

PBL Unit Title: Nuclear Power

Primary Subject Area: Chemistry

Interdisciplinary Areas also Covered: Technology, Government, Language Arts

Grade/Age Level: 10-12th Grade

Description of students' role and problem situation: Students will be members of a concerned citizens group discussing the transportation of spent fuel rods from a local nuclear power plant (Shearon Harris).

Educational Objectives: (Indicate if unit is interdisciplinary, but only list the objectives from primary subject area) Unit is interdisciplinary, but will focus on the following science objectives: Isotopic notation; explain the behavior of the atomic nucleus; show a general knowledge of how a nuclear reactor works; describe the energy source and list pros and cons involved.

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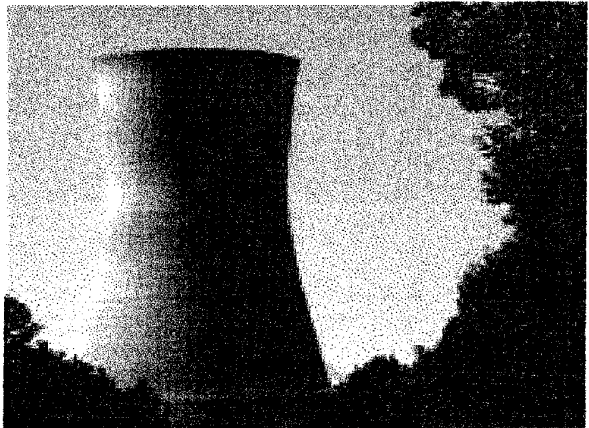
School Location: Durham, North Carolina

Attention Citizens of the Triangle and Triad communities of North Carolina

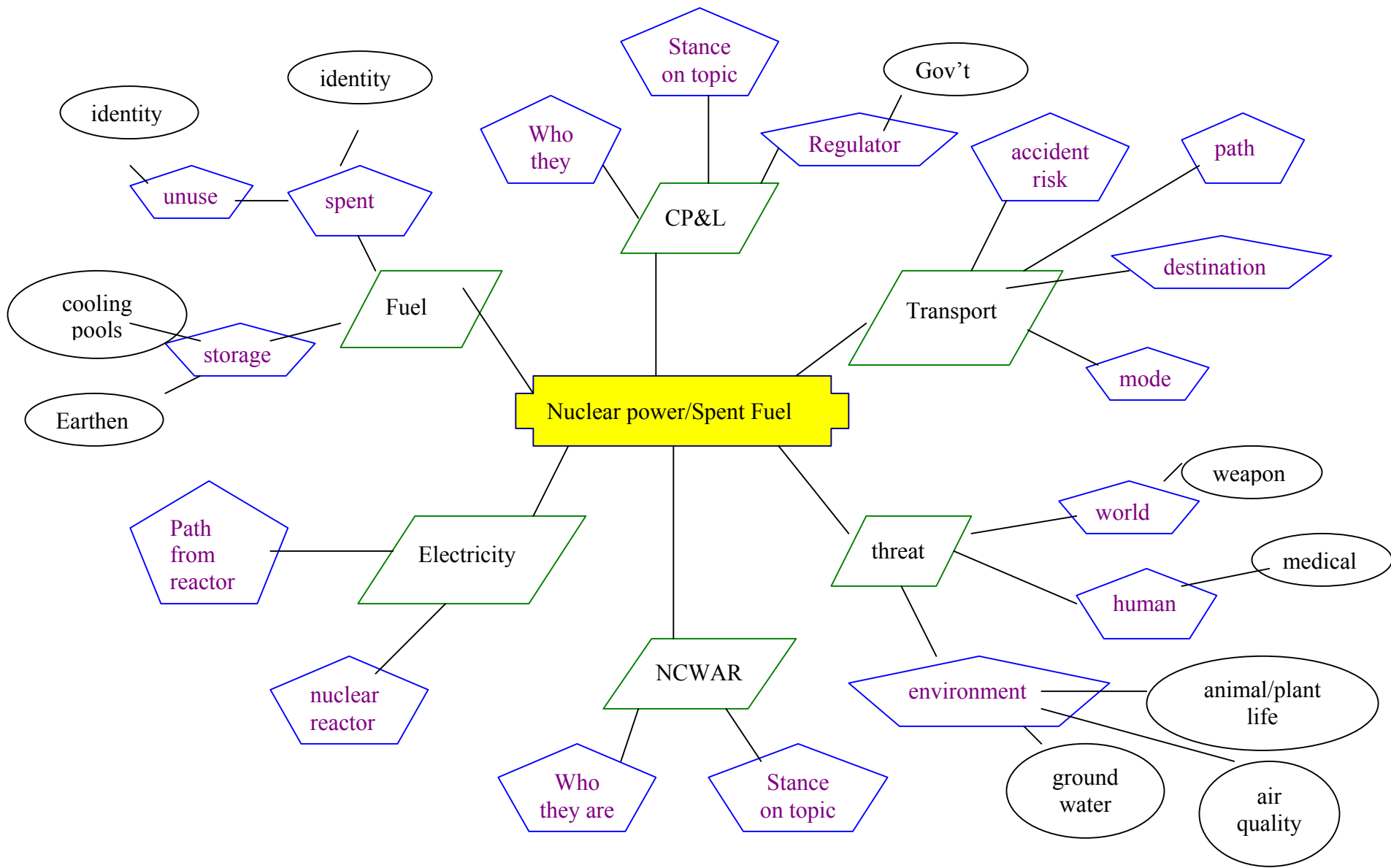
Triangle/Triad Communities Coalition for Informed Citizens (TCCIC)

CALENDAR OF EVENTS

Nuclear Power meeting:
 June 12, 2002
 6:30pm
 Town Hall, Pittsboro NC



Since CP&L built the Shearon Harris nuclear power plant in southern Wake County there have been numerous controversies regarding the safety of the communities surrounding the plant. The latest controversy has risen in light of the September 11 attacks. The Chatham County Commissioner has requested that shipments of spent-fuel rods to and from nuclear power plants be stopped temporarily, until an investigation of the possible threats and damages can be completed. Both CP&L and NCWARN have opposing opinions on this and other issues concerning nuclear power in our state. June 12, 2002 a meeting between all concerned parties will take place. The citizens group will have the opportunity at this time to express their opinions and share their concerns, whether it be in support of CP&L or NCWARN, or a compromise between the two opposing opinions.. - TCCIC



KNOW

- Role is of a citizens group
- Task is to express concerns and opinions
- Date is in two weeks
- Problem is about Spent Fuel Rod transport
- Commissioner of Chatham County wrote letter asking for temporary halt on transport due to threat
- Shearon Harris is a nuclear power plant
- Electricity comes from nuclear power
- CP&L own Shearon Harris
- NCWARN has differing opinions from that of CP&L
- Nuclear power uses “radioactivity”

NEED TO KNOW

- What is nuclear power
- What is a spent fuel rod
- Why are CP&L and NCWARN at odds
- What is the threat to
 - The world
 - The US
 - NC
 - Us
- What is the shipping route
- What is the mode of transportation
- Where are “they” transporting it to
- What is radioactivity
- How do “they” get electricity out of it

Curriculum Alignment

In Science, specifically Chemistry, the objectives met are:

Structure and properties of matter: 1.027, Isotopes	Student will learn isotopic notation, and be able to identify isotopes by mass number and atomic number
Structure and properties of matter: 1.05, Analyze and explain the nature and behavior of the atomic nucleus including radioactive isotopes and their practical application	Student will learn Characteristics of alpha, beta, gamma radiation: Relative masses, charges, symbols, penetrating ability; Shielding: air (alpha), metal (beta), and distance (qualitative use of inverse square law). Concepts of half-life, fission, and fusion. Decay equations
Energy Changes in Chemistry: 3.05, Nuclear	Student will show General knowledge of how a nuclear reactor works and Describe energy sources and the pros/cons of the energy source.

Other, interdisciplinary objectives met are:

Technology, goal 3	The learner will use a variety of technologies to access, analyze, interpret, synthesize, apply, and communicate information.
Social Studies, High School: Economic, Legal, and Political Systems in Action goal 9: The learner will explain how the political and legal systems provide for balancing competing interests and resolving conflicts.	9.1 The student will Evaluate the role of debate, consensus, compromise, and negotiation in resolving conflicts. 9.5 The student will Analyze roles of individual citizens, political parties, the media, and other interest groups in public policy decisions, dispute resolution, and government action.
Language Arts: 3.01 Use language persuasively in addressing a particular issue 3.03 Use argumentation	By: finding and interpreting information effectively; recognizing propaganda as a purposeful technique; establishing and defending a point of view; responding respectfully to viewpoints and biases. By: interpreting researched information effectively; establishing and defending a point of view. Addressing concerns of the opposition; using logical strategies (e.g., deductive and inductive reasoning, syllogisms, analogies) and sophisticated

	techniques (e.g., rhetorical devices, parallelism, irony, concrete images). Developing a sense of completion.
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The student is an eleventh/twelfth grader in an Honors level Chemistry class at a college prep high school, grade conscious, wanting to be treated as an adult, dependent on technology and over committed to the various extra-curricular activities available. They are also very social and would prefer to work in groups.

Anticipated Problem Statement

How can we as Citizens of the community *express our concerns and opinions about spent fuel rod transport* in such a way that:

- CP&L's side of the story has been considered
- NCWARN's side of the story has been considered
- Safety issues involving transport are identified
- Safety issues involving temporary storage are identified
- Economic issues involving temporary storage are identified
- We have an understanding of how nuclear power works
- We finish by June 12, 2002
- Our concerns are knowledge based, not emotionally based

Resource List

- American Nuclear Society, updated June 12, 2002. Found [online] <http://www.ans.org/pi/> accessed June 12, 2002
- Carolina Power and Light, updated June 12, 2002. Found [online] <http://www.cplc.com> accessed June 13, 2002
- How Nuclear Power Works, updated 2002. Found [online] <http://www.howstuffworks.com/nuclear-power.htm> accessed June 13, 2002.
- Lortie, Bret (2002) The big 'what-if'. Bulletin of the Atomic Scientists 58(1), 16-18.
- North Carolina Division of Emergency Management (1993) North Carolina emergency response plan in support of the Shearon Harris Nuclear Power Plant [microform] Raleigh, NC: The Division.
- North Carolina Waste Awareness and Reduction Network, updated May 2002. Found [online] <http://www.ncwarn.org> accessed June 12, 2002.
- O'Neill, Kate (1999) International Nuclear Waste Transportation. Environment 41(4), 12-22.
- Zuckman, Jill (2002) Website allows users to track path of nuclear waste to Yucca Mountain. (June 10, 2002). Chicago Tribune pg 16

Assessment Instrument for Capstone Performance

Criteria	Quality	Mediocre
<i>Statement (50):</i>		
Formatting	Proper grammar, punctuation, spelling using APA style; includes references section (10)	More than 3 or 4 grammatical errors or no apparent formatting style; reference section included (6)
Length	Written in 1.5- 2.5 pages (not including references) (6)	Written in 1 page (not including references) (3)
Supporting facts	Citations in APA style are used when documentation is necessary (10)	Citations are present, but not as many as necessary or are not in APA style (6)
Concerns/opinions	Concerns and opinions are present and written clearly (8)	Concerns and opinions are present but somewhat confusing (5)
Reflection	Includes thoughts about the knowledge and the process used to gain that knowledge (16)	Contains thoughts about either the knowledge or the process but does not link them together (10)
<i>Electronic Presentation (66):</i>		
Time	Total presentation is between 5.5 and 7 minutes (6)	Total presentation is 7-8 minutes or 4.5-5.5 (4)
Professionalism	Presenters are appropriately dressed (casual but not revealing); eye contact is made throughout; pace and volume are appropriate (8)	Presenters are mostly appropriately dressed or most students were reading or pace was somewhat fast or slow or volume was somewhat loud or soft (5)
Slides	Are in outline form; contain no more than two pictures apiece; words should appear in a timely manner; sounds should be appropriate (12)	Have some full sentences or contain more than one picture or transitions that are too slow or sounds inappropriate (9)
Concerns	Concerns are stated and explained (15)	Concerns are stated but explanation is somewhat confusing (10)
Supporting facts	Are mentioned and used effectively to explain concerns (15)	Are mentioned but seem to confuse the concerns/opinions (10)
Group work	Evidence of each person in the group participating (10)	Evidence of most people in the group participating (7)

The problem was that the community felt unsafe while the spent fuel rods were transported through the state. Since no one has come up with an alternative solution involving new ways to supply power to the state, the preferred solution must be one that

considers all points of view. The second solution suggested seems to have that quality. There is a compromise between the power company and the community. The community does not want spent fuel rods to be stored in their back yards for long periods of time, so they acknowledged that transport on a limited basis should happen. This decision will more that likely spark some discussions about the storage facilities themselves.

Description of Capstone Performance

In order to ensure that all opinions, compromises, and concerns are heard, all citizens entering the meeting on June 25th, 2002 must submit a statement of concern. Your concerns should be supported by facts (documented in APA style). The statement is also a way for you to reflect on the knowledge you've gained and the process you used to gain it.

Each citizen's group will be given no more than 7 minutes to present their concerns and opinions with supporting facts. The presentations should be professional in nature since representatives from CP&L, NCWARN, and the counties involved will be in the audience assessing your performance.

Coaching Questions

Meeting the Problem:

- C → What information about the nuclear power controversy have you received?
- M → Where should we start looking for a solution to the nuclear power problem?
- E → Why should the citizens of the Triangle and Triad get involved with this controversy?

Know/Need to Know

- C → How does the storage of spent-fuel relate to our problem?
- M → Why did you mention transport as a need to know?
- E → Why do we need to know about the nuclear reactor?

Debriefing Session

My debriefing session will start the day the presentations are given. I have 3 maybe 4 groups in the class so after 25 minutes I'll still have 20 minutes to chat with the students. I'm hoping that they will start asking questions and raising concerns on their own, as they have in the past. I will give them about 3 minutes to chat amongst themselves, walking around the room to make sure they're all discussing some aspect of the problem. Since we are still at a meeting, I will then call their attention. "We as a community still need to figure out the best solution to this problem. How should we begin?" After hearing several suggestions, I will either take one of theirs or suggest that we write pros and cons of each solution. Each group needs to write 3 pros and 3 cons for each solution. We will continue the meeting the next class period.

At the next class meeting I will ask each group to briefly explain their solution again and to write the pros and cons for their own group on the board. Each other group will add one suggestion to each side as well. If a natural discussion does not occur, I will ask groups how they know "that" will happen, or what would happen if "this." We will then toss around ideas for a "best" solution. If some concepts hadn't been brought in to the discussion, I will ask, "How many groups considered "this" when they were determining their solutions." If there are any positive answers, I will ask why they were discarded. We may need another class meeting to determine the "best" solution, depending on the discussion.

When the "best solution" has been formulated by the class, I will ask the groups to write a letter to the Chatham County Commissioner describing the solution and the reasons they believe it would work.