VIDEO DISCUSSION GUIDE

Into the Outdoors.org

DECODING INDUSTRIAL SAND MINING

energy science

Suggested Grade Levels:
High School - Grades 9-12

Time Required:
Two 50 Minute Class Periods

Materials Needed:
- At Least 4 Computers
- Butcher Paper
- Markers or Colored Pencils
- Tables or Desks That Can be Moved

Enduring Knowledge
The learner will demonstrate an understanding of the industrial sand mining process and the environmental, economic, and social impacts of industrial sand mining in the Upper Midwest.

LEARNING TARGETS:

1. The learner will be able to describe the process of mining industrial sand from beginning to end.
2. The learner will be able to assess the positive and negative economic, social, and environmental impacts of industrial sand mining by citing three or more examples from the video and offer potential solutions to these impacts.
3. The learner will be able to challenge proponents and opponents of industrial sand mining using specific details from the video and outside research to validate their position.

DISCUSSION GUIDE FOR VIDEO

player.vimeo.com/video/145684468

TEACHER BACKGROUND

Sand Mine Geology

The sand in industrial sand mines originates from the beaches of ancient seas. These seas existed during the Ordovician Era approximately 470 million years ago. Crashing waves polished the sand, cleaning it of impurities and creating clean, rounded sand grains. Over the span of millions of years, this sand settled and became the sedimentary rock known as sandstone in the St. Peter, Jordan, and Oil Creek formations of Minnesota, Wisconsin, and Illinois. Glaciers and rivers have, in the more recent past, carved away rock layers above these rock deposits to expose the formations mined today.

The Process of Mining Industrial Sand

There are many steps involved in industrial sand mining. First, companies must locate the sand deposits. They use sophisticated software and geologic maps to identify the best places to dig. The miners next remove all vegetation, topsoil, and rock above the layers of sandstone they are after. Large bulldozers and front-end loaders scrape the sand off the exposed rock faces and create large piles of high-quality, but untreated, sand. This sand must be cleaned with chemically-treated water to further remove any impurities still associated with the sand grains. Finally, the sand is dried, loaded onto trucks or trains, and the majority is sent to fracking operations. Sand mining does not end here, however.

Reclamation happens as sand is mined. Sand mining companies use GPS and GIS software to document the original topography of the area being mined. After an area has its sand removed, bulldozers move the topsoil and rock that was removed from above the sand and position it to match the original landscape. The ground is seeded with native plants and trees are planted to mimic original conditions. Over 90% of reclaimed sand mines match the orginal habitat productivity after three years.

TEACHER BACKGROUND *(continued)*

Sand Mine Safety:

Industrial sand mines must constantly monitor airborne dust and sand particles to prevent a condition called silicosis. This ailment is caused by the small particles entering a person's lungs. The hard silica (sand) particles scar the lungs and can limit a person's ability to breathe over time. Sand mine companies pour water on sand deposits to limit dust and require employees to wear dust monitoring kits at all times. Additionally, sand mine companies must collect data on the amount of dust that enters surrounding communities to ensure they are safe as well.

Environmental and Social Impacts:

Industrial sand mines have received harsh criticism for their use of water, impact on ecosystems, and perceived threats to the safety of surrounding communities. Alternatively, sand mines have been praised for bringing jobs and economic prosperity to rural areas and, as seen at the mine featured in the video, for benefitting wildlife. Many mines recycle much of their water, all reclaim mined land, all measure airborne silica, and only some monitor their impacts on wildlife. Research into the pros and cons of industrial sand mining continues and new laws are still being written to regulate the industry.

VOCABULARY:

- **Quartz:** One of the most common minerals on Earth that is often part of sandstone and other rocks.
- **Silica:** A hard, colorless compound between silicon and oxygen (SiO_2) commonly found in quartz.
- **Sandstone:** A common rock made up of quartz sand that is held together by different substances.
- **Fracking:** A method used to extract underground petroleum reserves by fracturing underground rock layers with water.
- **Reclamation:** The process of converting a mining operation back to a natural state.

SPECIAL CONSIDERATIONS:

Due to the controversial elements of industrial sand mining, it will be important to engage students in respectful debate because values may differ between students. Encourage students to use specific facts from the video during their debate to back up their positions.

BEFORE VIEWING THE VIDEO:

Test the prior knowledge of students by asking if they are familiar with industrial sand mining. If they are, prompt them to share their opinions. If students are not familiar with sand mining, use the teacher background information and our website to introduce the topic to them. Ask students to find articles in support of, and opposed to, sand mining to share with the class before viewing the video.

player.vimeo.com/video/145684468

VIEWING & DISCUSSION GUIDE:

1. As students watch the video, ask them to write two topics mentioned in the video that they think are controversial and leave a space underneath each topic. Ask students to write the alternative point of view on their topic in the space beneath it.

2. When the video is complete, ask students to begin sharing their topics. Create a list on the board of topics mentioned. After one third of the class shares, ask students if anyone has topics different from those already listed. Have students come up to the board and put a tally mark under the two topics they chose. When this is complete, count to see which four topics have the most tallies.

3. Split students into eight groups. Assign two groups to each topic and give each group a point of view to argue (for or against). Give students the rest of the class period and until the next class to research their point of view and decide how they want to defend their position and attack the position of their opponents.

4. Ask the two groups debating the first topic to come to the front of the room. Situate desks so that the entire group can face the entire other group while the rest of the class watches. Give each group two minutes to state their positions. Each group will get two minutes of rebutta following this. This can go back and forth as long as students are engaged and time permits. Each group will get 30 seconds for a closing statement.

5. When the debate is complete, ask the students in the audience to raise their hands to vote for who won the debate. Once a debate "winner" is chosen, have students from the audience share why they felt one group won over the other. Allow no more than three minutes for this portion. Ask the next two groups to debate when this discussion is complete.

6. Repeat the steps for the second, third, and fourth debate. Close by asking students to share their thoughts on the purpose of debate and explain that decisions about controversial issues are made following such debates in the "real world".

ADDITIONAL CONSIDERATIONS:

1. The online video "Decoding Industrial Sand Mining" contains four separate segments. You may want to stop the video after each of the four segments to allow students time to take notes and write down the topics that they feel may be controversial.

2. Depending on class dynamics, the teacher may want to divide students into groups ahead of time for the last activity to ensure students will be successful. If possible, students with different learning styles should be included in each group.

STUDENT PORTION:

Students may use drawings, resources from the internet, books, and other creative methods to support their points during their debate. Teachers should make sure some resources are available to help students with different learning styles find and present their information.

EVALUATION:

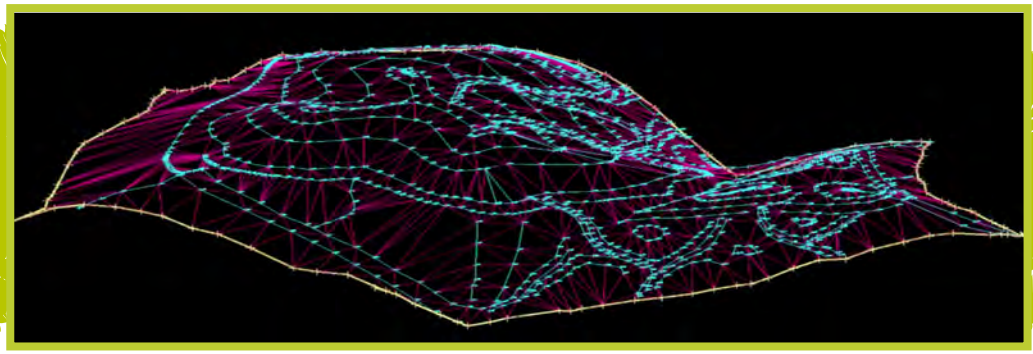
1. Students will be assessed by their preparedness and participation in the debate. Teachers may want to use a rubric for each student or they can tally how many times each student spoke. 3 or more times may be 3 points, 2 times may be 2 points, one time may be one point, and students that do not participate could receive no points. Similar scores could be assigned for the quality of what is said and how materials are used to support points.

2. Students could be required to submit an annotated bibliography on the day of the debates which can be scored at the teacher's discretion.

3. The teacher could ask students to go home and write a persuasive essay on the topic they chose. They can pick any perspective on the issue for the essay. Students should be encouraged to cite at least three credible sources to validate their position.

EXTENDED LEARNING:

1. Students could develop a larger-scale project with their group to augment the debate. Groups could use audio-visuals, PowerPoint, writing, or a poster to present their position in more detail and offer solutions to alternative viewpoints. This will provide additional practice with validating their positions using credible sources and practicing persuasive skills.



The following Student Proficiency Standards can be met by teaching

DECODING INDUSTRIAL SAND MINING

WISCONSIN STATE SCIENCE STANDARDS AND BENCHMARKS

A.12.1 Apply the underlying themes of science to develop defensible visions of the future.

A.12.2 Show how conflicting assumptions about science themes lead to different opinions and decisions about evolution, health, population, longevity, education, and use of resources, and show how these opinions and decisions have diverse effects on an individual, a community, and a country, both now and in the future.

E.12.4 Analyze the benefits, costs, and limitations of past, present, and projected use of resources and technology and explain the consequences to the environment.

G.12.3 Analyze the costs, benefits, or problems resulting from a scientific or technological innovation, including implications for the individual and the community.

G.12.5 Choose a specific problem in our society, identify alternative scientific or technological solutions to that problem and argue its merits.

H.12.1 Using the science themes and knowledge of the earth and space, life and environmental, and physical sciences, analyze the costs, risks, benefits, and consequences of a proposal concerning resource management in the community and determine the potential impact of the proposal on life in the community and the region.

H.12.4 Advocate a solution or combination of solutions to a problem in science or technology.

H.12.5 Investigate how current plans or proposals concerning resource management, scientific knowledge, or technological development will have an impact on the environment, ecology, and quality of life in a community or region.

H.12.6 Evaluate data and sources of information when using scientific information to make decisions.

WISCONSIN STATE SOCIAL STUDIES STANDARDS AND BENCHMARKS

C.12.8 Locate, organize, analyze, and use information from various sources to understand an issue of public concern, take a positions, and communicate the position.

NATIONAL COMMON CORE STANDARDS

CCSS.ELA-LITERACY.SL.9-10.1.A - Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence from texts and other research on the topic of issue to stimulate a thoughtful, well-reasoned exchange of ideas.

CCSS.ELA-LITERACY.SL.9-10.1.C - Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.

CCSS.ELA-LITERACY.SL.9-10.4 - Present information, findings, and supporting evidence clearly, concisely, and logically such that listeners can follow the line of reasoning and the organization, development, substance, and style are appropriate to purpose, audience, and task.

CCSS.ELA-LITERACY.SL.9-10.5 - Make strategic use of digital media in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.

NEXT GENERATION SCIENCE STANDARDS

HS.ESS3.2 Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

HS.ESS3.4 Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS.LS2.7 Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

OTHER RESOURCES:

When you've completed the discussion guide, choose similar science segments.

Industrial Sand Mining Introduction: http://intotheoutdoors.org/topics/industrial-sand-mining-introduction/

Technology & Engineering of Sand Mining: http://intotheoutdoors.org/topics/technology-engineering-of-sand-mining/

Environmental Impacts of Sand Mining: http://intotheoutdoors.org/topics/environmental-impacts-of-sand-mining/

Sand Mining and Ecosystems: http://intotheoutdoors.org/topics/sand-mining-and-ecosystems/

DECODING INDUSTRIAL SAND MINING DISCUSSION GUIDE

is brought to you by:

UNIMIN

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