity.
- Differences in the regulatory environments in Wisconsin and Minnesota include rigor of the mine permitting process, comprehensiveness of air quality monitoring, and power of local governments to regulate industry.
- Both states have observed proactive responses at the local level from local governments, advocacy groups, and citizen activists, both in opposition to and in support of mining.
- Some local governments in Wisconsin have encouraged mining by annexing land from municipalities with more strict regulations into municipalities with less strict regulations.
- The divergent industry growth patterns in Wisconsin and Minnesota, as well as potential decline in demand as a result of market saturation, suggest that Minnesota is unlikely to experience a boom in the silica sand industry as has occurred in Wisconsin.

Demand for Silica Sand in Wisconsin and Minnesota

Sand mining has occurred in Wisconsin and Minnesota for more than a century, but the rise of hydraulic fracturing, or "fracking," has increased demand for silica sand.[a] On a national scale, the U.S. silica sand market has doubled since 2008.[8] Fracking in nearby North Dakota, in particular, has driven demand for silica sand mined in Wisconsin and Minnesota.[9]

The future demand for silica sand is uncertain. According to some, demand for sand is likely to increase. One forecast estimates a long-term demand of 34 to 50 million tons per year, compared to a current combined production for Wisconsin and Minnesota of 28 to 30 million tons per year.[10]

However, an alternative view is that new oil and gas production has saturated the gas market and lowered prices, resulting in a drop in active drilling rigs and demand for sand.[11] Demand for sand is 40 to 60 million tons per year in the United States today but is estimated to drop to 34 million tons in 2015.[12] Another forecast estimates that annual demand for silica sand will increase 4.8 percent or more but will stop growing in 2016.[13] Expansion of silica sand mining in Wisconsin and Minnesota may have peaked as early as 2013, with some forecasts suggesting that currently permitted mines in Wisconsin alone may satisfy near-term demand.[14]

As a result of market saturation, some newly permitted sand mines and loading facilities across the United States, including those in Wisconsin and Minnesota, sit idle and some operators are stockpiling sand.[15] Buyers can demand higher-quality product of specific grain size with affordable and efficient transportation options.[16] Potential also exists for synthetic materials to replace mined sand in the future.[17]

Differences between Wisconsin and Minnesota that Drive Industry Development

Several differences between Minnesota and Wisconsin have contributed to the different levels of development, including geology, transportation infrastructure, community type, and state leadership.

Geology, transportation infrastructure, and community type

Accessible silica sand is more abundant in Wisconsin than in Minnesota.[18] Much of the sand formations in Minnesota lay beneath thick layers of till, sand, and gravel, making extraction more difficult.[19] In addition, Wisconsin has the necessary rail capacity to transport sand to major transportation hubs.[20] Minnesota has less capacity to transport sand to major transportation hubs, in part because old rail lines have been abandoned and in part because agricultural products use much of the available capacity. As a result, transport via rail costs more than other modes of transport in Minnesota and many silica sand companies rely instead on truck transport.[21] Increased truck traffic is a source of concern, and local governments have taken steps to minimize truck traffic via bans, restrictions, or fees.[22] Moreover, media reports suggest that the nature of affected communities has differentially influenced the development of the silica sand industry in Wisconsin and Minnesota. In Wisconsin, silica sand mining has occurred primarily in small farming communities. In Minnesota, larger cities near picturesque landscapes draw tourists, and activist groups worry that increased silica sand mining would undermine the state's tourism economy. Joint interests of environmentalists and business have created a less friendly environment for silica sand mining companies in Minnesota.[23]

a Fracking involves pumping fluid and sand deep below the surface to crack rock layers and release natural gas.

State leadership and regulatory environment

Although geology, transportation infrastructure, and community type influence industry development, the most significant difference between Minnesota and Wisconsin is the political orientation of state leadership (see *Table 2*).

Table 2
State Executive and Legislature Summary for Wisconsin and Minnesota, 2013-2014

	Wisconsin	Minnesota
Governor Name, Affiliation	Governor Scott Walker, Republican	Governor Mark Dayton, Democratic–Farmer–Labor
House (2013-2014) (Democrat:Republican)	39:60[24] Republican control	73:61[25] Democratic control
Senate (2013-2014) (Democrat:Republican)	15:18[26] Republican control	39:28[27] Democratic control

In the 2013-2014 session, Wisconsin had a Republican executive and a Republican-controlled legislature. In the 2015-2016 session, Wisconsin remained under Republican control.[28] In the 2013-2014 session, the Minnesota legislature was controlled by the Democratic-Farmer-Labor party, but the Minnesota House of Representatives came under Republican control with the 2015-2016 session.[29]

Wisconsin state leadership has created a pro-business climate in the state, which has been favorable for industry development.[30] Specifically, the pro-business climate in Wisconsin supports mining activity, whereas the tourism-oriented business community in Minnesota, especially in and around cities, aligns with environmental groups.

Governors express views on sand mining

The governors of Wisconsin and Minnesota have expressed differing views on the silica sand industry. Wisconsin Governor Scott Walker supports development of the silica sand mining industry. He has expressed "'thanks to God and the glaciers' for leaving behind the right kind of sand" and stated that "there is a miner on the Wisconsin flag for a reason."[31] Governor Walker's 2013-2015 budget included $6.4 billion for freight rail and roadway improvements to facilitate sand export.[32] His proposed 2015-2017 budget would commit $43 million to rail improvements and would increase executive control over environmental protections. Specifically, the 2015-2017 budget would remove authority from the board of the Wisconsin Department of Natural Resources (WDNR) to set policy for the department, instead making the board an advisory panel. The proposed budget would also eliminate 66 WDNR staff positions and freeze land purchases for natural resource conservation until debt service falls under a specified threshold.[33] These changes would provide the governor with greater power to set environmental protection requirements for the silica sand industry.

By contrast, Minnesota Governor Mark Dayton has expressed support for regulating the silica sand industry to prevent harm to the environment or public health. In 2013, Governor Dayton expressed support for a ban on sand mining in southeastern Minnesota.[34] In April 2014, when an advocacy group called the Land Stewardship Project circulated a petition calling for a two-year moratorium on sand mining in southeastern Minnesota and stronger statewide standards, Governor Dayton responded to the petition stating that he agreed with a ban but lacked the authority to impose one without support from the state legislature.[35] Instead, the Governor recommended that local governments enact moratoria on silica sand mining and processing within their own jurisdictions.[36]

State agencies play a role in industry development

State agencies have played less of a role in regulating the silica sand industry in Wisconsin than in Minnesota. In Wisconsin, only one state agency plays an active role in the discussion over silica sand mining. WDNR interacts with the silica sand industry through various activities (see *Table 3*).

Table 3
Wisconsin State Agency Activities Relevant to Silica Sand Mining

Activity	Description
Wisconsin Department of Natural Resources	
Permitting / Environmental review	WDNR issues the same air and water permits for silica sand mines as it does for other nonmetallic mining operations.[37] WDNR requires that companies assess air and water pollution impacts of their proposals.[38]
Collecting air quality data	WDNR requires that permitted operators submit air quality data, which WDNR reviews, compiles, and makes available on the agency website.[39]
Regulating borehole abandonment	Wisconsin law requires that drillers seal abandoned boreholes to prevent groundwater contamination, including holes drilled to locate sand deposits. WDNR provides forms and technical assistance to drillers.[40]
Auditing / Preparing model ordinances for mine reclamation	WDNR conducts audits of local government mine reclamation programs. In addition, WDNR provides templates to help local governments develop reclamation ordinances in compliance with state law.[41]
Research	WDNR published a report on the environmental and health impacts of silica sand mining in 2012.[42] In January 2015, WDNR agreed to update the report within a year.[43]

In Minnesota, multiple state agencies have played a part in regulating silica sand mining or raising awareness about its impacts, including the Minnesota Pollution Control Agency (MPCA), Minnesota Department of Natural Resources (MDNR), Minnesota Environmental Quality Board (EQB)[b], Minnesota Department of Health (MDH), and Minnesota Department of Transportation (MnDOT) (see *Table 4*).

b EQB is a state-level group with representatives from the Minnesota Governor's Office, nine state agencies, and the citizenry. EQB develops policy, creates long-range plans, and reviews proposed projects that would influence Minnesota's environment.

Table 4
Minnesota State Agency Activities Relevant to Silica Sand Mining

Activity	Description
Minnesota Pollution Control Agency	
Permitting	MPCA issues air and water permits for sand mining and storage operations, although the permits are not specific to silica sand mining.[44] Facilities with existing permits can mine silica sand without modifying their permits and new facilities must apply for permit coverage.[45]
Collecting air quality data	In 2012, MPCA began collecting air quality data from silica sand facilities, which it makes public on its website.[46] MPCA installed a monitor in downtown Winona in response to community concerns about dust from sand truck traffic (approximately 100 sand trucks pass through Winona per day). The monitor was the first installation not financed by industry.[47]
Regulating particulate pollution	MPCA is developing regulations to control particulate emissions from silica sand projects. MPCA released requests for comments in July 2013 and September 2014. MPCA plans to limit its new rules to air pollution control (public comments indicated that existing water permitting rules provide adequate protection) and will release draft rules for public comment in early 2015.[48]
Minnesota Department of Natural Resources	
Permitting	MDNR was tasked with developing a permit specific to silica sand projects.
Regulating mine reclamation	MDNR has responsibility for developing regulations for the reclamation of silica sand mines. As of February 2015, MDNR has developed draft rule language and has an open request for comments.[49]
Minnesota Environmental Quality Board	
Preparing model standards	EQB was directed to develop model standards and criteria to help local governments design regulations for silica sand mining, processing, and transportation.[50] EQB published the standards in its *Tools to Assist Local Governments in Planning for and Regulating Silica Sand Projects* document.[51]
Assisting local governments	EQB must assemble a technical assistance team to assist local governments with ordinance development, zoning, environmental review, permitting, monitoring, and other issues arising from silica sand mining and processing operations.[52] EQB also created a library of local government ordinances and local government permits approved for regulation of silica sand projects.[53]
Environmental review	EQB has responsibility for preparing an environmental assessment worksheet (EAW) for silica sand projects.[54] EQB must also develop rules for environmental review of silica sand projects.[55]
Minnesota Department of Health	
Providing information	MDH provides information on its website on health effects of exposure to crystalline silica released from sand mining.[56]
Developing a health-based value	In July 2013, MDH reported an air quality chronic health-based value for airborne crystalline silica of 3 micrograms per cubic meter, which represents a yearly average concentration. MDH used a yearly average because long-term exposure to crystalline silica is the primary health risk. The MDH value is lower than occupational guidelines because MDH adjusted the value for continuous exposure and uncertainty; the conservative standard protects even the most sensitive individuals from health effects resulting from exposure to airborne crystalline silica.[57]
Minnesota Department of Transportation	
Monitoring impacts	MnDOT assesses impacts on safety, mobility, and road conditions from commercial traffic related to the silica sand mining industry.[58]

Although the number of agencies differs, both Wisconsin and Minnesota have an agency addressing permitting, air quality monitoring, mine reclamation, local government guidance, environmental review, and information provision. However, neither state has an agency that regulates transportation activity related to silica sand. Of all of these activities, the states diverge most dramatically with regard to their permitting, air quality monitoring, and local government guidance.

Permitting in Wisconsin has come under fire for various reasons. First, WDNR does not have a permit specific to silica sand mining operations. Second, the agency has insufficient staff to handle permitting, compliance, and monitoring for silica sand mining. A 2012 internal workload review identified the need for 10 new positions, but the final 2013-2015 budget only provided for two and the number of facilities requiring monitoring has more than doubled since the review.[59] Consequently, as of 2014, WDNR had only inspected 80 percent of sand mining operations for compliance with state air pollution permits.[60] Third, the rate of non-compliance is high. In 2012, WDNR issued letters of noncompliance to 80 to 90 percent of inspected sand sites.[61] According to a 2014 report, over 40 percent of the 47 silica sand companies active in Wisconsin had committed serious violations of state regulations, requiring an enforcement conference with WDNR. Of these, more than half continued to violate regulations, warranting disciplinary action by the state.[62] Long wait times for decisions on violation cases are typical.[63] In addition to these critiques, the permitting process takes less time in Wisconsin than in Minnesota (i.e., weeks compared to months), owing in part to more extensive environmental review in Minnesota.[64]

Both states have an agency that collects air quality data. In Wisconsin, WDNR uses federal air quality standards for dust and requires that companies monitor larger particles (PM10). In 2011, WDNR decided against establishing silica-specific standards given the expense of buying equipment and hiring staff for monitoring.[65] WDNR does not mandate testing for smaller particles (PM2.5) because PM2.5 emissions from silica sand mining are more rare and the agency does not believe that a health concern exists.[66] As of September 2014, monitoring data have shown that companies comply with federal standards for PM10, but some sites would have exceeded federal PM2.5 standards had they been enforced.[67] WDNR waives air quality monitoring requirements in some cases.[68] Fewer than 10 percent of the silica sand mining facilities in Wisconsin must monitor their emissions and those that do track emissions monitor themselves.[69]

In Minnesota, MPCA assesses the potential for human health effects using ambient air quality standards for PM10, PM2.5, and total suspended particles (TSP) and a health-based value for airborne crystalline silica (PM4). As of February 2015, all reported values but one have been below the federal standards.[70] A monitoring site in downtown Winona recorded one exceedance of the daily fine particle standard in March 2014, which MPCA attributed to a regional weather pattern and not silica sand mining activity. MPCA notes that a monitoring site may report several exceedances per year without violating the air quality standard.[71]

With regard to transportation, neither state has an agency that regulates silica sand trucks or truck routes. However, in Wisconsin, state law allows local governments to regulate heavy traffic except on state roads and on roads where the business served by the traffic has an entrance.[72] Local governments can also require mining companies to enter into road agreements that govern routes, establish hours of operation, and specify payments required for road damage.[73] In Minnesota, local governments may negotiate preferred truck routes and other operating conditions within their jurisdiction as part of sand facility conditional use permits.[74] In addition, Minnesota state law allows counties to levy a tax of 15 cents per ton of extracted sand to offset road infrastructure impacts, although a fee of 22 cents per mile is more in line with actual costs.[75]

State legislatures pass legislation affecting sand mining

The state legislatures have influenced development of the silica sand industry. The Wisconsin legislature has a larger proportion of Republican-affiliated representatives than does the Minnesota legislature (see *Table 2*) and has enacted fewer state-level regulations of the silica sand industry. In fact, state-level legislation passed in Wisconsin (see *Table 5*) encourages industry by specifying conditions that local governments must meet to enact a moratorium on sand mining, thus making local bans more difficult to impose, and reducing requirements in the mining permit process.

Table 5
Wisconsin Legislation Relevant to Silica Sand Mining (Enacted)

Topic	Description
Local moratoria	Wisconsin Act 144 of 2011 limited the authority of local governments to establish development moratorium ordinances. The Act allows a local government to enact a development moratorium but specifies conditions, including adoption of a comprehensive plan (unless exempt) and procurement of a written statement from an expert outlining the need for a moratorium.[76]
Permitting	Senate Bill 1, signed into law in 2013, sped the mining permit approval process, eliminated case hearings from the process, and permitted waste and pollution release in sensitive areas with mitigation procedures.[77] Critics argue that the bill lessens citizen input and WDNR oversight and reduces environmental protections.[78]

In addition to the legislation enacted, the Wisconsin legislature proposed but did not pass a handful of other bills (see *Table 6*). All but one of the failed bills would have imposed additional restrictions on silica sand mining or enabled greater regulatory power for local governments. Industry opposed all but one of the failed bills; various industry organizations voiced support for reducing air and water quality regulations via Senate Bill 349 of 2013 (and reworked Senate Bill 632 of 2014).[79] The alignment of legislative action and industry preferences illustrates the pro-industry orientation of the state legislature.

Table 6
Wisconsin Legislation Relevant to Silica Sand Mining (Proposed but Not Passed)

Topic	Description
Zoning	Senate Bill 405, proposed in 2011, and Senate Bill 141, proposed in 2013, would have required that local zoning ordinances list frac sand mining as a conditional use, except in residential zoning districts, where frac sand mining would be prohibited.[80]
Advanced notice	Senate Bill 406, proposed in 2011, and Senate Bill 138, proposed in 2013, would have required 30-day advanced notice of a meeting involving action on frac sand mine applications, including 30-day advanced notice of the meeting for owners and occupants of land within one mile of the proposed operation.[81]
Extraction tax	Assembly Bill 868 proposed in 2013 would have imposed a fee of $1 per ton of frac sand extracted in Wisconsin.[82]
Compensation for impacts	Assembly Bill 868 would have provided for compensation to local governments for impacts of frac sand mining, including compensation for the costs of road repair, spill management, and wetland restoration.[83]
Setbacks	2013 Senate Bill 142 would have established setbacks of 2,500 feet from a single- or two-family residence or residential zoning district for frac sand mines, processing facilities, or loading facilities.[84]
Monitoring staff increase	Assembly Bill 306 and Senate Bill 411 of 2013 would have authorized eight full-time positions at WDNR for monitoring industrial sand mining and processing operations.[85]
Licensing	Senate Bill 140 of 2013 would have allowed counties to issue licenses for frac sand exploration, with a requirement that the licensee provide financial assurance for damage or injury and advanced notice before drilling and filling a hole. The bill would have also required WDNR to provide technical assistance for exploration, upon request.[86]
Eliminating air / water quality regulations	Senate Bill 349, proposed in 2013, would have prevented local governments from regulating air and water quality for any industry, including regulating silica dust from sand mining. This bill would have voided local regulations and agreements that address air and water quality, including moratoria, and would have prohibited local governments and WDNR from strengthening regulations of mine rehabilitation.[87] Supporters stated that the bill would provide economic certainty for industry, while opponents argued that the bill would undermine environmental and public health.[88] A reworked version of the bill was proposed in 2014 as Senate Bill 632. Senate Bill 632 would have limited the ability of local governments to regulate existing mines but not future mines. Current legislation applies to all nonmetallic mining, and critics worry that the mining laws cover concerns related to rock quarry mining but are insufficient to address concerns specific to silica sand mining.[89]

Whereas the Wisconsin legislature passed bills that support industry development, the Minnesota legislature passed a bill that establishes additional requirements for industry. Specifically, in May 2013, the Minnesota legislature passed House Bill 976 (now included in Chapter 114, Article 4 of the Laws of Minnesota 2013), which requires additional permits for silica sand activity in sensitive areas, bolsters environmental review, mandates development of state regulations and guidance for local governments, and enables local moratoria (see *Table 7*).

Table 7
Minnesota Legislation Relevant to Silica Sand Mining: House Bill 976 (Enacted)

Topic	Description
Permitting	Section 66 mandated that MDNR develop a permit for proposed silica sand projects within the Paleozoic Plateau, which includes Dakota, Goodhue, Houston, Fillmore, Olmsted, Wabasha, and Winona counties.[90] All silica sand mining activities within one mile of a designated trout stream now require a MDNR permit.[91] MDNR requires permit applicants to complete a hydrogeological evaluation, which MDNR uses to identify appropriate setbacks and other restrictions.[92]
Model standards / criteria	Section 91 mandated that EQB develop model standards and criteria to help local governments design regulations for silica sand mining, processing, and transportation.[93] The standards and criteria must include recommendations for setbacks, as well as requirements for air and water quality monitoring and protection, noise mitigation, inspection, chemical storage, financial assurance, and reclamation planning.[94] EQB published the standards in its *Tools to Assist Local Governments in Planning for and Regulating Silica Sand Projects* document.[95] Section 91 also required that EQB assemble a technical assistance team to assist local governments with ordinance development, zoning, environmental review, permitting, monitoring, and other issues arising from silica sand mining and processing operations.[96] Local governments must consider recommendations requested from the technical assistance team and justify any divergence from those recommendations.
Environmental review	Section 92 mandated an EAW for any silica sand project that meets or exceeds excavation and storage thresholds laid out in the legislation, except in cases where EQB requires an environmental impact statement (EIS). The EAW must require information on potential effects on ground and surface water, available water resources, potential effects of airborne particulates, traffic impacts and mitigation measures, existing use compatibility, and environmental impact mitigation measures.[97]
Technical assistance	Section 93 directed EQB to create and maintain a library of local government ordinances and local government permits approved for regulation of silica sand projects.[98] EQB developed the following website to meet these ends: http://www.eqb.state.mn.us/silicaLibrary.html.
Rule development	Section 105 granted rulemaking authority and required state agencies to develop rules for the silica sand industry.[99] MPCA – Adopt rules for the control of particulate emissions from silica sand projects. MDNR – Adopt rules pertaining to reclamation of silica sand mines. MDH – Adopt an air quality health-based value for silica sand. EQB – Amend rules for environmental review for silica sand mining and processing to account for increased activity and concern about operation size.
Local moratoria	Section 106 allowed local governments to extend or renew moratoria on silica sand projects by one year.[100]

Critics have expressed concerns that the Minnesota legislation did not go far enough to protect against negative impacts of silica sand mining. Anti-mining activists preferred a ban on silica sand mining over state standards, stating that standards are just guidelines and not enforceable law. Local government officials have commented that the state standards are less stringent than some existing local

ordinances, which could undermine local rules, and that local governments need more technical support from the state, including guidance on air quality monitoring.[101] Earlier iterations of the bill had involved a ban on silica sand projects within one mile of a designated trout stream, but legislators compromised by replacing the ban with additional assessment and permitting.[102] According to a February 2014 poll of 600 voters statewide, 64 percent favored a two-year moratorium in southeastern Minnesota and 52 percent opposed increased silica sand mining in the state.[103]

Similar to Wisconsin, Minnesota also had several proposed bills related to sand mining that failed to pass (see *Table 8*). However, the Wisconsin and Minnesota cases diverged in that the failed legislation in Wisconsin represented an opposing view to the successful legislation (increased regulation of industry versus reduced regulation of industry). In Minnesota, the failed legislation represented a bolder version of the passed legislation (even greater regulation). The legislation that failed to pass included a statewide ban on mining, an extraction tax, and funding for natural resource protection.

Table 8
Minnesota Legislation Relevant to Silica Sand Mining (Proposed but Not Passed)

Topic	Description
Moratorium	Senate Bill 786, proposed in the 2013 Legislative Session, included a yearlong ban on silica sand mining in southeastern Minnesota.[104]
Extraction tax	House Bill 1336 and companion Senate Bill 1487 imposed a tax of $1 per ton on sand extraction and a tax on sand washing and processing of three percent of the market value of sand produced. The bills increased the allowable tax rate and taxable amount for counties that levy production taxes on sand mining and import.[105] Another proposal, Senate Bill 786, provided authority to local governments to tax silica sand excavated then transported or sold or silica sand imported into the local government jurisdiction. The bill also included a state production tax for silica sand excavated within the state and transported or sold or silica sand imported into the state.[106] Opponents argued that a tax could drive business out of the state.[107]
Resource protection	Proposed Senate Bill 425 provided for bond proceed appropriations to MDNR to protect hydrological features, endangered or threatened species, and geological features by acquiring land or interests in areas where silica sand mining is likely to occur. The bill also included funding for permanent easements to prevent silica sand mining in wellhead protection areas.[108]

The Wisconsin and Minnesota legislation presents a dichotomy in the states' approaches to regulating the silica sand industry. Wisconsin limited local government ability to prohibit mining and made the permitting process easier. In contrast, Minnesota enabled local moratoria and provided assistance to local government seeking to regulate the industry, created additional permit requirements, and mandated development of new pollution and mine reclamation regulations for industry. The Wisconsin legislature created an industry-friendly regulatory environment and the Minnesota legislature established additional protections against impacts from industry growth.

Summary of regulatory environment

As a result of differences in state leadership, the silica sand mining industry faces different regulatory environments in Wisconsin and Minnesota (see *Table 9*). Key differences include rigor of the permitting process, comprehensiveness of air quality monitoring, and authority of local governments to regulate industry.

Table 9
Summary of Regulatory Environment for Silica Sand Industry in Wisconsin and Minnesota

Topic	Wisconsin	Minnesota
Permitting	General mining permits Permitting process shortened Limited state inspection and disciplinary action due to understaffing High level of industry non-compliance	General mining permits (sand-specific permits under development)
Air quality	Monitoring data available online Data collected for PM10 Monitoring requirements sometimes waived	Monitoring data available online Data collected for PM10, PM2.5, PM4, and TSP New pollution regulations under development Air quality health-based value for silica sand adopted
Mine reclamation	Reclamation plan and permit required Local governments allowed to require financial assurance and fees for unreclaimed land	New reclamation regulations under development
Local government	Plan adoption and expert opinion required for local moratoria	Local moratoria extensions enabled Model standards, ordinances, and permits provided in an online library
Environmental review	Less extensive environmental review	New EAW under development Environmental review regulation amendments under development
Transportation	Local governments allowed to regulate heavy traffic on local roads	Local governments allowed to levy extraction tax to offset road impacts
Information	Report published by WDNR Information on WDNR website	Report published by EQB Information on multiple state agency websites

Similarities in Local Responses to Sand Mining

Although differences exist between the two states, a proactive local response to silica sand mining activity is a common thread between them. Municipal governments have taken steps to promote local interests. In addition, advocacy organizations work to mitigate the negative impacts of silica sand mining or encourage industry growth.

Local governments

Local governments in Wisconsin have taken responsibility for controlling silica sand mining activity given the limited regulation at the state level. Local governments in Minnesota also have jurisdiction over regulating silica sand mining.[109]

Regulatory approaches that limit mining activity

Local governments in both states have employed various regulatory approaches to mitigate the impacts of silica sand mining, including the following:[110]

- Moratoria that temporarily prohibit silica sand mining
- Zoning rules that prohibit silica sand mining operations or list mining as a conditional use
- Nonmetallic mining ordinances that establish standards for silica sand mining operations and require operator licensing
- Mining agreements with companies that place restrictions on operations
- Town road ordinances that regulate use of town roads and require mining companies to enter into special agreements regarding routes, hours of operation, and payment for road damage

In Wisconsin, at least six counties—Trempealeau, Eau Claire, Pepin, Dunn, Buffalo, and Crawford—passed moratoria on new silica sand mining permits, all of which had expired by late 2013.[111] Trempealeau County has the most sand mines and processing plants in the state.[112] When the yearlong moratorium passed unanimously in August 2013, the county had permitted 26 mines and processing plants covering 4,733 acres.[113] The moratorium allowed time for the locality to study the health effects of air and water pollution from sand mining and produce a report, released in September 2014.[114] In a split vote, the county voted not to extend the moratorium, which expired at the end of August 2014.[115] By mid-2012, seventeen townships in Wisconsin had imposed moratoria.[116]

Local governments in Minnesota also placed moratoria on silica sand projects, including Houston, Goodhue, Wabasha, Winona, and Fillmore Counties; the cities of Red Wing, Winona, Lake City, Hay Creek, and Florence; and Featherstone Township.[117] All moratoria had expired as of May 2014, except the Houston County moratorium, which was extended until 2015, as enabled under state legislation.[118] The Houston County moratorium expired in March 2015.[119]

Not all communities have banned mining. Many communities that permit silica sand mining have established rules for the industry beyond state requirements. As an example of zoning to control mining, Eau Claire County in Wisconsin requires that a large mine operator rezone a property to the nonmetallic mining overlay district and then obtain a conditional use permit.[120] As another example, Hay Creek Township in Minnesota passed an ordinance with setback requirements. The ordinance also bans a controversial cleaning agent, limits the number of truck trips, and allows blasting only twice a year.[121]

In Wisconsin, the Crawford County Frac Sand Mining Study Committee developed a template for a nonmetallic mining licensing ordinance to guide municipalities.[122] The Town of Cooks Valley passed a nonmetallic mining ordinance to require a permit for a mine.[123] Stockholm Township also passed a frac sand licensing ordinance, which outlines concerns about environmental, public health, and economic impacts that the Township considers "substantially certain to occur" as a result of silica sand mining. The

ordinance requires licensing for sand mine operators and bans sand washing, sand processing, and rail or barge loading facilities; frac sand operations within 1500 feet to existing residences; and truck hauling of frac sand or frac sand mining waste in excess of 50 trucks per day or through town.[124] In Minnesota, Goodhue County recently approved two ordinances to limit the size of mineral extraction sites, establish a minimum distance from existing dwellings or platted residential subdivisions, and limit hours of operation. The county has authority to require air quality monitoring and add additional conditions to mitigate noise, dust, blasting, and hours of operation.[125]

The Town of Howard was the first in Wisconsin to enter into a mining agreement with a silica sand mining company in July 2011. The agreement prohibited mining during the summer, required water quality testing and well water replacement, regulated noise and light pollution, set time limits on blasting and hauling, and created a mechanism to compensate property owners who could not sell their property at market value.[126]

Annexation to encourage mining

By contrast, local governments in Wisconsin that wish to encourage silica sand mining activity have annexed property from neighboring jurisdictions. In Wisconsin, the annexing locality must pass an annexation ordinance with a two-thirds vote. If the annexed property lies within a county with a population of 50,000 or more, the annexation petition undergoes a public interest review through the State Department of Administration.[127] Sand mining companies have requested that towns with fewer regulations annex land from town with more strict regulations. According to a 2014 report by the Land Stewardship Project, at least 19 silica sand mining companies in Wisconsin sought annexation to avoid regulations between 2011 and 2014.[128]

Advocacy organizations

Numerous advocacy organizations, including new and existing groups, have taken a stance on silica sand mining. Both Wisconsin and Minnesota have observed strong opposition to mining from advocacy groups for environmental, cultural, and economic reasons. Opponents use a variety of methods to organize against mining, including posting information on their websites, publishing reports on the impacts of mining, hosting meetings to educate the public, encouraging citizens to contact government officials, and coordinating petitions and protests.

An example of an advocacy organization that has employed several of these strategies is the Wisconsin Network for Peace and Justice (WNPJ). WNPJ encourages citizens to contact local government officials and request that they pass moratoria on silica sand mining and to deny zoning permits for new mining or mining expansions. In 2013, WNPJ created a petition to ban silica sand mining in Wisconsin and led a rally against proposed state legislation (Senate Bills 349 and 632) that would have removed local government authority to regulate the silica sand industry. In 2014, WNPJ introduced a resolution to regulate silica sand dust, which has been approved in 23 of 25 counties.[129]

In Minnesota, the Land Stewardship Project (LSP) is a non-profit organization that promotes stewardship of farmland and sustainable agriculture.[130] In early 2014, LSP organized a petition that called for a two-year moratorium on silica sand mining in southeastern Minnesota and tougher statewide industry standards.[131] In November 2014, LSP published a report documenting violations of regulations by frac sand companies operating in Wisconsin.[132] LSP also hosts workshops and informational meetings about silica sand mining in Minnesota, including workshops to teach citizens how to use local regulations to control silica sand mining in their communities.[133]

Both states also have organizations that support sand mining. For example, the Wisconsin Industrial Sand Association (WISA) is a membership-based trade association formed in 2012 to promote safe and environmentally responsible sand mining standards and fact-based discussions among stakeholders.[134] WISA publishes white papers on topics related to silica sand mining and states that the silica sand industry complies with local, state, and federal regulations. As another example, the Minnesota Industrial Sand Council (MISC) is a member organization formed in late 2012 to address local government and public concerns about industrial sand mining. A member of MISC sits on the MPCA and MDNR Silica Sand Advisory Panel, which provides input to the regulatory development process.[135]

The Appendix includes a sample list of advocacy organizations that have taken a stand on the issue of silica sand mining in each state.

Citizen activists

Citizens have also taken action to influence the course of silica sand mining activity. In April 2014, dozens of citizens gathered at two silica sand sites in Winona, Minnesota to protest mining, representing the largest protest to date against the industry.[136] As another example, in early 2013, a group of citizens in Winona County, Minnesota filed an appeal after the County Board of Commissioners voted 3-2 to approve the Nisbit silica sand mine in Saratoga Township without requiring an environmental impact statement, despite concerns expressed by citizens regarding cumulative effects of the new mine along with other mines proposed for the area.[137] The Minnesota Court of Appeals upheld the Winona County decision to permit the mine and published its opinion to serve as precedent for future cases, showing deference for local government permitting decisions.[138] In January 2015, citizens protested a Minnesota House Mining and Outdoor Recreation Policy Committee informational hearing because the committee had invited industry representatives to testify but not the general public.[139] As in Minnesota, concerned citizens have taken action against silica sand mining in Wisconsin. For example, residents in the Town of Bridgeport filed suit over the decision to permit a silica sand mine near the Wisconsin River based on potential conflict of interest and inadequate public input in the permitting process, as well as concern over crystalline silica dust.[140] A January 2015 decision upheld the legitimacy of the permit.[141]

Conclusion

The different levels of silica sand mining activity in Wisconsin and Minnesota have multiple explanations, including different geology, rail transport capacity, and community type. However, the most significant point of divergence between the two states is the inclination of state leadership in Wisconsin to encourage industry growth by minimizing regulatory barriers, compared to the preference revealed by Minnesota state leadership to protect against negative impacts by imposing additional regulations on industry. Minnesota has a more rigorous permitting process, with extensive environmental review and silica-specific permits under development, relative to permitting in Wisconsin, where WDNR has received critique for incomplete monitoring and enforcement of standards, and industry has demonstrated a high level of non-compliance. In addition, Minnesota has set more comprehensive standards for exposure to air pollution released from silica sand mining activity and plans to adopt additional air pollution regulations. Finally, the state legislature in Minnesota has supported local government regulation of industry, including moratoria and extraction taxes, whereas the state legislature in Wisconsin has imposed conditions on local government moratoria. However, in both states, local governments have taken steps to regulate mining activity so as to prevent environmental, cultural, and economic damage in their jurisdiction. These differences, as well as potential reduction in demand as a result of market saturation, suggest that Minnesota is unlikely to experience a boom in the silica sand industry as has occurred in Wisconsin.[142]

To enhance understanding of the divergences in state leadership and local political activity, future research might explore the historical differences in political culture between Wisconsin and Minnesota, as well as any history of alliances among governmental and non-governmental actors. Future research might also consider the relationship of these actors with the mining, tourism, and other industries. In particular, industry may influence decisions by governmental actors, through partnerships and advocacy. Relationships between industry and government may differentially affect opportunities for industry development in Wisconsin and Minnesota.

This comparative case study demonstrates how decentralization can result in different levels of regulation and industry development in neighboring states with a shared resource and otherwise similar demographic and economic characteristics. This divergence is not unique to silica sand mining. In the related context of shale gas regulation, decentralization has resulted in disparate policies, even among states sitting atop the same shale deposit, with local governments playing a significant role in industry regulation to the extent allowed by state law. For both shale gas and silica sand mining, governments have prioritized either industry development or environmental protection, and this prioritization process has not yielded consistent results.[143] It is possible that regulation of silica sand mining continue along a similar track as shale gas regulation, with state-to-state (and municipality-to-municipality) variation and concerns relating to cross-jurisdictional environmental, economic, and cultural impacts.

Acronyms

EAW	Environmental assessment worksheet
EIS	Environmental impact statement
EQB	Minnesota Environmental Quality Board
LSP	Land Stewardship Project
MDH	Minnesota Department of Health
MDNR	Minnesota Department of Natural Resources
MISC	Minnesota Industrial Sand Council
MnDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
PM10	Coarse particulate matter (particles up to 10 micrometers in diameter)
PM2.5	Fine particulate matter (particles up to 2.5 micrometers in diameter)
PM4	Particulate matter up to four micrometers in diameter
TSP	Total suspended particles
WDNR	Wisconsin Department of Natural Resources
WISA	Wisconsin Industrial Sand Association
WNPJ	Wisconsin Network for Peace and Justice

Appendix

Silica sand overview

Silica sand consists of small, uniform, round quartz grains. Silica sand is used for numerous industrial applications (e.g., window glass, water filtration, abrasives) because it is strong and crush-resistant.[144] To be viable for mining, silica sand needs to be located within 50 feet of the surface.[145] Viable silica sand deposits are found in southeastern Minnesota and western Wisconsin, as well as in Iowa and Illinois. Hundreds of thousands of acres of silica sand lay near the surface in Minnesota and Wisconsin and the layers are typically between 50 and 100 feet thick.[146]

Concerns regarding silica sand mining

Numerous concerns exist surrounding sand mining, including the following:

- Air pollution – dust, silica (potential carcinogen)
- Water pollution and level changes
- Road damage from increased truck traffic
- Job creation/shift – people with expertise hired from outside the local community
- Shift in real estate markets – renting versus buying
- Change to landscapes
- Noise pollution
- Waste management – sand piles and spills
- Loss of animal habitat

Some of the major concerns, and their manifestations in Minnesota and Wisconsin, are discussed in the sections below.

Air

Silica sand mining generates particulate emissions, including airborne crystalline silica, which has known health risks. Information on health effects from breathing airborne crystalline silica comes almost exclusively from occupational settings, where exposures are more concentrated.[147] Long-term or intense crystalline silica exposure increases risk of lung disease, including silicosis, emphysema, chronic obstructive pulmonary disease, tuberculosis, and lung cancer, as well as immune disease. The risks of low-level exposure are unknown, but no evidence exists to indicate that exposure to low levels of airborne crystalline silica has adverse health effects.[148] There are no federal or state standards for silica in ambient air.

Water

Silica sand mining can result in water pollution. Chemicals used in the mining and washing processes (e.g., hydrochloric acid, acrylamide, DADMAC) can pose concern for drinking water contamination. In addition, silica sand mining can lower the pH of nearby groundwater, making minerals like iron and manganese dissolve more easily and resulting in unpleasant taste and odor. MDH recommends groundwater monitoring near silica sand mining facilities.[149] Chippewa County, Wisconsin runs an acrylamide monitoring program – the program has not detected acrylamide in aquifers or soil near sand mining sites.[150] In addition to chemicals used in the mining process, silica sand mining can produce acid runoff with toxic heavy metals like arsenic and lead.[151]

Additionally, silica sand mining creates waste, such as discarded sand and sludge, which facilities often store in holding ponds. Heavy rains can overflow these ponds and carry sediment into neighboring properties and public waters. Such violations have occurred with relative frequency in Wisconsin (most Wisconsin mines are designed to withstand a 10- or 25-year rain event).[152] Local media have reported water pollution resulting from heavy rains and runoff from silica sand mines.[153]

Beyond concern for human health, water pollution can impact fisheries in Wisconsin and Minnesota, by causing turbidity, sedimentation, thermal increases, decreased stream flow, fish entrapment, and stream channel realignment.[154]

Finally, silica sand mining and processing uses a lot of groundwater, which can lower groundwater levels and cause nearby wells to run dry.[155] According to a 2013 report, 30 sites in Wisconsin reported using more than 1.3 billion gallons of water to wash silica sand in 2013.[156] Individual mining operations consume 420 thousand to two million gallons of water per day.[157]

Roads

Trucks transport sand from mines to processing plants and shipping facilities, where trains or barges pick up the sand for long-distance shipping. Truck traffic in Minnesota has increased with the growth of the silica sand industry. Transporting sand from a single silica sand mining operation requires an estimated 70 to 250 heavy truck trips per day in Minnesota.[158] Thus far, road damage has been minimal, except for in the City of Winona, Minnesota where truck traffic is concentrated on routes that link mines to processing and rail facilities.

Rail

Most silica sand ships out of Minnesota via rail, with an estimated 2.5 trains added per day to an existing 150 trains per day statewide.[159] Wisconsin sand companies typically export sand via rail, with sand transport representing 10 percent of the volume moved by the Canadian Pacific Railway.[160]

Jobs

Silica sand mining has inconclusive job creation effects. A report by the Institute of Agriculture and Trade Policy states that silica sand mining does not provide significant economic benefits because of several factors, including fluctuating demand, increasing mechanization, mine depletion, worker commuting, negative environmental impacts, and displacement of higher-paying industries, such as tourism.[161]

The report used federal and Wisconsin state data to estimate the job production potential from silica sand production in Minnesota. The results suggest that silica sand production would create approximately 2,300 jobs in Minnesota, less than one percent of total employment in the state.[162] In Wisconsin, silica sand mines have created approximately 2,780 jobs.[163] Each primary job is expected to generate another six to 10 secondary jobs.[164] A 2011 report estimated that silica sand industry jobs pay between $12 and $23 an hour.[165] However, these positions have tended to fill with non-local industry experts.[166] A 2014 study for Trempealeau County, Wisconsin determined that mines provide jobs with competitive wages and benefits packages, which lure mid-management employees from local businesses and upper-management employees from outside the area.[167] Moreover, a 2013 report suggests that mining employees prefer to live away from the mining activity and commute into the area.[168]

Real estate

Silica sand mining and related activities have the potential to affect the real estate market. Experience in Wisconsin has shown that property owners have a harder time selling houses near a mine or a haul route; homes within a quarter-mile of a mine site have shown a 30-percent reduction in property value.[169] A 2009 report identified decreases in property value ranging from five percent at 2.5 miles away from silica sand mining operations to 25 percent or more at 0.31 miles from mining operations.[170] In addition, preference has shifted from buying to renting in areas with mining.[171]

Landscape

Silica sand mining occurs in various types of landscapes. In some instances, mining occurs in hilly landscapes and involves leveling hills and digging pits.[172] Citizens and advocacy groups have expressed concern about the change to landscapes that provide aesthetic and economic value (e.g., through tourism).

Noise

Noise pollution from equipment operation and blasting can drive wildlife away from mining areas, resulting in lost hunting, trapping, and other nature-related opportunities.[173]

Advocacy organizations

Wisconsin

Wisconsin Network for Peace and Justice

The Wisconsin Network for Peace and Justice (WNPJ) is a member organization composed of citizens and activist groups that works to eliminate violence and injustice.[174] WNPJ encourages citizens to contact local government officials to request that they pass moratoria on silica sand mining and deny zoning permits for new mining or mining expansions. In 2013, WNPJ created a petition to ban silica sand mining in Wisconsin and led a rally against state legislation (Senate Bills 349 and 632) that would have removed local government authority to regulate the silica sand industry. The legislation did not pass. In 2014, WNPJ introduced a resolution to regulate silica sand dust, which has been approved in 23 of 25 counties.[175]

Save the Hills Alliance, Inc.

The Save the Hills Alliance, Inc. is an organization formed in 2011 to educate the public about the environmental impact of the silica sand industry, including air and water pollution and truck traffic safety issues.[176] The organization has held public forums and informational meetings and operates a website with information about the silica sand industry in Wisconsin.[177]

Wisconsin League of Conservation Voters

The Wisconsin League of Conservation Voters (WLCV) is a non-profit organization that works to elect conservation leaders, hold decision-makers accountable, and encourage lawmakers to promote conservation and protect Wisconsin natural resources and public health.[178] WLCV urges citizens to send letters to government leaders to control silica sand mining activity and provides information about silica sand mining and its consequences on its website.[179]

Sierra Club-John Muir Chapter

The Sierra Club-John Muir Chapter is the Wisconsin branch of the Sierra Club and has 15,000 members.[180] The Chapter called for a moratorium on silica sand mining permits until completion of a comprehensive impact analysis by the state.[181]

Wisconsin Industrial Sand Association

Wisconsin Industrial Sand Association (WISA) is a membership-based trade association formed in 2012 to promote safe and environmentally responsible sand mining standards and fact-based discussions among stakeholders.[182] WISA publishes white papers on topics related to silica sand mining and states that the silica sand industry complies with local, state, and federal regulations.

Wisconsin Counties Association

The Wisconsin Counties Association (WCA) is an association of county governments that represents county officials at the State Capitol and provides training and education to members.[183] In collaboration with WISA, WCA created a Frac Sand Task Force that supports silica sand mining as a means of creating jobs in rural areas. The task force produced a Best Practices Handbook for Nonmetallic Mining to guide the development of local ordinances and agreements that protect the interests of county governments.[184]

Minnesota

Land Stewardship Project

The Land Stewardship Project (LSP) is a non-profit organization that focuses on promoting stewardship of farmland and sustainable agriculture.[185] In early 2014, LSP organized a petition that called for a two-year moratorium on silica sand mining in southeastern Minnesota and tougher statewide industry standards.[186] In November 2014, LSP published a cautionary report documenting violations of regulations by silica sand companies operating in Wisconsin.[187] LSP also hosts workshops and informational meetings about silica sand mining in Minnesota, including workshops to teach citizens how to use local regulations to control silica sand mining in their communities.[188]

Save the Bluffs

Save the Bluffs is an activist group formed in 2011 and based in Goodhue County that works to protect the county's air, water, and tourism-based economy by restricting or banning mining.[189] The group advocated successfully for a moratorium on fracking in Goodhue County and an ordinance that restricted mining to industrial zones where there is no sand in Red Wing City, all but banning the activity.[190] In late 2013, the organization pushed to ban silica sand operations within one mile of cities, suburban resident districts, and campgrounds; ban chemical cleaners from use in sand washing and processing; and implement penalties for mining, processing, and transportation and loading violations.[191]

Minnesota Industrial Sand Council

The Minnesota Industrial Sand Council (MISC) is a member organization formed in late 2012 to address local government and public concerns about industrial sand mining. The group is led by former Red Wing City Mayor Dennis Egan, who resigned as Mayor in April 2013 under criticism for his support of silica sand mining. A member of MISC sits on the MPCA and MDNR Silica Sand Advisory Panel.[192]

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Gerald R. Ford School of Public Policy
Joan and Sanford Weill Hall
735 S. State Street, Suite 5310
Ann Arbor, MI 48109-3091

The **Center for Local, State, and Urban Policy (CLOSUP)**, housed at the University of Michigan's Gerald R. Ford School of Public Policy, conducts and supports applied policy research designed to inform state, local, and urban policy issues. Through integrated research, teaching, and outreach involving academic researchers, students, policymakers and practitioners, CLOSUP seeks to foster understanding of today's state and local policy problems, and to find effective solutions to those problems.

web: www.closup.umich.edu
email: closup@umich.edu
twitter: @closup
phone: 734-647-4091