

# PROJECT REPORT

Northern Wyoming Community College District / National Science Foundation  
2011 Teachers Summer Energy Education Program

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## TITLE

From Mine to Reactor: What is the Nuclear Fuel Cycle?

## SUMMARY

### The Nuclear Fuel Cycle

The lesson will allow the student to trace the steps of the Nuclear Fuel Cycle. The cycle will begin with the mining process and end when the fuel rods are ready to be loaded into the fuel assembly for use in a nuclear reactor.

## ENERGY CONTEXT

One of our biggest concerns as a nation is energy. This lesson looks at nuclear power, specifically the nuclear fuel cycle. Nuclear power is a much-debated source of energy in our country. Currently, China, India, and France are leading the way in finding new reactor designs that would allow for fuel recycling and leaving a waste product that is more easily stored. The impact of the recent Tsunami and earthquake in Japan has brought nuclear power under scrutiny.

## ANTICIPATED TIME REQUIRED

This project will require:

- Group Assignments: 5 minutes
- Explain the assignment – 10 minutes
- Group Work –3 class periods (55 minutes each)
  - Students must create their presentation in a paper plate or “Post-it-Note” concept map before they will be allowed to present their information.
  - Students will take one day or two days to prepare their presentation.
- Presentations – 1 or 2 class period(s) (55 minutes each)

<b>INTENDED STUDENT LEVEL</b>
<p>Student Level</p> <p>This project will present learning activities and assessment activities intended for students entering the 10<sup>th</sup> – 12<sup>th</sup> grade.</p>
<b>ASSUMED PRIOR KNOWLEDGE</b>
<p>This project will assume that students have prior knowledge of:</p> <ul style="list-style-type: none"> <li>▪ Basic geology, vocabulary and knowledge</li> <li>▪ Basic report writing skills</li> <li>▪ Prior background knowledge of various energy resources</li> <li>▪ Group work etiquette</li> <li>▪ PowerPoint and/or Prezi skills</li> <li>▪ Camtasia skills</li> </ul>
<b>LEARNING OBJECTIVES (MICHIGAN)</b>
<ul style="list-style-type: none"> <li>▪ E2.2B Identify differences in the origin and use of renewable (e.g., solar, wind, water, biomass) and nonrenewable (e.g., fossil fuels, nuclear [U-235]) sources of energy.</li> <li>▪ E2.4d Describe the life cycle of a product, including the resources, production, packaging, transportation, disposal, and pollution.</li> </ul>
<b>MATERIALS</b>
<p>Each group needs:</p> <ul style="list-style-type: none"> <li>• Computers for research.</li> <li>• Two to three days of media center time.</li> <li>• PowerPoint or Prezi Software</li> <li>• Camtasia Software</li> <li>• Paper</li> <li>• Pens</li> <li>• Poster Paper</li> <li>• Notebook Cards</li> <li>• Markers</li> </ul> <p>Resources</p> <ul style="list-style-type: none"> <li>• <a href="http://www.geotech.org/survey/geotech/Uranium.pdf">http://www.geotech.org/survey/geotech/Uranium.pdf</a></li> <li>• <a href="http://geology.com/rocks/breccia.shtml">http://geology.com/rocks/breccia.shtml</a></li> <li>• <a href="http://www.world-nuclear.org/info/inf03.html">http://www.world-nuclear.org/info/inf03.html</a><a href="http://www.world-nuclear.org/info/inf03.html">http://www.world-nuclear.org/info/inf03.html</a></li> <li>• <a href="http://www.world-nuclear.org/education/nfc.htm">http://www.world-nuclear.org/education/nfc.htm</a></li> </ul>
<b>INTRODUCTION / MOTIVATION FOR STUDENTS</b>
<p>Introduction</p> <p>With the depletion of oil reserves looming in our near future, the exploration of</p>

alternative fuels in order to supply our electricity needs is of great importance. Include a short video on the recent Japanese reactor disaster.

## PROCEDURE

- Divide the class into the following areas of study for presentation:
  - The geology of uranium deposits
  - Mining of uranium
  - Enrichment of uranium
  - Fuel Fabrication
  - Nuclear Power Station
  - Waste Storage
- Each group will research their section.
- Each group will make a concept map that thoroughly explains their step of the Nuclear Cycle and answers the following three conceptual questions as well.
- Make sure you address these concepts in your section:
  - Is there an energy transformation during this process?
  - Identify the location of the energy at this step. Is it potential, chemical or kinetic
  - energy change?
  - What are the economic concerns, as-well-as the safety, health and/or environmental
  - issues that need to be addressed at this step?

## SAFETY ISSUES

No notable safety issues.

## TROUBLESHOOTING TIPS

If students have a weak geology background they will be referred to our geology section in the media center, the geology teacher in the building and/or on-line websites, such as YouTube.

Students will refer schools on-line technology link for Camtasia assistance.

## ASSESSMENT

See attachments for:

- Collaboration Rubric
- The Nuclear Fuel Cycle: Presentation Rubric

## SUGGESTED EXTENSIONS

- The next section that would be addressed would be that of reclamation.
- Divide the class into two teams, one pro and the other con. The students will debate the position they are assigned. Each student would be responsible for being able to answer questions and uphold their assigned position in the debate.
- The students will research the number of reactors in the United States as compared to other countries and the safety record for each country.
- Take a positive or negative stand, based upon uranium being mined in their country or having a nuclear power plant built in their community. The paper must go through the writing process with a topic sentence and three supporting sentences thoroughly supported.