

A SENCER Model: Chemistry and the Environment

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Civic Engagement and Young People

“Programs and organizations ought to address significant problems or passions in young people’s lives, and preferably in the larger community in which they live. In addition, these efforts must allow young people to provide **consequential input into decision-making and to produce tangible solutions or products...**” .

“Better Together”, Report of the Saguaro Seminar on Civic Engagement in America, John F. Kennedy School of Government, Harvard University, December 2000 (page 80).

Chemistry and the Environment

connects basic chemical principles and civic engagement through the public issues related to sustainability such as

- air quality,
- ozone depletion,
- climate change,
- acid rain, and
- water quality.

Chemistry and the Environment

Photochemical Smog	Clean Air Act, Bay Area Air Quality Control, Emissions Testing of Autos
Ozone Depletion	Montreal Protocol, Updates
Climate Change	IPCC; Future Carbon Trading
Acid Rain	Sulfur Dioxide (Pollution Rights) Trading
Indoor Air Pollution	OSHA and EPA regulations
Energy Alternatives	Deregulation in California
Nuclear Power	Regulation in US / international
Nuclear Waste	Laws and regulations in US / international
Water Quality	Clean Water Act

Chemistry and the Environment

The course also exemplifies the SENCER approach through **campus- and community-based projects** that are required of all the students.

Learning Outcomes

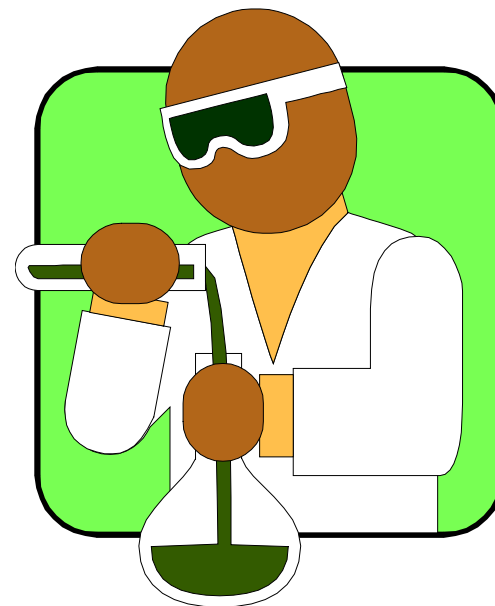
- understanding of and appreciation for the practice of science
- basic science related to project
- develop research skills
 - identifying a problem
 - literature searching (previous campus work, literature or other sources, observations),
 - developing hypotheses,
 - proposing, designing and conducting experiments,
 - analyzing data,
 - interpreting results and drawing conclusions (campus recommendations)
 - communicating results in several formats (written, poster, web, oral)

Learning Outcomes

- **time management and team management skills**
- **understanding of how the university operates**
- **develop sensitivity to the roles staff and administrators play in defining daily campus functions**
- **sense of ownership and connectedness to the campus**
- **recognize they are environmental stakeholders in any place they choose to live.**

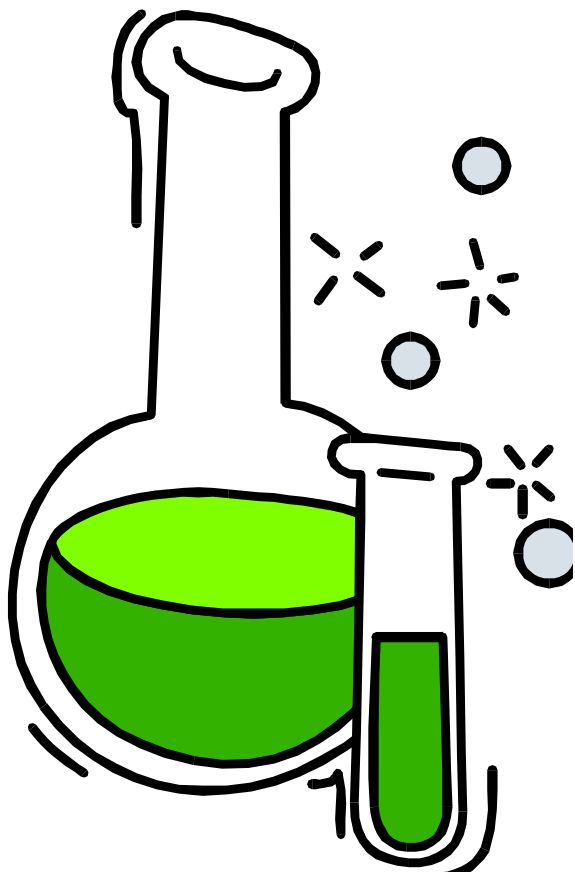
Sustainability and Chemistry

Several sustainability areas directly related to chemistry and present an excellent opportunity to introduce research methods to non-science majors (and majors).



- **waste management**
- **energy**
- **water quality**
- **land use**
- **food preparation**
- **transportation**
- **indoor environment**

Chemistry and the Environment



- a non-science majors environmental chemistry course
- 40-50 undergraduates
- course projects:
 - **groups of 4-6 students**
 - **group project proposal**
 - **progress reports**
 - **final report**
 - **poster presentation or website**
 - **recommendations for campus or community**

Indoor Air Quality

- **Indoor Air Pollution: VOCs, aerosols, molds, radon**
- **Testing of air quality (Drager tubes), mold growth, radon levels**
- **Recommendations: particulate testing, new materials, baking of buildings, radon monitoring**



Chemistry Connections:

- **atomic structure**
- **nuclear chemistry**
- **organic molecules**
- **air quality testing**
- **OSHA regulations**



Is Bottled Water Better?

- Survey of bottled water use on campus (over 13,000 bottles (0.5 liters) are sold per month on campus); taste test (tap vs. bottles); water analysis using atomic absorption spectroscopy
- Recommendations: drink tap water or refill bottle; recycle plastic bottle
- Chemistry connections: atoms, ions, metals, organic molecules, methods of analysis, spectroscopy, water purification, EPA and FDA regulations

Biodiesel research project exploring the feasibility of using used cooking oil as fuel in campus vehicle



Project Management Tips

- Undergraduate or graduate teaching assistant
- Align lecture topics with project areas (avoid teaching 20 mini-courses);
- Align project areas with available resources and expertise (e.g. limit to air or water quality)
- Engage partners (EHS officer, purchasing agents, and facilities and operations personnel)
- Conduct projects in groups and/or within the laboratory

SENCER SALG

Student Assessment of Learning Gains

Question	SENCER Chem. and Environ. a lot / a great deal n = 19	Traditional General Chem. a lot / a great deal n = 144
The course added to my skills in how to:		
Pose questions that can be addressed by collecting and evaluation scientific evidence	37%	44%
Extract main points from a scientific article and develop a coherent summary	48%	40%
Interpret tables and graphs	48%	70%

SENCER SALG

Student Assessment of Learning Gains

Question	SENCER Chem. and Environ. much / very much n = 19	Traditional General Chem. much / very much n = 144
How much did a course focus on the following help you in learning:		
Addressing real world issues	84%	20%
How science works	69%	49%
Interplay between science and social issues	90%	10%