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)

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University of Wisconsin-Madison
CHERNOBYL
INTEGRATING THE SOCIAL and NATURAL SCIENCES

LESSON PLANS

TEACHERS INVOLVED:

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University of Wisconsin, Madison 07/02/99

Wisconsin Teacher Enhancement Program in Biology: Study of Chernobyl
EDUCATIONAL STANDARDS WHICH APPLY:

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WISCONSIN ACADEMIC STANDARDS: SCIENCE

Science Connections: A.8.1 and A.8.6
Nature of Science: B.8.6
Science Inquiry: C.8.1, C.8.7, and C.8.11
Physical Science: D.8.3 and D.8.4
Biology: F.8.4
Science Applications: STS G.8.2 and G.8.3
Decisions concerning the individual H.8.1 and H.8.3

WISCONSIN ACADEMIC STANDARDS: SOCIAL STUDIES

Geography: People, places, and environments.
History: Time, Continuity, and Change.
B.8.2, B.8.3, B.8.4, B.8.8, B.8.9, B.8.10
Political Science and Citizenship: Power, Authority, Governance, and Responsibility:
C.8.6, C.8.7, C.8.8
Economics Production, Distribution, Exchange, Consumption:
D.8.4, D.8.5, D.8.6, D.8.7, D.8.8, D.8.11
The Behavioral Sciences: Individuals, Institutions, and Society:
E.8.4 and E.8.5

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NATIONAL SCIENCE EDUCATION STANDARDS: (NRC)

Science and Technology:
    Abilities of Technological Designs
Science of Physical Science:
    Properties and the changes of property in matter
    Transfer of Energy
Science of Personal and Social Perspective
    Personal Health
    Populations, Resources and Environments
    Natural Hazards
    Risks and Benefits
    Science, Technology and Society
History and Nature of Science Standards:  
Science as a Human Endeavor

NATIONAL STANDARDS: SOCIAL SCIENCE (NCSS)

1. People, Places, and Environment  
2. Science, Technology and Society  
3. Culture  
4. Time, Continuity and Change  
5. Power, Authority and Governance  
6. Production, Distribution, and Consumption  
7. Civic Ideals and Practices

INTRODUCTION / PURPOSE / RATIONAL

The intent is to explore and understand a negative example showing the intersection of science, technology and society, the explosion of the Chernobyl Nuclear Power Plant. The unit will integrate science and social science areas involving the study of basic nuclear energy concepts with a historical record of the incident followed by a debate on the merits of constructing a power plant.

RECOMMENDED GRADE LEVEL

The intended grade level is the 8th grade. It could be taught in a unified science and social science class, or in either class alone. The material could be covered in a few class periods or could be expanded to cover a much larger time span.

OBJECTIVES

ATTITUDES:
1. Awareness of problems concerning applications of science and technology.  
2. Awareness of the implications of technology on specific people and groups.  
3. Respect for the point of view of others.  

SKILLS:
1. Researching facts on assigned topic(s)  
2. Practice giving oral presentations  
3. Critical thinking skills including:  
   video evaluation(s)

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decision making skills
risk taking decisions

4. Form conclusions based on different perspectives

KNOWLEDGE:
1. History and information concerning the explosion at Chernobyl
2. Nuclear energy terms and concepts, including but not limited to:
   Radiation types, properties, abbreviations
   Processes of fission / fusion and chain reactions
   Natural background radiation
3. Some of the Pros and Cons of Nuclear Power plants
4. Familiarity with Victims of Chernobyl

TIME ALLOTMENTS

These time allotments are based on 45 minute classes meeting daily. Feel free to adjust as your schedules require.

1-2 days: Introductory Materials / Review of Concepts concerning Nuclear Energy

2 days: Video: including; general information, vocabulary words, concepts
        Show Video
        Evaluation

6-7 days: Role Playing.
          5 days for research time
          1-2 days for presentation and closure

2 days: Assessment Activity
        1 day: Presentation / Reading of Stories by Chernobyl Children
        1 day: Evaluation Due / Evaluated

TOTAL: 13 DAYS OF CLASS TIME

RESOURCES

1. Video: Back to Chernobyl. Nova. Any video catalog carrying nova’s should do

2. Project Learning Tree, “Things aren’t always what they seem” Pg.21 to 32. Contact the Wisconsin DNR for more information on how to obtain.

3. Appendix #1. Children of Chernobyl (4 pages)
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4. Appendix #2. Chernobyl’s Children’s Project (3 pages)

5. Appendix #3. Nevada County Chernobyl Children’s Project Info (web. Addresses)

6. Appendix #4. Terms for Nova Video

7. Appendix #5. Student Orientation Questions for Nova Video


PROCEDURE

1. Teacher Orientation: The students need to understand science and technology DO NOT exist outside a human context. The Chernobyl explosion is an important negative example of the intersection of science, technology and society as it impinges on countries, societies and individuals. Since it can’t and shouldn’t be repeated, the intent of this exercise is to learn from what happened and hopefully, what not to do again. The students should know:

   (a). the science knowledge content necessary to understand the event.
   (b). what actually went wrong.
   (c). upon what criteria could decisions be made in an effort to avoid a repeat.
   (d). some of the impact on the peoples involved

2. Student orientation: It is assumed students are already aware of basic nuclear energy information. The first day of this section would be a review of these concepts. Included, but not limited to: types and properties of radiation, background radiation, radiation instrumentation, fission / fusion, reactors and chain reactions.

   The review may be done using game formats such as BINGO and JEOPARDY. Alternatively multiple choice questions of varying difficulty could be presented to the class. If the students are divided into groups, the group must decide on one answer. Points could be awarded according to the difficulty of the questions. This is an active, involved setting for the review.


   (a). the students will probably need background information such as: date, location, alternative spellings (reason for) and type of reactor. Social / historical information about the culture would be helpful.

   (b). Some vocabulary terms need to be interpreted for 8th graders. The list is the appendix (#4). Also included in the appendix (#5), are a set of questions to Page #5.

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discuss prior to the video. It helps the students to be orientated for the material and gives a focus to follow during the show. Although not impossible, the video is a stretch for some / many students. The orientation is helpful.

(c). The video needs about 60 minutes to run. If the background information and terms are done first, the video may be started one day and finished the next. If this format is used, questions may be discussed on the completed section before resuming. Also setting the video back a bit to a section already seen will give the students a good orientation for the second day.

(d). Evaluation of the video. There are many ways to accomplish this:

* Use Project Learning Tree materials and evaluate information from an expert or lay person's point of view. Another scale shows how it might be interpreted from a risk perception point of view. Students might use either or both sets of criteria.

* Another evaluation technique could be a general information inventory. The topic, summary statement, main ideas could be listed. A concluding statement would be last.

* Interesting inventories for the teacher to learn from, involve the students listing facts, ideas, concepts that they did not know before seeing the video. It gives the teacher a great look into the starting point of the students. Add a question requesting the students to list any / some / all of their questions left unanswered at the end to give a wonderful spectrum of points to start with the next year. It has seemed these points don't vary much from year to year.

*An interesting but time consuming evaluation requires the rerunning of the video and students looking for specific examples of things in the video. Since they know the study line now, it is easier to find specific examples of ideas in the video. Ask the students to divide a sheet of paper in "hot dog bun" fashion and keep track of some pair of examples. Sample pairs might be: facts and conclusions; technical problems and humanitarian problems; outcomes and speculations (predictions); supported facts and unsupported facts; emotional / sensational statements or supported facts and conclusions or simply facts and conclusions. It's great practice technique but is time consuming to use.

* All techniques require follow up discussion and could be used for evaluation.

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NUCLEAR POWERED DEBATE
A ROLE PLAY

The following lesson plan devised by Gary Arce is a role-play based on debates about the construction of a hypothetical nuclear power plant in your community. He has spelled out the procedure and details for a specific location in California. To engage students and to heighten the drama, it would be necessary to adapt the scenario to a local area, preferably one that has ecological importance. This activity allows students to learn more about their community as well as the issues regarding nuclear power. Since roles are assigned, it allows students to present both sides of an argument without the stigma of voicing an unpopular personal opinion. After students have presented their positions, a vote is taken as to whether the plant should be built or not. This activity provides the opportunity to develop critical thinking about the complexity of the situation and the risks and trade inherent in this controversial topic.

The lesson plan is found in Appendix #6.

ASSESSMENT

Students read (or are read to) “Children of Chernobyl” fact sheet and the children’s writing of their experiences in the contaminated zone. (See attachments #1 and 2)
Students write about their reactions to these articles.
   Encourage students to back up their responses with examples of specific information learned in the unit.
   Students are to include their feelings about the Chernobyl accident and the victims.
   Recommendations are to be included concerning humanitarian efforts they feel are needed at this time or they would be willing to be involved with.

EXTENSION and ENRICHMENT

1. Read or act out the play Sarcophagus by Gubarev. This play, published first in the Soviet Union is about the Chernobyl accident. It dramatizes the medical activities immediately following the accident. See supplemental materials for more information.

2. Poetry writing (and read to the class) by the students about the children of Chernobyl or the ghost town of Pripyat.

3. Read Phoenix Rising by Karen Hesse. This fiction book is a “tale of love and hope”, a story of two teenagers whose lives intersect because of a nuclear accident in the northeastern U.S.

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4. Provide background materials on the political practices that led to the inevitability of the accident at Chernobyl. This will include the political and economical practices of the USSR during the years prior to the explosion.

5. Ask a History Teacher at the University to speak to your classes about the effect of Atomic Energy in this country on: economics, the road system, the development of cars and energy usage. If the teacher can not be present for all the classes, record the original presentation and play it back.

6. Ask a nuclear medicine or radiology doctor to speak to the group. Request examples of scans using nuclear materials be brought along if possible. Other topics to be discussed could be the source of radioactive treatment chemicals, the storage, the disposal. Where does the used material go? What is the Dr’s. feeling on Nuclear Energy and why?

7. More intensive use of risk evaluation materials and its application to nuclear energy use, to electrical production, to medical uses, and to the lives of the students in the class.

8. Use the tapes or CDs of Tom Lehrer to recall the attitudes and crises during the cold war and atomic energy one-upmanship years. Listen to the songs first as there will be many terms the students will need to be taught. ie. ICBMs.

9. Additional films are available to be used.
   The second NOVA in the series on Chernobyl which is “Suicide Mission to Chernobyl.” It records the exploration inside the reactor to determine where all the radiation went. The men doing the exploration are interviewed and the ghost town of Pripyat is shown.

   The Scientific American Frontiers series in segment #3, 1997-1998 revisited the radioactive reindeer of the Tundra. Original footage from the coverage right after the explosion was included as was an update of the same people and their problems now. The segment is called, “Radioactive Reindeer”.

SUPPLEMENTAL RESOURCES

Books:

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accident in the northeastern Unites States. It brings Chernobyl to our shores and into the lives of people who live among us. An easily read book of 182 pages with a poignant story for both boys and girls that captures the complex relationships that emerge as a result of the disaster.

3. Medvedev, Zhores. *The Legacy of Chernobyl*. New York: Norton Paperbacks, 1990. One of the few publications written by a Russian senior research scientist that presents “the real causes and effects” of the disaster. The book is written with deep political as well as scientific knowledge. Mevedev sees Chernobyl as a watershed in the use of nuclear energy and the policies that control it.


Web Sites:
1. Adolph Harash. *A Voice From Dead Pripyat*. Poems about the people who were victims. www.wsu.edu:8080/~brians/chemobyl_poems/chemobyl_poems.html


CDs and Tapes:
1. Tom Lehrer. “That was the Year that was, TW3 and Other Songs of the Year”. Recorded at hungry i. San Francisco. Reprise Records (Warner Communications Com). These are some of the songs Mr. Lehrer wrote concerning the arms race, war and atomic energy during the Cold War and atomic energy race years. There are more songs out there somewhere. It is part of our musical, entertainment history related to atomic energy.


Videos:
1. “Back to Chernobyl”: NOVA video recording the history of events during the Chernobyl explosion. It is usually available from any video catalog that

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carries NOVAs. Estimated running time, 60 minutes.

2. "Suicide Mission to Chernobyl." NOVA video that documents the exploration inside the sarcophagus to find the lost radioactive materials. The scientists who do the exploring are interviewed. Chernobylite, the new material produced by the explosion is shown. Estimated running time, 60 minutes.

3. "Radioactive Reindeer:" A video segment from Scientific American Frontiers Series. Segment #3, 1997-98. The original segment on the radioactive reindeer from shortly after the explosion is replayed. Then the same people are interviewed and the situation is updated. Estimated running time, 20 minutes.
APPENDIX #4
TERMS for BACK TO CHERNOBYL

1. Bata
2. Gamma Rays
3. Dosimeter
4. Polarizing
5. Desolate
6. Spectrum
7. Sarcophagus
8. Isotope
9. Natural Background Radiation
10. Decimate
11. Re.ms
12. Rads.
13. Turbines
14. Control Rods
15. Cesium 137
16. Strontium 90
17. Radiation Sickness
18. Fission
19. Meltdown

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APPENDIX #5.
QUESTIONS CONCERNING THE VIDEO

NO NOT TAKE NOTES DURING THE VIDEO. INSTEAD PAY CLOSE ATTENTION TO THE VIDEO AND WRITE YOUR ANSWERS LATER.

1. WHERE IS CHERNOBYL? BE SPECIFIC. RUSSIA IS NOT A CORRECT ANSWER.

2. WHAT HAPPENED THERE, WHEN DID IT OCCUR?

3. WHAT PROBLEMS WERE CREATED THAT DAY FOR RUSSIA AND THE WORLD AT THAT TIME?

4. LIST ONE WORD YOU DIDN'T KNOW OR UNDERSTAND THAT WAS USED IN THE VIDEO. THEN FIND AND WRITE DOWN THE DEFINITION.

5. WHAT NEW PIECE(S) OF INFORMATION DID YOU LEARN ABOUT THE CHERNOBYL INCIDENT FROM WATCHING THE VIDEO TODAY?