

Lesson 1: “Better Living Through Chemistry?”: Exploring the Role of Plastic in Post-WWII American Culture

Understanding Goals:

In this lesson, students will:

- Learn why plastics became such a pervasive part of American society during the postwar era.
- Explore early concerns about the potential effects of plastics on workers’ health
- Examine why different individuals and organizations evaluated and perceived risk differently

Lesson Overview:

The lesson will begin by first assessing what students know about synthetic chemicals associated with plastic. Recently, there has been growing concern about how certain chemicals associated with plastic, including PVC, bisphenol-A, and phthalates affect human and environmental health. Some students may have heard about these concerns; others may know very little about the subject. By first assessing what students know about the topic, the teacher will gain a deeper understanding of the knowledge that students bring to the classroom. It will provide a starting point to help students think about how different understandings of plastic’s effects on health are generated and reinforced. These preliminary conversations will demonstrate the point that how we know what we know is based on a wide variety of sources. It will help students recognize that we do not always evaluate these sources critically or thoroughly.

After assessing students’ initial ideas through small and large-group discussion, the teacher will provide some background on the history of the boom in the chemical industry and the production of plastics during the postwar era. Background information and additional resources are listed below.

Students will also have an opportunity to analyze primary documents from the 1950s and ‘60s to reinforce the idea that plastics became a significant part of the American society as a result of several of economic, cultural, and political factors. Then students will analyze primary documents to explore how and why new understandings about the relationship between and workers’ health emerged. This introductory lesson will help students understand the origins of debates over the regulation of synthetic chemicals.

This lesson will address the following Wisconsin History Standards:

B.12.2 Analyze primary and secondary sources related to historical question to evaluate their relevance, make comparisons, integrate new information with prior knowledge, and come to a reasoned conclusion

B.12.4 Assess the validity of different interpretations of significant historical events

This lesson will address the following Wisconsin Environmental Education Standards:

B.12.14 Investigate how technological development has influenced human relationships and understanding of the environment

B.12.18 Analyze cause and effect relationships of pollutants and other environmental changes on human health

B.12.20 Debate the risks of producing pollutants

Background Information:

From the cars we drive, to the computers we work on, to the water we drink, plastic has become a pervasive part of our society today. It has become such a ubiquitous part of our lives that is difficult to imagine a world without plastic. This introductory lesson will help students understand how plastic came to infiltrate virtually all aspects of our lives.

Plastic was first invented in the 1860s by Alexander Parkes in London. Known as Parkesine, the first plastic was made from cellulose and other organic materials. It served the same functions as rubber, but it was cheaper to produce. In 1869, an American chemist named John Wesley Hyatt produced the first thermoplastic—a substance shaped under pressure and heat that retains its shape when cooled. Known as celluloid, it was first used to replace ivory in billiard balls and provided materials for the first moving pictures. In 1907, Leo Baekeland developed Bakelite—a form of thermoplastic that was even more durable than previous plastics. In addition to a variety of household uses, the U.S. military used bakelite to produce lightweight weapons. War machinery improved with bakelite was extensively used in WWII. Also, prior to WWII, other notable thermoplastics such as polyvinyl chloride (PVC), polystyrene, and polyethylene came into production. As demand for resources increased during the war, these new plastics began to play an increasingly important role in American society.

During the war, engineers created a wide array of new products and lightweight materials—including everything from weapons to food packaging (Saran Wrap was a WWII invention). After the war, the production of plastic products for civilian uses increased exponentially. Plastics became a versatile symbol of the benefits of the growing industry. “Better living through chemistry” became Du Pont’s slogan and other chemical companies such as Dow, Monsanto, and Union Carbide and others also launched massive advertising campaigns. These campaigns depicted plastic as a savvy substance that could be molded to meet the many needs of modern society.

At the same time that chemical companies claimed that new plastic goods would provide solutions to an array of modern problems, the industry was also becoming aware of some of the deleterious effects that certain had on human health. We will explore the emergence of these new understandings in the latter part of this lesson.

Activity 1.1: Assessing Students' Understandings about Plastic

Assess students' existing knowledge about plastic's origins and its effects on human and environmental health. Ask students to reflect silently and then write down their ideas on the following questions:

1. Why do you think plastic was initially created? What purpose did it serve? Where was it first invented and used? By whom?
2. Why do you think people would have welcomed the invention of plastic in the early twentieth century? In the mid-twentieth century?
3. What do you know about how plastic affects human health? How does plastic affect the environment?

Assure students that you don't expect them to have the "right" answer at this point. Emphasize that you want them to think about plausible initial uses and past problems that plastics may have been invented to solve. Also, tell them that the point of this introductory activity is to assess the range of ideas that are out there about the relationship between plastic and health.

Large group discussion:

Students can all share their ideas by going around the whole class in a circle, or the teacher can ask a few willing individuals to share. Students will most likely come to class with a range of ideas based on an equally wide range of sources. When discussing their ideas about how plastic affects health, ask them where they got their information. This large-group discussion need not be too long or involved; simply emphasize the wide range of initial ideas and sources of where we get our information.

Activity 1.2: Exploring Multiple Causes & Effects of the Postwar Boom in the Plastic Industry

The teacher will explain that the postwar growth of the chemical industry was the result of a variety of economic, cultural, and political factors (i.e. the boom in petroleum production, the portrayal of plastic in popular media, the faith in science and technology, and the power and influence of the chemical companies). In addition to the background material provided, teachers can also access other resources at links provided at the end of this unit.

Analyzing Primary Sources:

After the teacher explains some of this background material, students will have an opportunity to analyze a range of documents from the mid-twentieth century about the status of plastic in American society. All students should get hard copies of each document or be able to access the documents electronically. Links to the electronic versions of these documents are provided below.

STEP 1: Students will read a short article on the postwar boom in petroleum that was published in *Science* in 1947. This source will help students understand the economic and material factors that helped to cause the postwar boom in plastics and synthetic chemical production. After reading the article on their own, students should break up into small groups and discuss the questions listed on the Activity 1.2 Worksheet. Encourage students to take notes because they will use parts of this discussion for their homework assignment.

STEP 2: After discussing the *Science* article, students should analyze advertisements created by chemical companies in the 1950s and '60s. Again, after they have a chance to independently examine the advertisements, they should discuss the documents in their small groups. Discussion questions to analyze the advertisements are also listed on the Activity 1.2 Worksheet.

These questions are the same for documents C, D, and E. Have students read and discuss the specified sections of the article by the British health scientist, D. Kenwin Harris.

Worksheet and Documents for Activity 1.2:

- A. Activity 1.2 Worksheet (This worksheet can be found at the end of this lesson)
- B. Kirtley F. Mather, "Petroleum—Today and Tomorrow," *Science*, New Series, Vol. 106, No. 2764, (Dec. 19, 1947), pp. 603-609.
- C. Two advertisements from chemical companies:
 - "News from Du Pont," Display ad in the *New York Times*, January 3, 1956.
 - "This is the World of Union Carbide," Display ad in the *New York Times*, January 9, 1961.
- D. D. Kenwin Harris, "Health Problems in the Manufacture and Use of Plastics," *British Journal of Industrial Medicine*, vol. 10, 1953. Students should read pages 255 to the top of page 261. Also read the "Discussion" and "Summary" sections on pages 266 and 267. Skim intervening section and note images of affected workers.

Activity 1.3: Analyzing Understandings

After talking about the perspectives offered by the different documents in small groups, the class will reconvene in a large group. Ask the students, according to these sources, "Why did plastics become such an important part of American society after WWII?" The purpose of this discussion is to encourage students to think about how

different economic, cultural, and political factors influenced the rise of the plastics industry.

Then ask the student to think about ways that the postwar boom in plastic production affected human and environmental health. What were some of the early concerns about plastics and how did different groups begin to develop different understandings about the relationship between plastics and health in the 1950s? Why do you think these different understandings arose? Depending on time available, this reflective activity can be done as a large-group discussion in class or assigned to students to complete at home.

Activity 1.5: Homework

Students should read portions of Rachel Carson's *Silent Spring*, answer the following questions, and be prepared to discuss their ideas in lesson two.

Read Rachel Carson, *Silent Spring* (New York: Houghton Mifflin, 1982), chapters 1,2 and part of 3, pp. 1-18.

Homework Questions:

1. What is the purpose of the book?
2. Why was Carson so concerned about ways in which humans have changed the environment since WWII?
3. Carson argues that Americans have a right not to be exposed to toxic chemicals. Do you agree or disagree? Why and under what conditions?
4. In your mind, whose duty is it to protect people from toxic chemicals? Why?
5. How do you think the chemical industry received the arguments Carson makes in *Silent Spring*?

Lesson 1 Reinforcement Activity: Analyzing a WWII-era Film by the Chemical Industry

If there is time available, before exploring the documents and questions in Activity 1.2, students can view a film created by the chemical industry in the 1940s to inspire young scientists to become chemists. It demonstrates how chemical companies used media to portray a wide variety of ways in which chemicals will benefit postwar society. After viewing the 9-minute video, ask students to respond to the following reflection questions:

1. What is the central message(s) of this video?
2. How do you think the filmmakers wanted the audience to respond?
3. What does this type of media say about the topic that would not be conveyed by a written source? Please be specific.
4. Write two questions that are left unanswered by the film.

Document for Reinforcement Activity:

- A. [“Test Tube Tale,” 1941. Vintage Chemical Industry Films, Quality Information Publishers.](#) (click to view video online)

Additional Resources:

The American Chemistry Council’s History of Plastic:

http://www.americanchemistry.com/s_plastics/doc.asp?CID=1102&DID=4665

Jeffery L. Meikle, *American Plastic: A Cultural History*, New Brunswick, N.J.: Rutgers University Press, 1995.

Worksheet for Activity 1.2: Exploring Multiple Causes & Effects of the Postwar Boom in Activity the Plastic Industry

1. Questions for “Petroleum—Today and Tomorrow,” 1947

1. According to this article, why had petroleum been “strategic mineral number one” in the years between WWI and 1947?
2. How had U.S. petroleum production changed during the twentieth century? Use the graphs to explain your answer.
3. Based on this document, why did plastic become such a significant part of American culture in the mid-twentieth century?
4. On page 608, the author gives two reasons why alternatives to petroleum were being sought. What were these reasons and what kinds of alternatives were being explored when this article was written in 1947?
5. Mather was a geologist and recognized that the amount of crude oil was limited, yet he remained optimistic that humans would always be able to meet their needs. Why was Mather so confident?

2. Questions for Postwar Ads and the Harris article

1. Who was/were the authors of this document? What do you know—or think you know—about the authors?
2. Who was the document’s intended audience?

Lesson 2: Exploring the Hidden Costs of “Better Living”

Understanding Goals:

In this lesson, students will:

- Learn how debates over the effects of plastics and new synthetic chemicals on workers’ health were connected to the growing consumer, public health, and environmental movements.
- Explore how the creation of new chemicals led to new knowledge and debates about how to regulate potentially harmful chemicals in the face of scientific uncertainty.

Lesson Overview:

This lesson investigates the rise of the synthetic chemical industry and explores debates over how new chemicals associated with the production of plastic affected human health. Activities help students make connections between the emergence of the debates over plastics and the broader environmental, public and consumer health movements. During the 1950s, as concern about the potentially harmful effects of new synthetic chemicals arose, the federal government began to consider measures for regulation. In the beginning portion of this lesson, students will explore testimony from the Chemicals in Food Products Hearings of 1950-51 and the Delaney Clause of 1958. Then they will learn about Rachel Carson’s *Silent Spring* and the backlash that her work received from the chemical industry. This lesson will help students gain a deeper understanding of historical debates about synthetic chemicals associated with the production of plastic.

This lesson will address the following Wisconsin History Standards:

B.12.2 Analyze primary and secondary sources related to historical question to evaluate their relevance, make comparisons, integrate new information with prior knowledge, and come to a reasoned conclusion.

B.12.4 Assess the validity of different interpretations of significant historical events

B.12.5 Gather various types of historical evidence, including visual and quantitative data, to analyze issues of freedom and equality, liberty and order, region and nation, individual and community, law and conscience, diversity and civic duty; form a reasoned conclusion in the light of other possible conclusions' and develop a coherent argument in the light of other possible arguments

This lesson will address the following Wisconsin Environmental Education Standards:

B.12.14 Investigate how technological development has influenced human relationships and understanding of the environment

B.12.18 Analyze cause and effect relationships of pollutants and other environmental changes on human health

B.12.20 Debate the risks of producing pollutants

Background Information:

This lesson demonstrates that concerns about the effects of chemicals on people and the environment preceded *Silent Spring*, but it also emphasizes that Carson’s work was extremely important for communicating scientific knowledge to a widespread audience. Students will explore debates from the 1950-51 Chemicals and Foods Hearings, learn about the Delaney Clause, and analyze *Silent Spring* and criticisms of Carson’s work.

Background on Chemicals and Foods Hearings of 1950-51

During the 1950s, a young representative from Queens, New York named James Delaney led a series of congressional hearings about the potential harm of chemical additives in food and related food products, such as plastic wraps and containers. Testimony at the hearings came from a variety of individuals and organizations that were becoming concerned about the potential health effects of plastics on health. In this activity, students will analyze excerpts offered by different perspectives during the hearing. Working in the same small groups, students will examine the different ideas about the role of chemicals in American life and growing concerns about how they might affect health.

Background on the Delaney Clause:

The federal dialogue that began with the 1950-51 Chemicals and Foods Hearing eventually led to an amendment of the Federal Food, Drug and Cosmetic Act in 1958. The amendment created new regulatory policies for “food additives” and included the controversial Delaney Clause. The Delaney Clause prevented the Food and Drug Administration from approving the use of chemical additives to food that had been proven to cause cancer in humans or other animals. This included packaging material and food related-materials like can liners and plastic wrap. According to the 1958 amendment, the food products and packaging industry had to prove to the FDA that all food additives were safe. At that time, there were only a few chemicals in use that had been proven to cause cancer in animal studies, so sponsors of the measure did not think it would have a major impact.

Background on Silent Spring and its Critics:

Rachel Carson’s *Silent Spring* played an especially important role in bringing widespread attention to some of the negative effects of chemicals on human and environmental health. When it was published in 1962, it became an instant bestseller.

Carson clearly articulated a growing fear among scientists and activists that synthetic chemicals could have hazardous effects on human health and environmental systems. Because of this public awareness, chemical companies were increasingly put on the defensive. As activists, scientists, and the federal government became increasingly concerned about the potential long-term harm that these new chemicals might inflict on people and the environment, the chemical industry enacted a massive public relations campaign to address these concerns and to undermine arguments made by chemical critics. For more background on *Silent Spring*, Rachel Carson, and the debates that her work inspired, see the links listed in the additional resources section of this lesson.

Activity 2.1: Understanding and Interpreting the Delaney Clause

The teacher should explain some of the background information about the rise of public concern about occupational and environmental health. Specifically, the teacher should talk a little about the 1950-1951 Chemicals in Foods congressional hearing. The hearing demonstrated that consumer health and environmental activists had become increasingly concerned about the effects that these new chemicals—used for both agricultural and non-agricultural purposes—would have on human and ecological health. The hearings had been led by James Delaney and eventually led to the 1958 Food Additives Amendment to the Federal Food, Drug, and Cosmetic Act.

As a class, have students read the 1958 Delaney Clause out loud.

"No additive shall be deemed to be safe if it is found to induce cancer when ingested by man or animal, or if it is found, after tests which are appropriate for the evaluation of the safety of food additives, to induce cancer in man or animal."

- The Delaney Clause, from the 1958 Food Additives Amendment (Section 409) to the Federal Food, Drug, and Cosmetic Act

Large Group Discussion:

Ask students to explain, in their own words, what they think the provision means. What are some of its strengths? What are some of its weaknesses? What measures would be required to implement the amendment? Can they think of any examples of regulation that might have been the result of the Clause or related a related principle?

Although there were several loopholes in the Delaney Clause (see Richard Merrill, 1997 and the Congressional Research Service's report by clicking on the links provided below), its passage indicated that the consumer health movement had begun to gain traction. Many people were becoming concerned about the abundance of synthetic chemicals in their food, water, and everyday products. It is important to emphasize to students that although many people think *Silent Spring* was the book that started the environmental movement by catalyzing public awareness about the

effects of chemicals on human and ecological health, prior to its publication, several scientists and activists had also been concerned about the issue.

Activity 2.2: Putting Concerns about Plastics in Historic Context: *Silent Spring* and Carson's Critics

Students should come to class having read the first three chapters of *Silent Spring*. The teacher should explain a bit about the background and significance of the book. As a class, review and discuss students' responses to the homework questions about *Silent Spring*:

6. What is the purpose of the book?
7. Why was Carson so concerned about ways in which humans have changed the environment since WWII?
8. Carson argues that Americans have a right not to be exposed to toxic chemicals. Do you agree or disagree? Why and under what conditions?
9. In your mind, whose duty is it to protect people from toxic chemicals? Why?
10. How do you think the chemical industry received the arguments Carson makes in *Silent Spring*?

After students discuss the book and explore some of their own reflections, the teacher should present them with some of the criticism of the book. Pass out copies of William Darby's review of *Silent Spring* from *Chemical & Engineering News* and have students read the review.

Document for Activity 2.2:

William J. Darby, 1962. "Silence, Miss Carson." *Chem. & Eng. News* (Oct. 1): 62-63.

In small groups, have students respond to the following questions:

1. What is Darby's main criticism of *Silent Spring*?
2. How does he think Carson "confuse the information" and bias the book with her opinions (p2)?
3. Darby makes a distinction between "occupational and residue hazards"—the former are isolated effects of chemicals on workers in manufacturing plants, the latter refers to residues of chemicals on foods and the environment. He claims that while there had been some trouble with health hazards at the workplace, in the broader environment there had been no examples of "injury resulting to man from these residues (p3)." What do you think about this claim?
4. How do Carson's and Darby's ideas about the relationships between human and the environment differ? How are they similar?

Activity 2.3: Homework Assignment: Comparing Delaney, Carson, and Darby

Students should read Delaney's 1951 report to the Committee to Investigate the Use of Chemicals in Foods. Then have them respond to the following questions:

1. Why does Delaney think that the investigation into the use of chemicals in food products is necessary? What is the problem?
2. How are Delaney's concerns different from Carson's? How are they similar?
3. How do you think William J. Darby would respond to Delaney's concerns?

Document for Activity 2.3:

- A. James J. Delaney, *et al.* "Investigation of the Use of Chemicals in Food Products," January 3, 1951, Report No. 3254 to the U.S. House of Representatives, 81st Congress, 2nd Session.

Reinforcement Activity: Exploring Different Interpretations of the Evidence

If there is time, after discussing these Carson's and Darby's ideas in Activity 2.2, have the class watch the second half of Bill Moyers' PBS Special Report on Rachel Carson. The program contains clips of the chemical industry's reaction to *Silent Spring* and explains the general public and federal government's response. It provides a concise and interesting summary of the issues explored in this lesson. The program also contains scenes from *A Sense of Wonder*, a play about Carson that was researched, written, and acted by Kaiulani Lee. Because the program is about 25 minutes long, depending on the amount of time available, the teacher may want to fast forward through some of these scenes.

Teachers can download the second half of the Bill Moyers Special Report at: <http://www.pbs.org/moyers/journal/09212007/watch2.html>

Additional Resources:

The U.S. Food and Drug Administration, "The Story Of The Laws Behind The Labels," <http://www.cfsan.fda.gov/~lrd/history1.html>. The agency explains the history of federal regulation of food, drugs, and food additives.

Richard Merrill, "Food Safety Regulation: Reforming the Delaney Clause," *Annual Review of Public Health*, 1997, 18:313-40.

Donna U. Vogt, "The Delaney Clause Effects on Pesticide Policy," Congressional Research Service, <http://www.ncseonline.org/nle/crsreports/pesticides/pest-1.cfm>.

On Rachel Carson and Silent Spring:

<http://www.rachelcarson.org/>

http://www.eoearth.org/article/Rachel_Carson's_environmental_ethics

<http://www.chatham.edu/RCI/>

[http://www.nationalhumanitiescenter.org/tserve/nattrans/ntwilderness/essays/carson.h
tm](http://www.nationalhumanitiescenter.org/tserve/nattrans/ntwilderness/essays/carson.htm)

Lesson 3: The PVC Story: Exploring Responses, Regulation, and Research Validity

Understanding Goals:

In this lesson, students will

- Learn how different interests develop knowledge and approach decision-making in regards to toxic chemicals
- Consider different historical perspectives on what constitutes ‘sound science’ and its role in regulating potentially toxic chemicals

Lesson Overview:

This lesson helps students understand how knowledge about toxic chemicals was created, used, and framed in different arguments for and against the regulation of polyvinyl chloride (PVC). Students will examine how competing claims about the possible risks to health played out in debates about the regulation of PVC. By exploring different perspectives, students will gain a better understanding of why different interests—activists, scientists, industry representatives, workers—developed different interpretations of the same phenomenon.

This lesson will also provide opportunities for students to understand how historians evaluate the reliability and effectiveness of primary sources. Activities will also help students understand how historical knowledge is used in contemporary debates.

This lesson will address the following Wisconsin History Standards:

B.12.1 Explain different points of view on the same historical event, using data gathered from various sources, such as letters, journals, diaries, newspapers, government documents, and speeches

B.12.5 Gather various types of historical evidence, including visual and quantitative data, to analyze issues of freedom and equality, liberty and order, region and nation, individual and community, law and conscience, diversity and civic duty; form a reasoned conclusion in the light of other possible conclusions' and develop a coherent argument in the light of other possible arguments

This lesson will address the following Wisconsin Environmental Education Standards:

B.12.14 Investigate how technological development has influenced human relationships and understanding of the environment

B.12.18 Analyze cause and effect relationships of pollutants and other environmental changes on human health

B.12.20 Debate the risks of producing pollutants

Background Information:

Controversy over the health effects of PVC grew during the 1970s as the deaths of workers in different chemical plants were linked to the carcinogenic properties of a PVC monomer. During the beginning stages of the controversy, because there was so little known about the effects of new synthetic chemicals, it was difficult to make claims that PVC caused cancer. Scientists, workers, industry representatives, and the press attributed causality and approached regulation in different ways. These different understandings lay at the heart of debates over how to regulate PVC.

In 2002, historians Gerald Markowitz and David Rosner published *Deceit and Denial: The Deadly Politics of Industrial Pollution*. Two chapters of the book explain how the chemical industry tried to hide and distort studies that proved that the vinyl chloride monomer was carcinogenic. The authors relied on evidence gathered as a result of legal proceedings against the industry. A lawyer from Lake Charles, Louisiana named Billy Baggett, Jr. had collected a warehouse full of internal memos, meeting minutes, and correspondence produced by the Manufacturing Chemists Association. These documents not only helped produce *Deceit and Denial*, but they were also used in a 2001 Bill Moyers' Special Report called *Trade Secrets* and a 2002 documentary by Judith Helfand and Dan Gold called *Blue Vinyl*. Many of the documents can be accessed at the Chemical Industry Archives at the link listed in the Additional Resources section of this lesson.

In response to the media attention received by these productions, the chemical industry criticized all three for misrepresenting evidence and distorting the truth. They claimed that these liberal media sources sensationalized the issue and played on people's preconceived notions of the chemical industry. After analyzing some of the same primary documents used in these productions, student will have a chance to draw their own conclusions. Then they will compare their ideas with the historians, the filmmakers, and their critics.

Activity 3.1: Analyzing Causes for Concern

Using primary sources, students will analyze a range of documents to gain a deeper understanding of how different perspectives—scientists, chemical industry executives, and chemical workers and their families—understood the effects of chemicals. Students will break up into small groups of three people. Each group will get a copy of all three documents listed below. Each student will analyze a different document and answer the questions listed below. When all group members finish their analyses, they will report to their small group.

Documents for Activity 3.1:

- A. P.L. Viola, et al. "Oncogenic Response of Rat Skin, Lungs, and Bones to Vinyl Chloride," *Cancer Research*, 31, 516-522, May 1971.
- B. Letter from R.N. Wheeler, jr. (Union Carbide) to J.L. Carvajal, et al. May 31, 1973. Confidential Correspondence between Members of the Manufacturing Chemists Association from Trade Secrets, industry archives
- C. Victor Cohn, "Plastics Found in Bloodstreams," *Washington Post*, January 18, 1972.
- D. Mikie Sherman, "Goodrich Employee Dies of Cancer-Linked Death," *Elyria (Ohio) Chronicle-Telegram*, November 3, 1975.

Questions:

1. Who was the author(s) of this document? What do you know about the author(s)?
2. Who was the intended audience of this document?
3. Why do you think this document was created? What evidence does the document contain that makes you think it was produced for that reason? Please refer to specific quotes from the document.
4. What does the document say about the potential affects PVC on human health?
5. List three questions that are left unanswered by the document.

After each student reports to the small group, students should compare the different documents. Ask the small groups to consider how each author would address questions about regulating potentially harmful chemicals. Have students explain to each other what kinds of measures that they think P.L. Viola, the Italian scientist; R.L. Wheeler, jr., the Union Carbide executive; and Valerie Arthur the deceased worker's 15 year-old-daughter would advocate for in dealing with the PVC issue. Why do students think the different perspectives would be likely to take those actions? How do their decisions relate to the principles behind the Delaney Clause?

Activity 3.2: Exploring the Plastics Industry's Response to Environmental Concern

In the early 1970s, the plastic industry faced growing criticism from scientists, activists, and increasingly, federal legislators. One representative of the industry complained that he hated to go to cocktail parties because he always seemed to get into a "big environmental argument with somebody's wife (See the transcript of Harding's 1971 talk, p9)." In order to ameliorate concerns about plastics' effect on human and environmental health, they launched a "grass roots" program. Plastic advocated a "persuade your neighbor" campaign where individuals would spread positive information about the plastic industry as being "part of the solution—not pollution."

In this activity, half of the class will analyze a speech given in 1971 by the Executive Vice President of the Society of the Plastics Industry. Depending on the discretion of the teacher, after students have a chance to read the document by themselves, they

can either discuss the following questions in small groups or write their answers independently.

1. Who is the author of this document? Who is the intended audience?
2. What are the main problems that the author addresses? How does the author talk about these problems?
3. According to Harding, who are the members of his audience responsible to?
4. How does he describe changes in the public's ideas about corporations? How do these changes affect his audience?
5. Harding quotes the "three basic objectives of a public relations program" as outlined by Harold Burson, chairman of the Burson-Marsteller corporation. What are these three objectives and how does Harding say they relate to the plastic industry?
6. What does Harding think the most important first step of the plastic industry's public relations program will be? Do you think would be an effective approach? Why or why not? What are the strengths of this approach? What are its weaknesses?

While half of the class is analyzing Harding's speech, the other half will examine a 1971 article from the trade journal, *Plastics World*. Again, depending on the discretion of the teacher, students can either discuss the following questions in small groups or write the answers independently after they have a chance to read the article.

1. Who is the author of this document? Who is the intended audience?
2. What are the main problems that the author addresses? How does the author talk about these problems?
3. According to the author, what are the "facts about PVC"?
4. What does the author say is the best way to deal with PVC?
5. The authors list several "action steps" that readers can take to address the broader problems faced by the plastics industry. Which of three of these steps do you think would be most effective? Why?
6. Which three of the proposed "action steps" do you think would be least effective? Why?

After each half of the class has a chance to analyze their document and answer the questions above (either independently or in small groups), reconvene as a class. Have members from each side explain to the other half of the class what their document was about, what problem it meant to address, and how it aimed to address the problem. Encourage students to make connections between the two sources.

Documents for Activity 3.2:

- A. Ralph L. Harding, Jr., Executive President of the Society of the Plastics Industry, "Plastics Public Relations and the Environment," Paper delivered before the Chemical Public Relations Association, March 9, 1971.

B. “Where do we stand—ecologically?” *Plastics World*, June 1971.

Activity 3.3 Comparing Interpretations

After looking at the plastics industry’s response to public concerns, the teacher should explain the controversy over the Markowitz and Rosner’s book *Deceit and Denial*. Because the book may be a little dense for high school students, the teacher should explain the authors’ argument and the documents they used. Specifically, the teacher should tell students that Gerald Markowitz and David Rosner argued that the chemical industry successfully deceived its workers and the public by “hiding its information about cancer from the government” and “deflecting national attention away from the potential hazards of thousands of mostly untested new chemicals and of vinyl chloride in particular (p178).” After looking at the sources in Activity 3.1 and getting a sense of the plastics industry’s public relations campaign in Activity 3.2, ask students if they agree with the historians’ interpretation? Why or why not? Discuss this as a large group.

Depending on time and availability, the teacher may want to show students excerpts from Bill Moyers’ *Trade Secrets* and/or Judith Helfand’s *Blue Vinyl* (see the film trailer at http://www.youtube.com/watch?v=UwC74_VV7nU&feature=related). Moyers and Helfand come to similar conclusions as Markowitz and Rosner; namely, that the chemical companies withheld information about the risks of PVC to workers, surrounding communities, and the general public. Have students compare their own understandings to these additional sources. Do they agree with the central claims of these documentaries? What questions do they have for the filmmakers? What are the strengths of these documentaries? What are their weaknesses?

Activity 3.3: Homework: Evaluating Criticism and Debating Research Validity

Like the *Trade Secrets* and *Blue Vinyl* documentaries, the teacher should explain that the publication of *Deceit and Denial* generated controversy and has had important legal impacts. In 2005, Markowitz was to serve as an expert witness in a trial in Mississippi where a chemical worker was planning to sue his former employer for knowingly exposing him to the polyvinyl chloride monomer that gave him cancer. In response to Markowitz’s subpoena, the chemical industry hired lawyers and a professor from Rutgers University named Philip Scranton to discredit his research. Similarly, the American Chemistry Council (ACC) criticized Bill Moyers’ program for being one-sided and misleading. On the PBS webpage, Moyers’ staff responds to individual criticisms <http://www.pbs.org/tradesecrets/accharges.html>.

Read the information on the PBS website and answer the following questions:

1. What are some of the ways that the ACC defends itself against the Moyers’ accusations?
2. How does Moyers’ rebut their claims? Give specific examples.
3. Who do you think is more convincing? Why?

4. What other evidence would you need to determine whether or not the chemical industry did in fact deceive its workers, federal regulators, and the general public? Where would you go to find this information?

Reinforcement Activity: Mapping Cancer Alley

In this activity, students will examine the locations of petrochemical plants in cancer alley and explore demographic data about surrounding communities. Who are the people who live near our country's largest concentration of petrochemical industries? Why do they live there? The purpose of this spatial analysis is to encourage students to think how questions of social and environmental justice play into debates over the regulation of synthetic chemicals.

Procedure: Click on the U.S. National Library of Medicine's Environmental Health E-Maps site (TOXMAP): <http://toxmap.nlm.nih.gov/toxmap/home/welcome.do>. In the search fields, select "Louisiana" as the state. A map showing the locations of all facilities that are included in the Toxic Release Inventory will appear. Students will be able to visually see the large concentration of toxic plants along "cancer alley." Have students zoom in on this part of the state by clicking on the "Zoom In +" icon. To the right of the map there is a section called "Apply to this map." This gives users options to add about race, income, and health of the area under investigation.

1. Have student click on "U.S. Census Data" and in the list of data from "2000 Race," have them select a category to investigate. Then have them click on "Submit." The map will then show this demographic data with the location of the TRI facilities superimposed on it. Ask students to examine the relationships between concentration of facilities and this demographic data. Do they see any patterns?
2. Then have them return to the right side of the map and click on "Income Data." Have them click on the Per Capita Personal Income value for a given year. Again, ask students to examine the relationships between concentration of facilities and this demographic data. Do they see any patterns?
3. Repeat this with the "Health Data" section and have students explore different categories under the "Mortality, Cancer 2000-2004" field. Again, ask students to examine the relationships between concentration of facilities and this demographic data. Do they see any patterns?

Ask students to reflect on what these maps. Where does the information used to generate these maps come from? What general patterns do they seem to show? How would they test relationships between the location of plants that release toxins and surrounding communities? What are the strengths of mapping tools such as TOXMAP? What are their weaknesses? What kinds of questions do these spatial analyses raise?

Have them repeat steps 1-3 for their home communities. How do their home communities compare to “cancer alley”? Do they notice any similar patterns? What are the major differences?

Additional Resources:

Chemical Industry Archives, <http://www.chemicalindustryarchives.org/>

Bill Moyers, *Trade Secrets: A Moyers Report*, PBS Special Report, <http://www.pbs.org/tradesecrets/program/program.html>.

Toxic Comedy Pictures, *Blue Vinyl* website, <http://www.bluevinyl.org/animation.htm>.

Lesson 4: Exploring the Future History of Plastics: Contemporary Debates about Bisphenol-A and Phthalates

Understanding Goals:

In this lesson, students will:

- Analyze current controversies over the regulation of bisphenol-A.
- Make connections between current issues and debates and themes discussed in previous lessons.

Lesson Overview:

In the first three lessons, students learned how and why synthetic chemicals became such a pervasive part of American life. They considered how different perspectives developed different understandings of the effects of synthetic chemicals on human and environmental health. Activities also helped students understand the complexity of regulating synthetic chemicals. In this final lesson, students will grapple with questions about risk and uncertainty by engaging in a case study about the regulation of bisphenol-A and phthalates.

Background:

Since the 1950s, bisphenol-A and a number of phthalates have become ubiquitous in the environment and in our bodies. Though it was invented in the nineteenth century, the mass-production of bisphenol-A began after WWII as a component of polycarbonate plastic—an especially lightweight, durable, and clear type of plastic. It has been used to make everything from food and drink containers, to car parts, to digital media and electronics. Phthalates have also become ubiquitous in a wide array of everyday products. Phthalates are a set of compounds that are added to plastic and vinyl to make materials more pliable. They are also a primary ingredient of many personal care products. In 1972, scientists discovered phthalates in human blood. In October 2007, the US Centers for Disease Control and Prevention (CDC) found that 93% of a random sample of 2,517 people had bisphenol-A in their urine.

Independent studies have linked these chemicals with endocrine disruption and are currently looking into the relationship between these chemicals and cancer, obesity, and hyperactivity. Other studies, funded primarily by the chemical industry, have found no causal link between bisphenol-A and phthalates and these deleterious effects. Some states taken action to regulate these chemicals. California, Minnesota, Washington and Maryland have all proposed legislation to regulate phthalates. On Friday, April 18, 2008 Senator Charles E. Schumer (D-NY) reported that he was going to introduce legislation to ban the use of bisphenol-A in all children's products and "food contact" consumer products—including water bottles and food containers. This proposed legislation is central to the main activity in this lesson: a hearing about whether or not the federal government should ban the use of bisphenol-A and phthalates in all consumer products.

Preparation:

Teachers should be familiar with the contemporary debates about bisphenol-A and phthalates by exploring the links in the Perspectives Section. This lesson also requires that student pairs have access to the internet. In addition to copies of documents listed below, students will use on-line sources to build and refine their arguments. This will ideally be done in a computer lab, or encourage students to bring laptops to class if they have them.

Activity 4.1: Ban Bisphenol-A?: Exploring a Contemporary Debate

In his activity, students will make arguments for or against the banning of bisphenol-A, or for alternative measures, by drawing on a variety of ideas and sources. Working in pairs, students will assume the identities of different perspectives including the American Chemistry Council, a European risk expert, health scientists, a historian, investigative journalists, an expecting parent, and others. Pairs will be given some primary documents to work with and links to additional resources to draw from. They will spend half the class period developing their argument and will also investigating counter-arguments by exploring other links. Teachers should encourage creative, but sound arguments.

In addition to the student pairs, three students will be selected to serve as the hearings' Executive Committee. They will ultimately decide the outcome of the hearing. As others are building their cases during the first half of the course, the Executive Committee will familiarize themselves with as many perspectives as possible—though not to the same level of depth as the other groups. The Executive Committee will be responsible for running the hearings and being as fair and responsible to each party.

The second half of the class period will be devoted to the hearing itself. To begin, each pair will have 2 minutes to make their opening statement, including their stance on the proposed legislation and an explanation of this opinion. Then each group will have 2-3 minutes to explain their criticism of other group's perspectives. Following the critique, there will be an open session moderated by the Executive Committee. The Committee should be prepared to ask questions or call on representatives to clarify certain points. At the end of the hearing, the Executive Committee will determine the course of future action.

Perspectives for Activity 4.1:

1. Anna Soto, M.D., Professor of Cell, Molecular and Developmental Biology, Tufts University

Background Material: Testimony before Senate Health and Human Services Committee and Assembly Health Committee, Joint Informational Hearing on Breast Cancer and the Environment, October 23, 2002.

2. Steven Hentges, Ph.D., Executive Director, Polycarbonate/BPA Global Group, American Chemistry Council

Background Material: “Bisphenol-A Fact Sheet.” Also see <http://www.bisphenol-a.org>.

3. Bill Durodie, Centre for Risk Management, King’s College London, also New College, University of Oxford

Background Material: Bill Durodie, “The True Cost of Precautionary Chemical Regulation,” *Risk Analysis*, Vol. 23, No. 2, 2003.

4. Susanne Rust, Meg Kissinger, and Cary Spivak, Investigative Journalists for the *Milwaukee Journal*

Background Material: “WARNING: The chemical bisphenol A has been known to pose severe health risks to laboratory animals. AND THE CHEMICAL IS IN YOU,” *Milwaukee Journal Sentinel*, December 2, 2007. <http://www.jsonline.com/story/index.aspx?id=692145&format=print>

5. National Toxicology Program, Center for the Evaluation of Risks to Human Reproduction (CERHR)

Background Material: “NTP Draft Brief on Bisphenol-A,” April 2008 <http://cerhr.niehs.nih.gov/chemicals/bisphenol/bisphenol-eval.html>. Also see information on various phthalates: <http://cerhr.niehs.nih.gov/reports/index.html>.

6. Fred vom Saal, PhD, Developmental Biologist, University of Missouri.

Background Material: Liza Gross, “The Toxic Origins of Disease,” *PLoS Biol* 5(7): e193.

7. Sarah Vogel, MPH, MEM, Ph.D., Historian, Columbia University

Background Material: “Battles over Bisphenol-A,” GWU's Scientific Knowledge and Public Policy website, http://www.defending-science.org/case_studies/Battles-Over-Bisphenol-A.cfm

8. Hon. Andrew von Eschenbach, M.D., Commissioner, U.S. Food and Drug Administration

Background Material: Response to Committee on Energy and Commerce’s investigation about health effects of Bisphenol-A,

http://energycommerce.house.gov/Press_110/110nr179.shtml;

<http://energycommerce.house.gov/Investigations/Bisphenol.shtml>

9. Hon. John D. Dingell, Chairman on Committee on Energy and Commerce & Bart Stupak, Chairman of the Subcommittee on Oversight and Investigations, House of Representatives.

Background Material:

<http://energycommerce.house.gov/Investigations/Bisphenol.shtml>

<http://www.sciam.com/article.cfm?id=plastic-not-fantastic-with-bisphenol-a&print=true>

10. Royal Society of Chemistry, London

Background Material:

<http://www.rsc.org/chemistryworld/Issues/2008/April/BisphenolABabyBottleDebate.asp>

11. Expecting Parent

Background Material: Shanna Swan, “Parents needn’t wait for legislation to shield kids from toxins in products,” *San Francisco Chronicle*, January 9, 2006, [http://www.sfgate.com/cgi-](http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2006/01/09/EDGMKGJGL61.DTL)

[bin/article.cgi?f=/c/a/2006/01/09/EDGMKGJGL61.DTL](http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2006/01/09/EDGMKGJGL61.DTL); “Toxic Baby Bottles?” *Parenting Magazine*,

<http://www.parenting.com/article/Baby/Feeding/Toxic-Baby-Bottles>.

Activity 4.2: Homework Assignment: Reflections on the Precautionary Principle

For this activity, students will need access to an internet connection. They will explore the Environmental Working Group’s Skin Deep: Cosmetic Safety Database site to check the toxicity of certain products that they use on a regular basis. The EWG website allows users to search specific products—everything from deodorant and toothpaste to nail polish and hair gel—to assess how hazardous they may be to users’ health.

To begin, have students write a list of personal care products that they used in the last 24 hours. The list should be as specific as possible, including brand names, particular scents or flavors, etc. Using the EWG website, students should search their products and write down each product’s “hazard score.” For the highest scoring product, have students click on the product and gather information on why the product received its score. The homework worksheet “Analyzing the Skin Deep: Cosmetic Safety Database” will help guide students through an evaluation of the website. It also

introduces them to the precautionary principle and asks students to write a short reflection essay about whether or not, on a smaller scale, they would apply the principle to their own decisions. That is, will they keep using the certain products once they know that they may be hazardous? Why or why not? The worksheet is provided below.

