

**CHERNOBYL:
A THEME TO INTEGRATE THE NATURAL AND
SOCIAL SCIENCES**

Lesson Plans

**A Joint Effort of the Center for Russia, East Europe, and Central Asia
(CREECA), the Wisconsin Teacher Enhancement Program in Biology
(WisTEB), and Friends of Chernobyl Centers United States (FOCCUS)**

**June 28-July 2, 1999
University of Wisconsin-Madison**

THE CAUSE AND EFFECT OF NUCLEAR WASTE ON THE ENVIRONMENT

Clifford McClain- Chernobyl Children Project
Dolores Liamba- UW-Madison
Stuart Vamstad- Darlington H.S.
Don Vincent- Madison West H.S.

Wisconsin Environmental Education Standard “C” –Students will be able to identify, investigate, and evaluate environmental problems and issues.

Rationale: Solving environmental problems and issues requires skills in environmental investigations. These skills, in turn, provide students with opportunities to apply and improve their capacity for systems thinking and their understanding of a sustainable world and society. Focusing on environmental issues offers students a means of integrating their knowledge of human and environmental systems and a way of finding personal relevance in that knowledge.

National Council for the Social Studies Standards. Stand #8 – Social studies programs should include experiences that provide for the study of relationships among science, technology, and society.

Rational: Students need to learn how technologies form systems and how their daily lives are intertwined with a host of technologies. They should understand about how the decisions we make can affect our lives in many ways. They need to think more deeply about how we can manage technology so that we control it rather than the other way around.

Recommended grade level: 9-12 General Science or Social Studies

UNIT OBJECTIVES:

1. List and discuss the various sources of energy and their use in our daily lives.
2. List and discuss the various methods of producing electricity.
3. Discuss the uses of nuclear energy and what are the consequences of its use.
4. List and define the four categories of nuclear waste.
5. Discuss the relevance of nuclear waste to his/her life.
6. State and discuss how each type of waste is or will be disposed of.
7. List and discuss the negative effects of radiation poisoning on humans from the Chernobyl accident.

Time allotment: 3 -45 minute class periods with an optional 2 days.

Resources needed: Almost all resources are included in this lesson plan.
<http://www.ymp.gov/learn/educ/index.htm> (This is the source for lesson plans, reading lessons, review test, and supplemental lessons.)

Additional resources:

Nuclear Energy: Who's afraid of atomic power?, edited by Richard Buckley, published by European Schoolbooks Publishing Limited, the Runnings, Cheltenham GL51 9PQ, England, 1995. Telephone: (01242) 245252; Fax: (01242) 224137. (16 pages plus large global map, ISBN 0-85048-957-1). Can be ordered through Social Studies School Service.

Back to Chernobyl, Video by NOVA. Available through CREECA (Center for Russia, East Europe, and Central Asia) <http://polyglot.lss.wisc.edu/creeca>, telephone: (608) 262-3379; Fax: (608) 265-3062.

Procedure: The following is a brief outline of the three lessons:

Day 1- Introduce students to a discussion of the uses of energy, especially electrical, in their everyday lives. Next focus on the use of nuclear energy, how it plays a part of meeting global electrical demand, and the issues that must be considered when using this form of energy. Finally, present an overview of nuclear power stations and how they function. Introduce the Chernobyl disaster by showing part of the video *Back to Chernobyl*. Finally have the students begin to think about disposing of nuclear waste. Students will be given the homework assignment *Investigating Human-Made Waste* and the reading assignment *high-level waste factsheet*.

Materials: 1.) *Energy and Electricity Review*, Science, Society, and America's Nuclear Waste Reading Lesson for discussion questions of energy (8 pages). This reading lesson provides questions that teachers can use to focus the discussion on energy usage. From <http://www.ymp.gov/learn/educ/index.htm>

2.) *Back to Chernobyl* video

3.) *Nuclear Energy* global map from European Schoolbooks Publishing Limited

4.) *Investigating Human-Made Waste* homework assignment (1 page)

5.) *high-level waste factsheet* homework assignment (4 pages)

Day 2 - Help students to begin to understand how nuclear waste is important for all of us to consider. First students will review what they learned in the first lesson about energy, nuclear power, and the nuclear accident of Chernobyl. Students will then begin to focus on the relevance of nuclear waste in their own lives. Use transparencies on the location of nuclear power plants and the percentage of electricity generated by nuclear power plants in the U.S. Also use global map on nuclear energy. Students will discuss the benefits and problems associated with different energy sources. In their discussion they will present the waste products they brought from home and talk about how they are recycled. Students will summarize what they read in the homework reading assignment "high-level waste factsheet." and ask questions about what they do not understand. For homework students will read *Nuclear Waste: What is it? Where is It?*

- Materials: 1.) Unit Grid *Nuclear Waste* and Teachers Guide *What Does Nuclear Waste Have To Do With Me?*
2.) *Nuclear Energy* global map from European Schoolbooks Publishing Limited
3.) *Nuclear Waste: What is it? Where is It?* homework assignment (10 pages)

Day 3 - This lesson plan is designed to be covered in two class periods, therefore, the teacher can decide which of the material is most relevant or continue the lesson on an optional fourth day. The lesson will help the students to focus on the issue of how to dispose of the accumulated nuclear waste. Students will discuss the four categories of nuclear waste and will identify where and how nuclear waste is currently stored in the U.S. The teacher will review the homework reading lesson and discuss the storage of spent fuel. Finally the teacher will assess how well the students have mastered the information presented. Students can be given an optional essay question on the impact of nuclear waste disposal in their own lives. An additional social studies assignment could be assisting students to become pen pals with the children from one of the Chernobyl Children's Projects.

- Materials: 1.) Unit Grid *Nuclear Waste* and Teachers Guide *Nuclear Waste: What Is It? Where Is It?*
2.) *Nuclear Energy* global map from European Schoolbooks Publishing Limited
3.) *Review Test* Unit 1.

Nuclear Waste and the Environment

Introduction:

Nuclear energy is a subject discussed in many science classes around the world. Students examine various aspects of nuclear related topics. This paper will concentrate on nuclear waste.

Our students need to be better informed about energy resources. They need to understand the facts and issues concerning our future energy needs. They also need to know that there are many choices regarding our use of energy. Although the United States occupies only 6 percent of the world's population, we consume approximately 30 percent of the energy. Our fossil fuel resources are finite and will eventually run out. Countries such as Japan and Korea are viewing nuclear power as an alternative to our dwindling supplies of gas and coal. Although nuclear power accounts for only a small percentage of our overall energy demand (17 percent worldwide), our students need to know the facts in order to make informed decisions regarding their future.

The Chernobyl accident on April 26, 1986, was the world's worst disaster at a power plant. It is also one of the most widely know industrial disasters of all time. Perhaps even more worrisome than the possibility of another nuclear meltdown are the problems associated with nuclear waste disposal.

More than 50 years have passed since the first controlled nuclear reaction, and yet, scientists have not found a safe and permanent method for disposing of radioactive waste. In addition, this storage facility would need to remain stable for tens of thousands of years. Burying radioactive waste in the ground has been proposed for the Yucca Mountain site in Nevada. In the recent past these methods have been controversial. Problems with storing nuclear waste include: chemical bursting of containers, corrosion, gas leaks, and contamination of ground water. Because these materials can be used for proliferation of nuclear weapons, this burial site will need a military guard to protect us from such intervention. The cost of this type of safeguard (which could be \$billions) will be passed on to future generations, long after the last nuclear power plant has been decommissioned. Add to the cost of this extremely expensive protection the biohazards of polluting the soil, water, and air and the realities of nuclear power are even more questionable.

The lesson plans and references in this packet will give teachers an opportunity to examine some of the impacts regarding nuclear waste.

Investigation of Human-made Waste

Purpose: Students will examine the origin and disposal of human-made waste.

After watching the Nova video “Back to Chernobyl”, students will make a list of all the waste produced in their society. Students should consult all members of their family in producing this list. Students will bring a sample of a waste product to share with their class. Please no hazardous waste.

Questions:

1. How are these waste eliminated?
2. Are there better methods of waste disposal?
3. What is hazardous waste?
4. Are some of these waste hazardous?
5. Should all waste be recycled?

Discussion:

Distinguish between household and industrial waste including nuclear waste.

Homework assignment:

Write a paragraph about how you will dispose of your waste. Considering the what you have learned, which is the best method for recycling your waste.

Assessment: At the end of the teaching packet, a unit exam is included consisting of 20 multiple choice questions. There is also a unit exam for the supplemental lessons that can be found on the web site: <http://www.ymp.gov/learn/educ/index.htm>

In addition, the following essay questions could be used:

1. explain the different risk factors that you would encounter if you lived
 - A. at a high altitude vs. a low altitude.
 - B. near a nuclear power plant vs. a coal-generated plant.
 - C. near a nuclear power plant vs. a hydro-electric plant.

2. In a paragraph or two, explain the economics involved in producing electricity from nuclear power and at least two other forms of energy.

Supplemental Resources:

CHERNOBYL:

Cheney, Glenn Alan, Journey to Chernobyl: Encounters in a Radioactive Zone, Academy Chicago Publishers, Chicago, 1995.

Chernobyl: Implications for Illinois, Proceedings of the Conference October 22 and 23, 1987, Chicago. Illinois Department of Nuclear Safety. 1987.

Testimonies: Chernobyl Papers No. 1, Greenpeace International, Amsterdam, 1996.

Chernousenko, Vladimir M., Chernobyl: Insight from the Inside, Springer Verlag, Berlin, 1991.

Edwards, Mike, "Living with the Monster: Chernobyl," National Geographic, August, 1994, pp. 99-114.

Gale, Robert Peter, Final Warning: The Legacy of Chernobyl, Warner Books, New York, 1998.

Gubaryev, Vladimir, Sarcophagus – A Tragedy, a play about Chernobyl, Vintage Books, New York, 1987.

Hawkes, Nigel (et al...), Chernobyl: The End of the Nuclear Dream, Vintage Books, New York, 1987.

Marples, David R., Chernobyl and Nuclear Power in the USSR, St. Martin's Press, New York, 1986.

Marples, David R., The Social Impact of the Chernobyl Disaster, St. Martin's Press, New York, 1988.

Medvedev, Grigorii, The Truth about Chernobyl, Basic Books, New York, 1991.

Medvedev, Grigorii, No Breathing Room: The Aftermath of Chernobyl, Basic Books, New York, 1993.

Medvedev, Zhores A., The Legacy of Chernobyl, W.W. Norton, New York, 1990.

Nardo, Don, Chernobyl, Lucent Books, San Diego, 1990.

Pohl, Frederik, Chernobyl – A Novel, Bantam Books, New York, 1987.

Read, Piers Paul, Ablaze: The Story of the Heroes and Victims of Chernobyl, Random House, New York, 1993.

Rickard, Graham, The Chernobyl Catastrophe, Bookwright Press, New York, 1989.

Roche, Adi, Children of Chernobyl, Fount Paperbacks, London, 1996.

Shcherbak, Yuri, "Ten Years of the Chernobyl Era," Scientific American, April, 1996, pp. 44-49.

Shcherbak, Yuri, Chernobyl: A Documentary Story, St. Martin's Press, New York, 1989.

Stone, Richard, "The Explosions That Shook the World," Science Magazine, V. 272, April, 1996, pp. 352-59.

Yaroshinska, Alla, Chernobyl. The Forbidden Truth, University of Nebraska Press, Lincoln, 1995.

Supplemental Resources: Internet Sites

- Don't waste America:<http://www.nirs.org/dtwsam.htm>

Y2K and Nuclear Power

- <http://www.nirs.org/y2k/y2kandnuclearpowerwebpage.htm>

The NIRS Toolbox! Hundreds of articles, reports, testimony and other material gathered by NIRS on everything from decommissioning to wind energy, from Chernobyl to radioactive waste.

- Also lists numerous other sources of information on nuclear power and energy issues..... <http://www.nirs.org/toolhome.htm>

- Concerned Citizens for Nuclear Safety.....<http://www.nuclearactive.org/>

Nuclear Waste:..... <http://www.e-democracy.org/mn-politics-archive/9703/0413.html>

Senate adds restrictions on Nuclear Waste.....<http://www.e-democracy.org/mn-politics-archive/9703/0413.html>

- Nuclear Waste at the Beatty Waste Dump, Beatty, Nevada. Nuclear Age Peace Foundation. A non-governmental educational organization: performs research and analysis on global peace and survival, supports the abolition of nuclear weapons,.....<http://www.wagingpeace.org/beatty.html>

OCRWM Curriculum - Science, Society, and America's Nuclear Waste.....<http://www.rw.doe.gov/progdocs/edresource/edresource.htm>

- Nuclear Waste Program: This page discusses Southwest Research and Information Center's work on environmental issues and community...
URL: www.sric.org/Nuclear/

Office of Civilian Nuclear Waste Management

- <http://usgovinfo.miningco.com/library/weekly/aa012298.htm>