

Activity **8**



For or Against the Implementation of a Nuclear Power Plant

Activity developed at Cégep Beauce-Appalaches
By **FRANCE GARNIER**

For or Against the Implementation of a Nuclear Power Plant

Date Last Tested

1995

Author's Name

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Scientific Discipline

Chemistry

Average Age of Students

18 years old

Course Title and Number

Chemistry from Yesterday to Tomorrow
(202-AWE-03)

Duration of Activity

3 three-hour periods

NOTE

In this document, the masculine is used without discrimination and solely to make the text easier to read.

Appendices are available in PDF and Word format on the CD provided with this document.

In addition, an instructional analysis of the activity is available in the pedagogical treasures section (Trésors pédagogiques) on the Saut Quantique Web site at:

<http://www.apsq.org/sautquantique>.

Use of this text is authorized for instructional purposes, provided that author's name and college are mentioned.

Adherence to these recommendations will encourage authors to share their experience.

For or Against the Implementation of a Nuclear Power Plant

Description of Activity

OVERVIEW

As part of a complementary course entitled “Chemistry from Yesterday to Tomorrow”, the last pedagogical activity submitted to the students was to simulate the creation of a citizens’ committee concerned about the potential implementation of a nuclear power plant in their region.

The teacher presents the situation scenario *For or Against the Implementation of a Nuclear Power Plant* to the class. The students then choose a topic for further study and divide themselves into teams. The teacher acts only as guide/facilitator. The students take part in discussions to shed some light on the topic based on bibliographical research done between classes.

Although the students have limited scientific knowledge – the course is not available in the *Science* program –, they should nevertheless research the problem in detail, just as would any responsible citizen concerned about the quality of his environment, form a critical opinion, and develop concrete measures to inform the population of their position on the issue.

This activity may be integrated into other courses, such as *General Chemistry: Matter, Physical Science 436, Electricity and Magnetism, Learning Integration*, etc. In this case, the activity may need to be rearranged to make it shorter. For example, it could be introduced at the end of a theoretical course to enable the students to familiarize themselves with the issue, divide into teams and assign tasks. Afterwards, one or two laboratory sessions could be scheduled for students to exchange information.

RELEVANCE AND ORIGINALITY OF ACTIVITY

In addition to providing scientific and technical knowledge about a nuclear power plant, this activity: 1) increases student confidence in taking on a science topic, 2) raises student awareness to the fact that a science subject can impact their lives and immediate environment, 3) shows all the factors involved in taking a critical position, and 4) makes students responsible and gets them to assert their position.

Objectives and Relation to the Program

PEDAGOGICAL OBJECTIVES OR TARGETED COMPETENCIES

The complementary course *Chemistry from Yesterday to Tomorrow* is part of the field of study *Scientific and Technological Culture* and targets the objective 000X:

- *Explain the general nature of science and technology, and some of the major contemporary scientific or technological issues.*

More specifically, the activity gets students to achieve the fourth competency element of this objective:

- *Deduce different consequences and questions resulting from certain recent scientific and technological developments.*

Additionally, the activity serves as a good pretext to introduce several scientific and technical concepts using a problem-based approach: the nature of the atom, the periodic table, radioactivity, nuclear fission, half-life, energy, operating electric power plants and alternators, electricity, etc.

LINK BETWEEN THE ACTIVITY AND THE PROGRAM

General Program Goals Targeted

If the simulation of the citizens' committee is integrated into a course in the *Science* program, it targets the following general goals:

- To reason logically;
- To communicate effectively;
- To learn autonomously;
- To work as members of a team;
- To make connections between science, technology and social progress;
- To define one's personal system of values;
- To become familiar with the context in which scientific concepts are discovered and developed;
- To apply what has been learned to new situations.

Link with Course

As this course is divided into three parts, i.e., past, present and future, this activity is the end result. Simulating the creation of a citizens' committee concerned about the implementation of a nuclear power plant projects the students into the future. This situation scenario seeks to provide knowledge on a controversial subject, but mostly it aims at getting students to reflect on their place in a society that relies heavily on scientific and technical expertise.

Link with Other Courses

This activity can easily be linked to physics courses, as several concepts are related to this field, such as the nature of the atom, electricity, radioactivity, nuclear fission, the transformation of energy, etc.

Number of Students and Educational Support

APPROXIMATE NUMBER OF STUDENTS IN CLASS

8 students, but this number can easily be greater

NUMBER OF STUDENTS PER TEAM

2-3 people

EDUCATIONAL SUPPORT

The teacher prepares the problem by doing sufficient bibliographical research to master the subject (a few references are provided in the *Media Directory* section).

He either writes the situation scenario, uses or adapts the one provided in Appendix S.1. He then presents it to the students in class. He suggests a timetable and lets students assign their tasks and define their roles.

During the discussions, the teacher may act as secretary and use the blackboard to post important points brought up during the brainstorming session and clarify certain issues if the students are unable to come up with an answer.

In addition, he may step in to make the students realize that the information available is limited and that there are several points of view and aspects influencing their position (political, scientific, social, ethical, environmental, economic, etc.). He may also point out that common real life situations are often much more complex than they initially appear, and that the choices made by society depend on many factors and especially on prevailing values. Moreover, the teacher should sensitize the students to the fact that making a choice as important as accepting or refusing the installation of a nuclear power plant close to home should be based on more than arguments built solely on fear.



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Depending on the context, the teacher could provide further guidance by:

- Providing a clearer definition of the problem;
- Explaining the steps involved in the problem-based approach;
- Asking students to bring forth their spontaneous conceptions (spontaneous knowledge about the subject);
- Reviewing previously-taught material that may be useful for the activity;
- Proposing a list of new concepts that the students will have to master at the end of the activity (e.g., atom, nuclear fission, half-life, radioactivity, nuclear power plant, alternator, electricity, nuclear energy, etc.);
- Assigning student tasks;
- Providing information on the foundations of effective teamwork;
- Initiating the students to the steps involved in conducting document searches at the library and on the Internet.

Conducting the Activity

CONDUCTING THE ACTIVITY AND TIME REQUIRED TO COMPLETE EACH STEP

Before

The teacher should schedule some time to prepare a file on scientific and technical knowledge, as well as on the political, economic, environmental, social and other factors involved in the implementation of a nuclear power plant. This research depends on the teacher's experience. It is estimated that beginners will require from two to ten hours, based on the level of exhaustiveness.

As for the students, no preparation is needed prior to the presentation of the activity itself.

During

1st period (3 hours)

The teacher presents the activity at the beginning of the class, by distributing a situation scenario on the fictitious implementation of a nuclear power plant close to home, in the year 2010 (see Appendix S.1).

The students read the situation scenario. They must then agree on the organization of a citizens' committee and divide the group according to individual interests. The teacher can suggest themes to explore (e.g., operating a nuclear power plant, effects of radioactivity, storing nuclear waste, difference between the operation of a nuclear power plant and an atomic bomb, evacuation plan, etc.) and references, as needed, depending on the estimated level of student autonomy.

Each team must then define the mandate of its members based on time constraints. The work should be divided in such a way that each member does an in-depth research on a given theme to then make a detailed presentation to his team members. A representative of each team then presents a summary of the team's findings to the entire class, just as if information was being exchanged in a real citizens' committee.

2nd period (3 hours)

For the first half-hour, the students work in teams, and share what they learned during their bibliographical research. One student in each team gives an account of the team's findings to the class (the report can also be submitted in writing). The teacher facilitates the discussion to make sure that everyone's input is clearly understood.

During the discussion, the students in each team redefine a new mandate based on the issues to be clarified. The teacher can explain certain scientific or technical concepts as deemed necessary.

3rd period (3 hours)

The students present their research findings once again, and must then discuss their position and the measures to be taken if they had to sensitize the rest of the population to their opinion. The teacher can once again step in to explain certain concepts and get students to reflect on the meaning of critical arguments that extend beyond fear.

After

As applicable, the teacher can ask the students to write a short text at the end of the period, summarizing whether they are for or against the implementation of a nuclear power plant close to home, or he can wait until the exam to ask the students to state their point of view.

Evaluation and Required Material

SUGGESTED EVALUATIONS

The students can be evaluated based on scientific and technical knowledge by means of a conventional exam.

Each step can be subject to an evaluation: individual or team reports, oral presentations, teamwork (self-evaluation), etc.

However, it is especially important to evaluate students for their ability to provide a argued position on the implementation of a nuclear power plant in their region. This evaluation can be done as part of an exam question such as: “What is your position on implementing a nuclear power plant close to home?”, with sub-questions in

which students are required to define what a nuclear power plant is, how nuclear fission works, how radioactivity impacts our health, etc.

The number of points allotted for these questions depends on their importance in comparison to the course contents. For example, points may vary between 5 and 10%.

APPENDICES

Appendix S.1: Situation Scenario “Fictitious Implementation of a Nuclear Power Plant in Saint-Georges”

Note:

This appendix is available on the CD provided with this document.

Other Suggestions and Media Directory

OTHER IDEAS TO EXPLORE

The activity simulating a citizens’ committee may be adapted to various problems, to introduce new scientific and technical concepts, such as the installation of a plant to destroy PCBs (polychlorinated biphenyls), the construction of a hydroelectric dam, the establishment of a pig farm, using water from the water table, etc.

Here are other activities to be considered: visit the *Gentilly II* nuclear power plant located in the Bécancour industrial park, conduct a debate during special events (e.g., during the lunch period, in front of all the students in the *Science* program, as part of a science week, etc.).



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MEDIA DIRECTORY

FLAMAND, Eddy and René P. Tremblay (1990). *La chimie et le monde moderne* (Chapter on nuclear energy). Sainte-Foy, Les Éditions *Le Griffon d'argile*, 1990, 291 p. (Simple concepts on the subject for students with limited knowledge in chemistry and physics).

Information booklets on the *Gentilly II* nuclear power plant (available at the plant).

Canadian Coalition for Nuclear Responsibility, [Online]. URL Address: <http://www.ccnr.org>.

Atomic Energy of Canada Limited, [Online]. URL Address: <http://www.aecl.ca>.

Greenpeace, [Online]. URL Address: <http://www.greenpeace.org/international/campaigns/nuclear>.

Here are a few suggestions of keywords to be entered in the Google search engine (<http://www.google.ca>):

- *Gentilly II*;
- Nuclear;
- Atomic energy;
- Nuclear energy;
- Radioactivity;
- Nuclear waste;
- etc.