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
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The lessons in this collection were developed by K-12 science and social science educators who participated in an interdisciplinary workshop held at the Madison campus of the University of Wisconsin. The five-day course broke new ground as it brought together teachers from disciplines that often acknowledge each other from a distance. Yet we live in a world in which the issues of science and technology are inevitably woven into a political, cultural, and economic context. In order to explore ways in which students can grasp how these different sectors intersect in the real world, the 1986 accident at the Chernobyl nuclear power plant in Ukraine was chosen as a model.

The following teachers and activists prepared the mini-units on Chernobyl. The units, which cover a wide range of suggested grade levels, are arranged from low grades to high.

“Chernobyl: The Experience”
Cecile Calhoun              Children of Chernobyl-US Alliance, Ellensburg WA
Tom Kropidlowski           Seton Catholic Middle School, Menasha WI
James Sherburne             Marshfield Junior High School, Marshfield WI
Ethel Stern                  Lake Shore Middle School, Mequon WI

“Chernobyl Lesson Plans”
Patricia Brotman            Nevada County Chernobyl Children’s Project, CA
David Blado                  P.J. Jacobs Junior High School, Stevens Point WI
Barbara Splinter             Marshfield Junior High School, Marshfield WI
Marilyn Wilson               Madison Metropolitan School District, Madison WI

“Chernobyl: The Environmental and Economic Components of a Nuclear Disaster”
Robert Kroncke                Rufus King High School, Milwaukee WI
Margaret Martin               Wausau West High School, Wausau WI
Jim Flora                      New Holstein High School, New Holstein WI

Jake Altwegg                  Monona Grove High School, Monona WI
Karen Bleifuss                Wayland Academy, Beaver Dam WI
"The Cause and Effect of Nuclear Waste on the Environment"
Clifford McClain  Chernobyl Children's Project, Petaluma CA
Dolores Liamba  University of Wisconsin-Madison
Stuart Vamstad  Darlington High School, Darlington WI
Don Vincent  Madison West High School, Madison WI
CHERNOBYL: The Experience

By: Cecile Calhoun, Children of Chernobyl-US Alliance, Ellensburg, WA
Tom Kropidowski, Seton Catholic Middle School, Menasha, WI
James Sherburne, Marshfield Jr. High, Marshfield, WI
Ethel Stern, Lake Shore Middle School, Mequon, WI

NCSS STANDARDS – THEMATIC STRANDS

III. People, Places, and Environment
IV. Individuals, Groups, and Institutions
VII. Production, Distribution, and Consumption
VIII. Science, Technology, and Society
IX. Global Connections

WISCONSIN D.P.I. ACADEMIC STANDARDS ADDRESSED

Social Studies:
A.8.1 Use a variety of geographic representations to gather and compare information about a place.
A.8.11 Give examples of the causes and consequences of current global issues.
B.8.8 Identify major scientific discoveries and technological innovations and describe their social and economic effects on society.
C.8.7 Locate, organize, and use relevant information to understand an issue of public concern, take a position, and advocate the position in a debate.
D.8.11 Describe how personal decisions can have a global impact on issues.
E.8.1 Give examples to explain and illustrate the influence of prior knowledge, motivation, capabilities, personal interests, and other factors on individual learning.
E.8.8 Give examples to show how media may influence the behavior and decision-making of individuals and groups.
E.8.15 Describe cooperation and interdependence among individuals, groups, and nations, such as helping others in times of crisis.

Science:
A.8.4 Collect evidence to show that models developed as explanations for events were based on the evidence available to scientists at the time.
B.8.3 Explain how the general rules of science apply to the development and use of evidence in science investigations, model-making, and applications.
C.8.1 Identify questions they can investigate using resources and equipment they have available.
C.8.2 Identify data and locate sources of information including their own records to answer the questions being investigated.
C.8.5 Use accepted scientific knowledge, models, and theories to explain their results and to raise further questions about their investigations.
D.8.2 Use the major ideas of atomic theory and molecular theory to describe physical and chemical interactions among substances.
D.8.9 Explain the behaviors of various forms of energy by using the models of energy transmission, both in the laboratory and in real-life situations in the outside world.
G.8.3 Illustrate the impact that science and technology have had, both good and bad, on careers, systems, society, environment, and quality of life.
H.8.3 Understand the consequences of decisions affecting personal health and safety.

INTRODUCTION – PURPOSE / RATIONALE

The explosion and subsequent radiation damage caused by the Number 4 reactor at the Chernobyl facility occurred 13 years ago, the year many of our students were born. The environmental and human consequences of the worst nuclear disaster in history remain with us today, but it is likely that our students have little or no knowledge or exposure to this event. The significance of this disaster is often dismissed as either not news-worthy or sensational enough to generate concern or interest, or associated with anti-nuclear groups who use it as a “doom and gloom” banner to promote their agenda. Yet Chernobyl still exists today, and the devastation of its radiation has left thousands of square miles of once productive farmland contaminated and millions of lives disrupted and their health endangered. The purpose of this lesson plan is to use Chernobyl as a focal point for students to experience the reality of a traumatic event, to elicit concern and curiosity in questioning what really happened, and to use a variety of skills as they investigate the causes and consequences of nuclear power gone awry. The lesson is intended to develop critical thinking skills, exposing students to information that will help them to become an informed citizen capable of making informed decisions, and finally to raise their consciousness of people who are victims who lack the resources to meet their basic needs.
RECOMMENDED GRADE LEVEL / COURSE PLACEMENT

This lesson plan is developed for presentation to middle school students, primarily those who have experience with the scientific method. It is recommended that it be taught as part of an integrated curriculum involving collaboration between science, social studies, and language arts teachers. However, the lesson plan is such that a single teacher within a single discipline, editing activities, can wholly present it to make them subject appropriate.

OBJECTIVES

Knowledge – Students will:

- Identify the geographic location of the region affected by the Chernobyl disaster.
- List the effects of Chernobyl’s radiation on the environment and human body.
- Explain the structure of the atom, radioactive isotopes, and the effect of radiation on human tissue.
- Describe how a nuclear reactor works.
- Describe the causes of the reactor explosion at Chernobyl.
- Compare the differences in reactor design and safety procedures between the United States and former Soviet nations who use nuclear power.

Attitude – Students will:

- Demonstrate awareness of the serious consequences of accidental radiation.
- Form opinions about the use and safety of nuclear power.

Skills – Students will:

- Participate in small groups to solve problems.
- Formulate questions about Chernobyl, nuclear power, and radiation.
- Use appropriate resources to find factual data.
- Support hypotheses with facts.
- Use the scientific method to discover facts concerning the Chernobyl disaster.
- Utilize maps, charts, and the periodic table to gain information.

TIME ALLOTMENT

The various activities in the lesson plan, if followed sequentially, will take four 45-minute class periods, plus time for student groups to do research and topic presentations. The Extension and Enrichment activities may be interjected to allow for
more out-of-classroom time for research. Teacher creativity is, of course, encouraged. The Chernobyl topic can be covered in two weeks (10 teaching days).

RESOURCES NEEDED

Videos:
- ABC News Nightline, “Chernobyl Nuclear Disaster”. 1986. 30 minutes in length.
- The Video Project, Shevchenko, Vladimir (Director), “Chernobyl: Chronicle of Difficult Weeks”. 1988. 54 minutes in length. Documentary filmed during 3 months following the disaster. (Edited clips to be used.) These and other Chernobyl videos are available from the Center for Russia, East Europe, and Central Asia (CREECA) at the University of Wisconsin-Madison. tel. (608) 262-3379.

Student materials:
- A journal / notebook.
- Wall or desk maps / atlases showing Eastern Europe.
- Periodic Table of Elements. (Desk copies or board display).
- Access to research materials (Internet, reference books, etc.)

Teacher materials:
- Teacher-directed script of “CHERNOBYL: The Experience”. (See Procedure).
- Rubric to be used for individual or group assessment. (See Appendix 3).

PROCEDURE

Day 1: ACTIVITY 1: “CHERNOBYL: The Experience”(Part 1)

Materials needed: ABC News Nightline “Chernobyl Nuclear Disaster” video, video equipment, student journals. Journal prompts written on board.

Tell the students that they are about to begin a simulation activity, and that they will be keeping a journal in which they will record their experiences. Have them copy into their journals the following (from the board or overhead): 28,04,86. This is a common way in Europe of writing dates, but do not tell them what it is. Also on the board, write the names Prpyat and Chernobyl. Then read the following script to them:

You and your family live in a town called Prpyat, adjacent to another town called Chernobyl. Your family consists of your mother and father, an 18-year-old
brother, your pet dog “Sharik,” and yourself. It is a Monday night, and all of you are in the living room watching TV.

At this point, show the ABC News Nightline video “Chernobyl Nuclear Disaster”. To heighten the drama, interrupt the video with loud knocking. The timing should be done so that you will have enough time to conclude Activity 1 during the present class period.

(Sudden knocking on the door) Continue the script:

Your father answers the door, and returns to the living room with shock on his face. He says, “A bus will be picking all of us up in 30 minutes. We were told to pack everything we will need for the next 3 days into a small suitcase or backpack, one for each of us. Go quickly now to your rooms and pack! We have less than 30 minutes! We will be back in 3 days, so take everything you will need for the next 3 days.

JOURNAL ACTIVITY 1
Materials needed: student journals, journal prompts posted on the board.
Have the students get out their journals. On the board, write the following prompts:

• What are you thinking / feeling about the situation that just happened to you?
• Write down 2 questions that you would most like answered at this point.
• List at least 10 things you would pack to take with you from your room / house.

(Teacher note: The above list can easily be used as a values clarification extension in another class or at a later time. Reduce the items to just 5, and then 3, etc.)

DAY 2 ACTIVITY 2 “CHERNOBYL: The Experience” (Part 2)

Materials needed: student journals, poster paper for each working group, marker, tape.
The class will need to be divided into working groups of 4 or 5 students before beginning the next activity. They will need their journals, using the questions written during Journal Activity 1.

In their working groups, have them share their 2 questions with each other, and among their group members, decide on the three most important questions that need to be answered. Write them on poster paper and post on the board. After all groups have posted their questions, have them return to their seats for individual work. Continue the script:

You have just finished packing what you could into your backpack when the bus arrives promptly 30 minutes after the knock on your door. It is night, and the darkness is accented by the silence on the bus as your family leaves your house
behind. You’re not sure where you are going, and guess that the trip has lasted at least half an hour, when the bus suddenly stops. You have reached your destination.

You all walk single-file toward a large gymnasium, carrying your bag or backpack. At the door, you are checked with a detector. You’ve never seen one, but you think it might be a Geiger counter, because it makes a crackling noise as it is brushed over your backpack and the clothes you are wearing. You are told that all your clothing and everything you brought with you from home is contaminated. Your are issued a new set of clothing, and sent to shower. When you return, you notice that all your possessions have disappeared. Some people standing with you are talking about a large, open trench just behind the building.

Suddenly, another uniformed guard speaks to your group: “We are sorry, but we must leave this building now. You will board the buses outside. They will take you to a safer area. Do not, I repeat, do not eat or drink anything unless it is given to you by someone in authority. And I must also regretfully inform you that it is not known when—or if—you will be able to return to your homes.” The guard abruptly leaves the room.

**JOURNAL ACTIVITY 2**

On the board, write the following journal prompts, to be answered individually:

- Write 2 questions you would most like answered about what just happened.
- Name 3 things you think you would most miss by not being home.

(Teacher note: *Activity 2 and Activity 3 may be done during the same class period, or separately.*

**ACTIVITY 3: “CHERNOBYL: The Experience” (Part 3)**

Materials needed: student journals, 2 poster papers, marker, and tape for each working group. Continue reading the script:

After an all-night long bus ride, you arrive in a city much larger than Prypyat. As you step off the bus, your parents are ordered to report to the clinic. As you all arrive, doctors suddenly surround you, looking concerned and using strange-looking instruments and meters. But they say nothing to you. You’re not sure, but you think you hear words like “iodine” and “thyroid” as they whisper to each other. After a few minutes, you are seated in a small room with your family, when a very tired-looking nurse comes in with a small glass tube and tells you to drink it. You first ask what it is, and she says, “Potassium iodide...now drink it. I have much to still do.” It tastes awful! As you leave the clinic with your family, you notice people being carried in on stretchers, many who look like they are badly sunburned, and you see others who are vomiting.
brother, your pet dog “Sharik,” and yourself. It is a Monday night, and all of you are in the living room watching TV.

At this point, show the ABC News Nightline video “Chernobyl Nuclear Disaster”. To heighten the drama, interrupt the video with loud knocking. The timing should be done so that you will have enough time to conclude Activity 1 during the present class period.

(Sudden knocking on the door) Continue the script:

Your father answers the door, and returns to the living room with shock on his face. He says, “A bus will be picking all of us up in 30 minutes. We were told to pack everything we will need for the next 3 days into a small suitcase or backpack, one for each of us. Go quickly now to your rooms and pack! We have less than 30 minutes! We will be back in 3 days, so take everything you will need for the next 3 days.

**JOURNAL ACTIVITY 1**

**Materials needed:** student journals, journal prompts posted on the board.

Have the students get out their journals. On the board, write the following prompts:

- What are you thinking / feeling about the situation that just happened to you?
- Write down 2 questions that you would most like answered at this point.
- List at least 10 things you would pack to take with you from your room / house.

*(Teacher note: *The above list can easily be used as a values clarification extension in another class or at a later time. Reduce the items to just 5, and then 3, etc.)*

**DAY 2**

**ACTIVITY 2 “CHERNOBYL: The Experience” (Part 2)**

**Materials needed:** student journals, poster paper for each working group, marker, tape.

The class will need to be divided into working groups of 4 or 5 students before beginning the next activity. They will need their journals, using the questions written during Journal Activity 1.

In their working groups, have them share their 2 questions with each other, and among their group members, decide on the three most important questions that need to be answered. Write them on poster paper and post on the board. After all groups have posted their questions, have them return to their seats for individual work. Continue the script:

You have just finished packing what you could into your backpack when the bus arrives promptly 30 minutes after the knock on your door. It is night, and the darkness is accented by the silence on the bus as your family leaves your house.
JOURNAL ACTIVITY 3A: FACT FINDING MISSION

Write the following words on the board: iodine, thyroid, potassium iodide. Also write down the following journal prompts and allow time to complete:

- What are you thinking / feeling about your situation?
- Make a list of all the facts you know so far about what is going on, and what is happening to you.

Ask the students to rejoin their working groups. Tell them that they are now on a “fact finding mission” using the facts they recorded in their journals. Their mission is to list on poster paper only the facts they know. They cannot post any opinions, inferences, or assumptions…only facts. Stress that facts are based on direct observations. After a few minutes, have them post their lists. Have the class assess each fact sheet, crossing out invalid data.

(Teacher note: The Fact List should be very small. For example: An event happened at Chernobyl (but is it linked to what happened to you?) / Our family was removed from our homes / We were checked for contamination (but what type is still unknown) / Our possessions were taken away (but not told where or really why, or by whom) / We were treated with a dose of something (was it really potassium iodide?) / Several people were injured, and some were sick (but cause unknown) / etc. Radiation is still an assumption, a nuclear accident affecting you is a guess, injuries observed or feared are not yet linked to a nuclear disaster.)

JOURNAL ACTIVITY 3B: QUESTIONS WITHOUT ANSWERS

Conclude Activity 3 by having each working group discuss and list in their journals the following: (prompts on board)

- List what you don’t know.
- List what you need to know.

Direct each group to write down the 4 most important questions needing answers on the poster paper, and post them.

DAY 3

ACTIVITY 4: GETTING SOME ANSWERS

Materials needed: Individual student copies of “Atoms and Isotopes”, and “Radiation and Radioactive Decay”. These are taken from the DOE publication The Harnessed Atom, Unit 2 (See Appendix 1 and Appendix 2). A Periodic Table of Elements (may be desk copies or on overhead or board).

Teacher Directed Lessons

If necessary, present a mini-lesson on the scientific method to remind students about how to find answers to questions scientifically.
Present a lesson on atomic structure, isotopes, radiation, and radioactive decay. You may use the lessons included in Appendix 1 and Appendix 2, or create a more suitable presentation using resources available in your school.

DAY 4       ACTIVITY 5: “CHERNOBYL: The Experience” (Part 4)


Preparation: You will need to locate an appropriate video clip from Shevchenko’s documentary. It should show the damage to the reactor, and the efforts of the thousands of “liquidators” that were used to put out the fires and stop the release of radiation, and the “sarcophagus” hastily built to contain the damaged reactor.

Have students sit separately for the first part of the activity. Continue the script:

You can still taste the bitterness of the liquid that nurse gave you to drink in the clinic. Your family is given a very small 2-room apartment to stay in for the time being. An announcement is made that each family with males 18 years old and older should send one male volunteer to a central staging area to serve as a “liquidator.” All you know is that these liquidators have an important job to do, and that it might be dangerous; but they are promised to be well paid. Your older brother volunteers to go instead of your father. You accompany your brother to the bus station and watch as he boards a bus that turns down the road you had just come from the night before.

A few days later, you have heard nothing from your brother. But then someone tells your family to come and watch a special broadcast on their TV. This is what you see:

At this point, show the video clip from “Chernobyl: Chronicle of Difficult Weeks.

JOURNAL ACTIVITY 4

Have students journal their responses to the video clip by providing the following prompts:

- List facts that you gathered from the video about what happened.
- Write a short letter to your brother. Include 4 or 5 things that you know about the work he and others are probably doing. Try not to convey your fears.

Have students turn in their journals when done.
ACTIVITY 6: FINDING THE ANSWERS

**Materials needed:** poster paper, marker, tape for each group.

Reform the working groups. After discussion among their group, have each group develop and write down on the poster paper a **hypothesis** to explain what happened at Chernobyl and a **hypothesis** about what happened to each of them. Using the poster questions from Journal Activities 1, 2, and 3, guide the class into developing areas or topics that could be researched. Suggested areas to guide the students toward should include:

- Where is Chernobyl? (Geography)
- Whom did Chernobyl affect? (Geography and Cultures)
- How do nuclear reactors work? (Science)
- What does radiation do to you? (Medicine and Science)
- Is nuclear power safe?

From the list of topics that are developed, have each group select a topic to research and present to the class. The research must be documented with sources used. The presentation should be based on a question formed from the topic chosen, and must include at least one visual (map, graph, table, etc.). Time frame for the research and presentations depends on resource availability, and schedules. It is recommended that the presentations be under 5 minutes. The audience can use a rubric to assess or grade the presentations.

If time allows, some of the Extension and Enrichment activities that follow can be used during class time or by individual groups to allow for more out-of-class research time.

ACTIVITY 7: A SUMMARY OF WHAT HAPPENED

**Materials needed:** Video tape “Ten Years After Chernobyl,” by Holbrook Teter. 1996. 30 minutes in length.

To complete the unit on Chernobyl after the group presentations, it may be well to show a documentary that reviews the Chernobyl disaster and that includes the ongoing problems it has created.
EXTENSION AND ENRICHMENT

- The book *Phoenix Rising*, by Karen Hesse, focuses on two teens caught up in the aftermath of a nuclear accident. The book could be read to the class, or read by a literature circle of students. Discussion can follow about topics related to nuclear power safety, as well as recognizing bias of the writer.

- Vladimir Gubarev, a Russian science editor, wrote a play entitled *Sarcophagus* shortly after the Chernobyl accident. It could be read or acted out in part or in its entirety. The book is available from many university libraries, including Memorial Library at the University of Wisconsin-Madison.

- A debate can be held on the topic of the safety of nuclear power. If possible, stage a debate between a proponent and an opponent from the local community. Otherwise, students can be selected to research the safety of nuclear power and be led by the teacher in a classroom debate.

- Friends of Chernobyl Centers United States (FOCCUS) is an organization that has worked with UNESCO in developing and assisting 9 community centers for social development in the regions affected by Chernobyl. A part of its mission is to engage in public education activities which bring the issues and problems raised by Chernobyl to the attention of the American public. For more information, contact: Norma Berkowitz, IIC/FOCCUS, 5818 Anchorage Ave., Madison WI 53705.

- Another group that deals directly with children affected by the consequences of the Chernobyl accident is the Chernobyl Children’s Project. This group is a community-based organization of volunteers dedicated to providing humanitarian relief to children whose health has been affected by the Chernobyl accident. They provide a six-week respite to selected children to strengthen their weakened immune systems. Speakers may be available. Contact: Cec Calhoun, 400 E. 8th Ave., Ellensburg WA 98926-7401. Web-sites include: (Error! Bookmark not defined.) and (Error! Bookmark not defined.)

SUPPLEMENTAL RESOURCES


RUBRIC FOR STUDENT ASSESSMENT
CHERNOBYL: The Experience

Student Name__________________________________________ Class________

Points assessed for completed activities are in parentheses.

Journal Activity 1
( ) Journal entry on thoughts / feelings.
( ) 2 Questions on what’s happening.
( ) List of 10 items packed.

Activity 2 Group Work
( ) Group poster with 3 “Most Important Questions.”

Journal Activity 2
( ) 2 Questions on what’s happening.
( ) 3 activities missed from home.

Journal Activity 3A Fact Finding Mission
( ) Journal entry on thoughts / feelings.
( ) List of facts.

Activity 3 Group Work
( ) Group poster from Fact Finding Mission posted.

Journal Activity 3B
( ) List of what I don’t know.
( ) List of what I need to know.

Group Poster
( ) 4 questions that need answers.

Activity 4
( ) “Atoms and Isotopes” worksheets completed.
( ) “Radiation and Radioactive Decay” worksheets completed.

Journal Activity 4
( ) List of facts from video “Chernobyl: Chronicle of Difficult Weeks.”
( ) Short letter to my brother.

Activity 6
( ) Group poster with 2 hypotheses.
RESEARCH PROJECT
   ( ) Number of sources used and properly listed in Bibliography.

TOPIC PRESENTATION  (Done by audience and averaged)
   ( ) Number of persons presenting.
   ( ) Quality of visuals used. Scale: 1-5 (low-high)
   ( ) Quality of information given. Scale: 1-5

PARTICIPATION POINTS  (Completed by the other members in your group and averaged)
   ( ) How well you contributed to your group. Scale: 1-10 (low-high).

TOTAL POINTS ACCUMULATED
TOTAL POINTS POSSIBLE