



Teacher's Edition: SAFL Field Trip

National Center for Earth Surface Dynamics (NCED), St. Anthony Falls Laboratory
2 - 3rd. Avenue South East, Minneapolis, MN 55414 Phone 612.624.4606 FAX 612.624.0066



Background:

If you are coming for a tour at St Anthony Falls Laboratory (SAFL), you want your students to view this trip as an integrated part of the class and their life. This worksheet is designed to help students preview the laboratory, answer factual and higher level questions, relate the history of the lab to regional history, make a connection between science and people in their community, and consider research as a career. If you do the post-field trip activity described below, you will further increase your students' understanding of science.

The questions on the worksheet and the talking prompts given to tour guides integrate the National Science Education Standards and Benchmarks for Science Literacy. While these standards are designed with K-12 science literacy in mind, undergraduates will find the information helpful and will be able to consider it and respond at a sophisticated level.

Procedure:

Prepare students for their field trip by pointing them to the website and assigning the pre-trip homework. You may want to demonstrate reading the research project websites, because they are dense for non-specialists, and then set students in groups to read, talk through the details, and summarize.

At the lab, encourage students to observe, ask questions, record answers and ideas.

After the field trip, assign one of these projects:

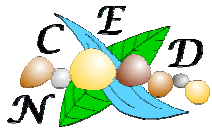
- How could you participate in SAFL or NCED as an undergraduate, graduate student, or post-doctoral associate? Outline what you would need to do to join a research group, which PI (Principal Investigator) you would work with, and what questions you would like to investigate.
- If you could take over an experimental facility at the lab, which one would it be and what would you do? Identify, for example, one of the applied research projects, its facility, and a selected application. How would you set up the facility? What would your independent and dependent variables be? How would you vary your independent variables through time? How would you collect data?
- If you could design a simple experiment at your home institution, what would it be and how would you do it? Use the facilities at SAFL as a model, and design the facility. What would the experiment test? How would you adjust variables through time to create new knowledge? How would you collect data?
- Use data from the NCED data repository to explore a research question. For example, on the NCED education activities page, <http://www.nced.umn.edu/activities.html>, the “‘Jurassic Tank’ River Delta Formation” activity and five associated videos allow student-researcher to explore questions related to erosion and sedimentation.

Assessment:

Students can be assessed on group work, their field trip sheet, their behavior, and on their post-trip work.

Extensions:

Mathematics: Find one poster on the wall with mathematics (usually algebra), and ask the researcher connected with that work to discuss the math and how math is used to quantify the world. (Note this at the time of your tour request.)



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Resources:

- Saint Anthony Falls Laboratory <http://www.safl.umn.edu>
- National Center for Earth-surface Dynamics <http://www.nced.umn.edu>
- National Park Service: Mississippi National River and Recreation Area
<http://www.nps.gov/archive/miss/maps/model/stanthony.html>
http://www.nps.gov/archive/miss/maps/model/history/stanthony_history.html
- Engineering the Falls: The Corps Role at St. Anthony Falls
<http://www.mvp.usace.army.mil/history/engineering/>
- Minneapolis Public Library: History
<http://www.mpls.lib.mn.us/history/eh5.asp>
- US Army Corp of Engineers: Hydraulic and hydrologic data
<http://www.mvp-wc.usace.army.mil/projects/SAF.shtml>
- Mill City Museum <http://www.millcitymuseum.org/>

NSES and Benchmarks

Science as a human endeavour

<p>NSES Content Standard G History and Nature of Science: Science as a human endeavor Grades 9-12, page 200</p> <p>Individuals and teams have contributed and will continue to contribute to the scientific enterprise. Doing science or engineering can be as simple as an individual conducting field studies or as complex as hundreds of people working on a major scientific question or technological problem. Pursuing science as a career or as a hobby can be both fascinating and intellectually rewarding.</p>	<p>Science for All Americans The Nature of Science: Chapter 1, page 8</p> <p>Science goes on in many different settings. Scientists are employed by universities, hospitals, business and industry, government, independent research organizations, and scientific associations. They may work alone, in small groups, or as members of large research teams.</p>
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Models and evidence

<p>NSES Content Standard Unifying Concepts and Processes: Evidence, models and explanation Grades K-12, page 117</p> <p>... Models help scientists and engineers understand how things work. Models take many forms, including physical objects, plans, mental constructs, mathematical equations, and computer simulations.</p>	<p>Benchmark 11B Common Themes: Models Grades 6-8, page 269</p> <p>Models are often used to think about processes that happen too slowly, too quickly, or on too small a scale to observe directly, or that are too vast to be changed deliberately, or that are potentially dangerous.</p> <p>Benchmark 11B Common Themes: Models Grades 9-12, page 270</p> <p>... The graphic capabilities of computers make them useful in ... simulation of complicated processes.</p>
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Historical perspectives

NSES Content Standard G

History and Nature of Science: Historical perspectives

Grades 9-12, page 201

...Much can be learned about the internal workings of science and the nature of science from study of individual scientists, their daily work, and their efforts to advance scientific knowledge in their area of study.

Scientific enterprise

NSES Content Standard E Science and Technology: Understandings about science and technology Grades 9-12, page 192

... Many scientific investigations require the contributions of individuals from different disciplines, including engineering. New disciplines of science, such as geophysics and biochemistry often emerge at the interface of two older disciplines.

Benchmark 1C

The Nature of Science: The Scientific Enterprise Grades 9-12, page 19

... many problems are studied by scientists using information and skills from many disciplines. Disciplines do not have fixed boundaries, and it happens that new scientific disciplines are being formed where existing ones meet and that some subdisciplines spin off to become new disciplines in their own right.

Benchmark 1C

The Nature of Science: The Scientific Enterprise Grades 9-12, page 20

Funding influences the direction of science by virtue of the decisions that are made on which research to support. Research funding comes from various federal government agencies, industry, and private foundations.

Change and measurement

NSES Content Standard Unifying Concepts and Processes: Constancy, change, and measurement Grades K-12, page 118

Changes in systems can be quantified. Evidence for interactions and subsequent change and the formulation of scientific explanations are often clarified through quantitative distinctions--measurement. Mathematics is essential for accurately measuring change.

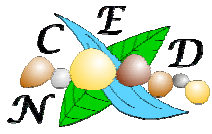
NSES Content Standard Unifying Concepts and Processes: Constancy, change, and measurement Grades K-12, page 118

Scale includes understanding that different characteristics, properties, or relationships within a system might change as its dimensions are increased or decreased.

Benchmark 11C Common Themes: Constancy and Change

Grades 9-12, page 275

Graphs and equations are useful (and often equivalent) ways for depicting and analyzing patterns of change.



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Answers to factual questions on the student worksheet:

<p>How high is St. Anthony Falls?</p>	<p>At the Laboratory: What is happening in the picture of St Anthony Falls from the 1860's? (by the front office)</p>
<p><i>49 feet at the lock</i></p>	<p><i>This picture shows the falls before the concrete apron, with rocky ledges. Logs are shown going over the falls. Without the falls, log mills and flour mills would not have operated and Minneapolis would not be such a large city today</i></p>
<p>What does it look like?</p>	<p>Who built St Anthony Falls Laboratory? How did building this Laboratory help the community?</p>
<p><i>Answers vary: often described as a "concrete apron" or "wide"</i></p>	<p><i>Dr Straub was the force behind building the lab. The lab was built as a Depression-era WPA (Works Progress Administration) project and employed many people</i></p> <p>What kind of science is done at the Laboratory?</p> <p><i>Engineering, environmental, biological and geophysical fluid mechanics</i></p> <p>What is your tour guide's educational background? What do they do for work when they are not leading tours?</p>
<p>When was the laboratory built?</p>	<p>What would you have to do to become a researcher here?</p>
<p><i>1938</i></p>	<p><i>As an undergrad student: a research experience for undergraduates (REU)</i> <i>As a post-grad student, MS or PhD: meet an advisor and enter a degree program</i> <i>As a post-doc: post-doc associate or professor doing research</i> <i>As an administrator, engineer, writer, computer specialist, accountant</i></p>
<p>What building shares Hennepin Island with the Laboratory?</p>	<p>Write about one research experiment or model you observed. Describe what it was investigating.</p> <p>How is data being collected and analyzed on that experiment or model?</p>
<p><i>XCEL hydropower plant</i></p>	