VIDEO DISCUSSION GUIDE

Into the Outdoors.org

DECODING INDUSTRIAL SAND MINING

energy science

Suggested Grade Levels:
Middle School - Grades 6-8

Time Required:
50 Minutes

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 summarize 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.
3. The learner will be able to challenge proponents and opponents of industrial sand mining using specific details from the video 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.

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. Try to find articles in support of, and opposed to, sand mining to share with your class before viewing the video.

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.

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 two topics have the most tallies.

3. Split students into four groups. Assign two groups to each topic and give each group a point of view to argue (for or against). Give students 10 minutes to meet with their group to decide how they want to defend their position and critique 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 rebuttal and then 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 other two groups to debate when this discussion is complete.

6. Repeat the steps for the second 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.

STUDENT PORTION:

Students may use drawings, resources from the internet, or other creative methods to explain 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 participation in the debate and for their participation in subsequent discussions. 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.

2. 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.8.3 Defend explanations and models by collecting and organizing evidence that supports them and critique explanations and models by collecting and organizing evidence that conflicts with them.

C.8.1 Identify questions they can investigate using resources and equipment they have available.

C.8.11 Raise further questions which still need to be answered.

F.8.9 Explain how some of the changes on the earth are contributing to changes in the balance of life and affecting the survival or population growth of certain species.

F.8.10 Project how current trends in human resource use and population growth will influence the natural environment, and show how current policies affect those trends.

G.8.3 Illustrate the impact that science and technology have had, both good and bad, on careers, systems, society, environment, and quality of life.

G.8.5 Investigate a specific local problem to which there has been a scientific or technological solution, including proposals for alternative courses of action, the choices that were made, reasons for the choices, any new problems created, and subsequent community satisfaction.

H.8.1 Evaluate the scientific evidence used in various media to address a social issue, using criteria of accuracy, logic, bias, relevance of data, and credibility of sources.

H.8.3 Understand the consequences of decisions affecting personal health and safety.

WISCONSIN STATE SOCIAL STUDIES STANDARDS AND BENCHMARKS

B.8.9 Explain the need for laws and policies to regulate science and technology.

D.8.7 Identify the location of concentrations of selected natural resources and describe how their acquisitionand distribution generates trade and shapes economic patterns.

D.8.11 Describe how personal decisions can have a global impact on issues such as trade agreements, recycling, and conserving the environment.

NATIONAL COMMON CORE STANDARDS

CCSS.ELA-LITERACY.SL.8.1.A - Come to discussions prepared, having read or researched material under study; explicitly draw on that preparation by referring to evidence on the topic, text, or issue to probe and reflect on ideas under discussion.

CCSS.ELA-LITERACY.SL.8.1.C - Pose questions that connect the ideas of several speakers and respond to others' questions and comments with relevant evidence, observations, and ideas.

CCSS.ELA-LITERACY.SL.8.1.D - Acknowledge new information expressed by others, and, when warranted, qualify or justify their own views in light of the evidence presented.

CCSS.ELA-LITERACY.SL.8.4 - Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

CCSS.ELA-LITERACY.RH.6-8.8 - Distinguish among fact, opinion, and reasoned judgment in a text.

CCSS.ELA-LITERACY.RST.6-8.9 - Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

NEXT GENERATION SCIENCE STANDARDS

MS.LS2.1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS.LS2.5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

MS.PS1.3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

MS.ESS3.1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

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

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