



Landmark Lesson Plan:

## The Legacy of Rachel Carson's *Silent Spring*

Grades: 9-12

Subject areas: Chemistry, biology and environmental science

Based on the "[The Legacy of Rachel Carson's \*Silent Spring\*](#)" National Historic Chemical Landmark

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The following inquiry-based student activities are designed for use in high school lesson planning. The handout, activities and video will help students understand the reasons for the widespread use of the insecticide DDT earlier in history as well as its subsequent banning. They will be able to see the lasting effect Rachel Carson's book *Silent Spring* has had on chemistry itself, our view of the environment and how we weigh the benefits and drawbacks of new materials and technology.

The activities are designed as a ready-to-go lesson, easily implemented by a teacher or his/her substitute to supplement a unit of study. In chemistry, the activities relate to concentration, with units as small as parts per million; solubility of compounds in water versus fat; and decision-making based on green chemistry principles. In biology, the activities relate to the effect of a contaminant on a food chain and bioaccumulation of a fat-soluble contaminant. In environmental science, the activities highlight the weighing of benefits versus drawbacks in the use of a material or technology, and the effect of *Silent Spring* on our views of humans and nature. Other science-related concepts include the types of information that can support a rigorously researched scientific argument.

All resources are available online at [www.acs.org/LandmarkLessonPlans](http://www.acs.org/LandmarkLessonPlans).

While these activities are thematically linked, each is designed to stand alone as an accompaniment for the handout. Teachers may choose activities based on curricular needs and time considerations.

- Take a few minutes to introduce the lesson with a few conversation starters. Ask students to consider the different connotations of the words insecticide, pesticide and biocide. All three could be used to describe the compound DDT. Would there be a reason to choose one over the others, depending on your position related to DDT or the audience to whom you are speaking? Discuss other situations where materials that were in widespread use were eventually banned in certain areas or in particular situations, similar to the example of DDT. One example is the partial ban on the manufacture or sale of mercury-containing thermometers due to the difficulty of cleaning up mercury if a thermometer breaks and the release of harmful mercury vapor into the air. Another example is restricting the use of antifouling paint containing tin compounds due to its toxicity for marine life.
- Show the ACS Reactions video "[Zika, Mosquitoes and How to Not Get Bitten](#)" (4 min., 24 sec.). The video discusses the massive increase in the Zika virus in 2015, its transmission via a particular type of mosquito, and individual's use of insect repellent to try to avoid getting bitten. It also mentions some interesting ideas scientists have to try to control the mosquito population. Students could discuss how the video suggests avoiding infection by a mosquito-transmitted disease such as Zika and compare/contrast these methods with the past use of DDT to control other diseases carried by mosquitoes, such as malaria.
- Have students read the handouts on **The Legacy of Rachel Carson's *Silent Spring***.
- Distribute the **Activities** selected for the class.
- After class use the **Answer Guide** for student feedback and discussion.

### Student Activities with Objectives

**History Exercise: Chronology of Carson's Work and DDT**

(10–20 min.)

**American Chemical Society**

National Historic Chemical Landmarks | [landmarks@acs.org](mailto:landmarks@acs.org) | [www.acs.org/landmarks](http://www.acs.org/landmarks)

- Using the handout, students place events from Carson's life in chronological order on a timeline. They then add marks to the timeline to indicate key events in DDT discovery and use, to illustrate how the main part of Carson's career aligns with the rise and fall of DDT. They also discuss how Carson's background made her well suited to present in-depth scientific information to the general public through a work like *Silent Spring*.

**Science, Society and *Silent Spring***

(15–20 min.)

- Students recognize that different groups of people can have different reactions toward a scientific work. They also note the different types of information and sources that Carson included in her rigorously researched work and discuss the book's lasting effects.

**Science and Decision Making**

(20–25 min.)

- Students realize that the use of any material or technology has both benefits and drawbacks, and that considering whether the positives of their use outweigh the negatives can be complex. They identify specific drawbacks related to DDT's benefits, devise arguments both in support of and against an idea, and consider additional information that would be needed to make a decision in a green chemistry scenario.

**Concentration and Solubility**

(15–20 min.)

- Students explore the concepts of concentration of a solution and the ability of a solute to dissolve in water versus fat. They picture an imagined dilution of food coloring to help grasp the idea of small concentrations such as one part per million. They also predict the effects that ingesting fat-soluble DDT can have on organisms in a marsh food chain.

## Legacy of Rachel Carson's *Silent Spring*

Rachel Carson's book *Silent Spring*, published in 1962, was a landmark in the development of the modern environmental movement. It explained how the indiscriminate application of agricultural chemicals, pesticides and other modern chemicals polluted streams, damaged bird and animal populations, and caused severe medical problems for humans.

*Silent Spring* sparked widespread debate about the effect of pesticides on the natural world, leading to new policies that protect our air, water and health and safety. The book promoted a major shift in how chemists practice their discipline and helped establish a new role for chemists in investigating the impact of human activity on the environment. The legacy of *Silent Spring* continues today in the chemistry community's focus on green chemistry practices and the public's support for sustainability.

### Progress after WWII

To understand how radically her book changed the modern mindset, we have to go back to the era between World War II and the late 1950s, when Carson first decided to write *Silent Spring*.

New technologies flourished during the war as biologists, chemists, physicists and others aided the military. Science and industry then translated these and other developments into products aimed at improving the quality of life for civilians.

DDT (dichloro-diphenyl-trichloroethane) is one example. A potent insecticide, DDT was effective at preventing the spread of typhoid, malaria and other diseases transmitted by insects, and it saved countless lives during the war. After the war, the U.S. Department of Agriculture and corporations promoted DDT and other powerful chemicals to increase domestic productivity and combat a variety of ills. DDT's widespread use is reflected by the range of products in which it was sold, from large-

scale aerial sprays to insecticidal paint and wallpaper.

Carson, who was employed with the U.S. Fish and Wildlife Service from 1936 until 1952 as a field scientist and writer, was acutely aware of the policies and practices of the day. In her view, government leaders and industry were eager to create sweeping change, but were advancing new technologies without knowing the full implications of their decisions.

### Master of Two Worlds

Rachel Carson was one of the few people capable of writing with the scientific thoroughness her subject required and the engaging writing style that could rivet a nation's attention. She was born in 1907 in Springdale, Pennsylvania, a rural river town outside of Pittsburgh. By age 11, she was winning writing competitions. She entered the Pennsylvania College for Women (now Chatham University) to pursue a writing career, but after classes in biology Carson changed majors, graduating in 1929. She earned a master's

degree in zoology at Johns Hopkins University in 1932.

In 1951, *The Sea Around Us* elevated Carson to fame and cemented her credentials as an interpreter of science for the public. The book was a bestseller and won a National Book Award. In her acceptance speech Carson outlined her beliefs about the public's interest in science:

"Many people have commented with surprise on the fact that a work of science should have a large popular sale. But this notion that 'science' is something that belongs in a separate compartment of its



Rachel Carson

Courtesy U.S. Fish and Wildlife Service

own, apart from everyday life, is one that I should like to challenge... Science is part of the reality of living; it is the what, the how and the why of everything in our experience. It is impossible to understand man without understanding his environment and the forces that have molded him physically and mentally.”

### ***Silent Spring*: A Change in Perspective**

In *Silent Spring*, Carson assembled information on chemicals used in aerial sprayings, in industrial settings and on food. She characterized the impact of these agents in ecological terms rather than simply portraying the effectiveness of the chemicals. Carson did extensive research, citing dozens of scientific reports, conducting interviews with leading experts and reviewing materials across disciplines.

*Silent Spring* seeded important new ideas in the public mind: That spraying chemicals to control insect populations can also kill birds that feed on dead or dying insects. That chemicals travel not only through the environment, but through food chains. That chemicals can accumulate in fat tissue, causing medical problems later on, and that chemicals can be transferred from mothers to their young.

Paramount among these ideas was the notion that life is much more interconnected and interdependent than people had realized. Yet, Carson called not for an outright ban on agricultural chemicals but for caution, further study and the development of biological alternatives.

When *Silent Spring* was released in the fall of 1962, it was met with enormous public interest as well as substantial criticism. Many government leaders, including President John F. Kennedy and his Secretary of the Interior, Stewart L.

Udall, took Carson seriously. Others criticized her vehemently. William J. Darby authored a review of *Silent Spring*—titled “Silence, Miss Carson”—in the Oct. 1, 1962, issue of *Chemical & Engineering News*, published by the American Chemical Society. Darby criticized Carson for not adopting the views of “responsible, broadly knowledgeable scientists” and recommended that “in view of her scientific qualifications in contrast to those of our distinguished scientific leaders and statesmen, this book should be ignored.”

### **Rachel Carson's Legacy**

But Carson's book was not ignored. Her research and ideas became central testimony at two congressional hearings, and a Presidential Science Advisory Committee report on pesticides in 1963 affirmed Carson's call for limits on pesticide use and further research into their health hazards.

Carson and her book are frequently cited as the catalysts that inspired the environmental movement that began in the 1960s and that gained national and international momentum by the 1970s. The years following the controversy over *Silent Spring* saw the establishment of the U.S. Environmental Protection Agency and the passing of numerous laws protecting the environment and human health, including a ban on domestic use of DDT in 1972.

Since the publication of *Silent Spring*, the discipline of chemistry has grown to include green chemistry—the design, development, and implementation of chemicals, products and processes that reduce energy use and lower or eliminate the use or generation of substances hazardous to the environment and human health—and a new role for chemists in investigating the

impact of human activity on the environment. Scientists, policy makers and the public now recognize and weigh trade-offs of new technologies. Several generations have grown up embracing Carson's ideals of ecological awareness, environmental protection and conservation.

A more telling measure of how attitudes have changed is reflected in a letter penned by Rudy M. Baum, editor-in-chief of *Chemical & Engineering News*, published in the June 4, 2007, edition:

“At a time when humans largely believed themselves to be apart from nature and destined to control it, Carson argued passionately that nature is, in fact, a network of interconnections and interdependencies and that humans are a part of that network and threaten its cohesion at their own peril. ...What is mainstream today was heretical in 1962.”

Carson, who died in 1964, inspired a new paradigm of thinking—where humanity is not the center of life on earth, but part of nature.

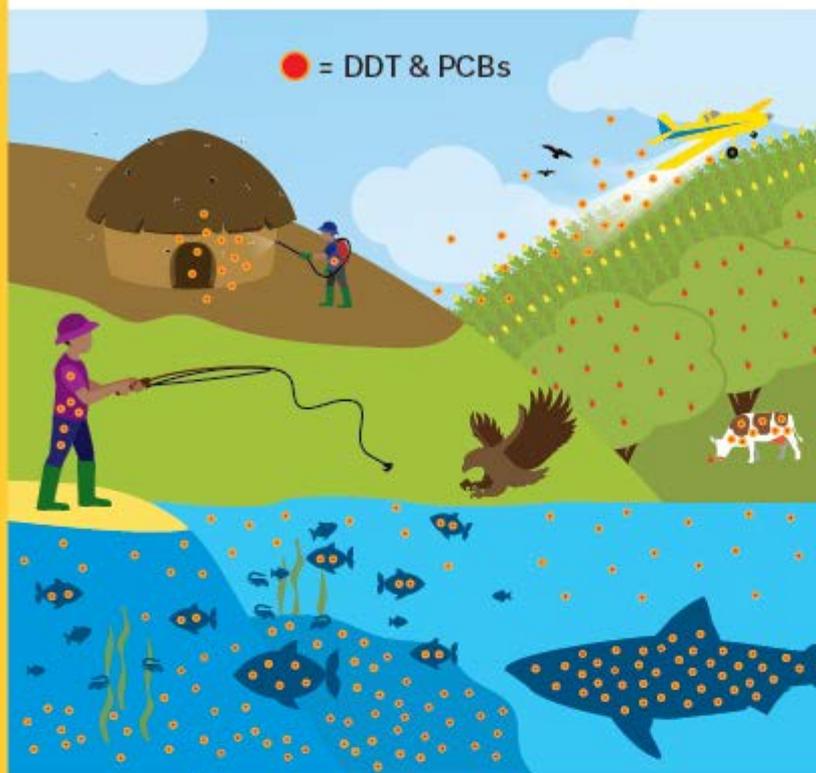
The legacy of *Silent Spring* continues today in the scientific community's increased focus on environmentally friendly practices and the public's heightened support for sustainability in all areas of life.



*DDT spraying to control insects was common when Silent Spring was published.*

# Bioaccumulation & Biomagnification

RACHEL CARSON



The study of the pesticide DDT provides a good example of bioaccumulation and biomagnification of toxic chemicals in the ecosystem.

Bioaccumulation is the buildup of absorbed chemicals in an organism over time.

Biomagnification is the increase in concentration of these chemicals in each organism up the food chain.

In both processes, chemical concentration increases because organisms cannot break down or excrete these substances as quickly as they are absorbed.

Bioaccumulation and biomagnification of DDT contributed to the near extinction of bald eagles and other birds. The birds absorbed DDT by eating contaminated fish and subsequently laid defective eggs.

PCBs, once widely used in electrical equipment, have escaped into the environment. In polluted water, plankton bioaccumulate these toxic chemicals and are then eaten by small fish, which in turn provide a meal for bigger fish that are eventually consumed by people. Each step up the food chain concentrates the PCB contamination.

Rachel Carson's book *Silent Spring* was a landmark in the development of the modern environmental movement.

Her scientific perspective about the effect of pesticides on the natural world sparked widespread debate about the impact of human activity on the environment.

Carson wasn't the first to realize how bioaccumulation and biomagnification work, but her work as an author and advocate helped spread the awareness to the general public and policy makers, which led to new laws that protect our air, our water, and, ultimately, our health and safety.

Her legacy continues today in the public's heightened support for sustainability and the chemistry community's increased focus on environmentally friendly practices.

## BIOACCUMULATION



## BIOMAGNIFICATION



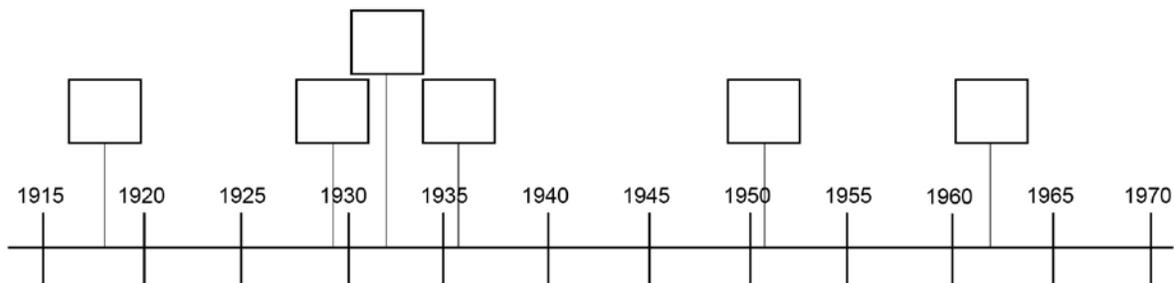
■ Contaminant levels

### History Exercise: Chronology of Carson's Work and DDT

Rachel Carson's background helped to make her uniquely suited to produce a work like *Silent Spring* that presented in-depth scientific information in a way that the general public could grasp. It also overlapped with events related to the use of DDT.

1. Using the handout provided, identify the year of the events from Carson's life listed below and indicate their chronological order using numbers 1 through 6. Then place them in their correct location on the timeline by writing the event letter in the corresponding box.

	Event	Year	Order
a.	Began work for U.S. Fish and Wildlife Service as field scientist and writer	_____	_____
b.	Published award-winning nonfiction book <i>The Sea Around Us</i>	_____	_____
c.	Won writing competitions by age 11	_____	_____
d.	Received degree in zoology	_____	_____
e.	Received degree in biology	_____	_____
f.	Published book <i>Silent Spring</i>	_____	_____



Student Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

2. Although DDT was first synthesized in 1874, its potential as a highly effective insecticide was not revealed until 65 years later. For each of the key DDT events listed below, make an appropriate mark on the lower part of the timeline to show how DDT's history aligned with Carson's.

- 1939: Research reveals DDT's potential as a highly effective insecticide.
- 1942–1945: DDT used during World War II to fight diseases transmitted by insects.
- 1945–1963: Widespread domestic use of DDT in U.S.
- 1972: Domestic use of DDT banned.

3. Briefly discuss how events a–e listed in question 1 above positively impacted Carson's ability to write *Silent Spring*.

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Student Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

b. Our view of the environment

c. Chemistry as a discipline

### Science and Decision Making

Technology and other materials that we use have benefits as well as drawbacks. We may decide that the benefit of using something outweighs the drawbacks or the potential risks associated with it. Considering both sides can be complex. For example, the long-term effects of something cannot be known right away, and changing one variable in an interconnected system such as nature can have unforeseen results.

1. Some of the qualities that make DDT desirable for use as a pesticide also have an associated drawback. For each benefit below, identify a drawback specifically related to it.

Benefit	Related drawback
DDT kills multiple types of insects, including those that transmit diseases such as malaria and typhus.	
A single application of DDT can remain effective for a long period of time.	
DDT is not water soluble, so it does not get diluted and washed away by rains.	

2. Scientist Paul Müller won the Nobel Prize for Physiology or Medicine in 1948 for his discovery that DDT is a highly effective insecticide, particularly against insects that transmit malaria and typhus. DDT's domestic use was banned over two decades later. Should the discovery have received the Nobel Prize? Make an argument in support of it and against it.

a. In support of the Nobel Prize:

b. Against the Nobel Prize:

3. Green chemistry seeks to reduce or eliminate the use of substances that are hazardous. One example of this is finding a replacement for perchloroethylene (PERC) in the dry cleaning industry. PERC is a solvent that removes grease from clothing. However, it can be harmful to humans and the environment. Liquid carbon

Student Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

dioxide together with a polymer is one possible replacement. What information would you want before making a decision about whether to use PERC or liquid CO<sub>2</sub>?

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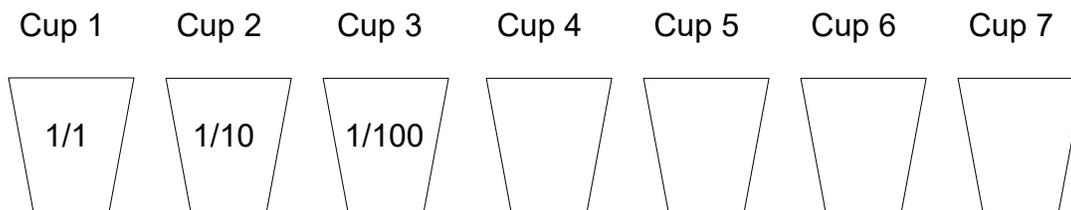
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### Concentration and Solubility

A common example of the concentration of a chemical compound is dissolving sugar and a packet of unsweetened powdered drink mix in water. You can add different amounts of sugar—the full amount listed on the packet, or much less for a not-so-sweet drink, or somewhere in between. The solution with the largest amount of solute (sugar) dissolved in the solvent (water) would have the highest concentration, and the solution with a much smaller amount of sugar with the same solution volume would have a lower concentration.

When measuring the concentration of small amounts of dissolved substances, a typical unit of measurement is parts per million, or ppm.

1. To help envision how small a concentration of 1 ppm is, imagine diluting food coloring as described below. Cup 1 represents undiluted food coloring. If you took 1 teaspoon of food coloring from cup 1 and mixed it in cup 2 with 9 teaspoons of water, the concentration would be 1 part food coloring to 10 parts solution (1/10), and the color of the solution would be lighter. If you then took a teaspoon of the cup 2 solution and mixed it in cup 3 with 9 teaspoons of water, the concentration would be 1 part per 100, and the color would be lighter still. Continue with the remaining cups, filling in the concentrations.



a. Which cup represents 1 part per million? \_\_\_\_\_

b. At that concentration, the naked eye does not detect a noticeable color to the solution. Do you believe it still contains food coloring molecules? Why/why not?

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Contaminants that are soluble in water, that is, can be dissolved in it, can easily be flushed from the body by the kidneys. Contaminants like DDT are practically insoluble in water, but soluble in fats. Because of this, DDT can accumulate in fat tissues of organisms instead of being more easily flushed from the body. This can lead to problems within a food chain/web. When one organism eats another, it is also ingesting

Student Name: \_\_\_\_\_ Date: \_\_\_\_\_ Period: \_\_\_\_\_

this accumulated DDT, which it retains in its own fat tissues. This is called bioaccumulation.

2. A marshy area might contain the following simplified food chain:  
plankton living in the water → small fish eats plankton →  
bigger fish eats small fish → bird eats bigger fish

Consider if the area was sprayed with DDT to control the insect population, with a small DDT concentration remaining in the water. A very small concentration of DDT is found in the plankton.

a. Which organism in the food chain would have the highest concentration of DDT in its fat tissues? Explain your answer.

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b. DDT can cause birds' eggshells to become thinner and break more often, resulting in the death of the embryo and a decrease in the bird population. How would a decreased bird population potentially affect the food chain?

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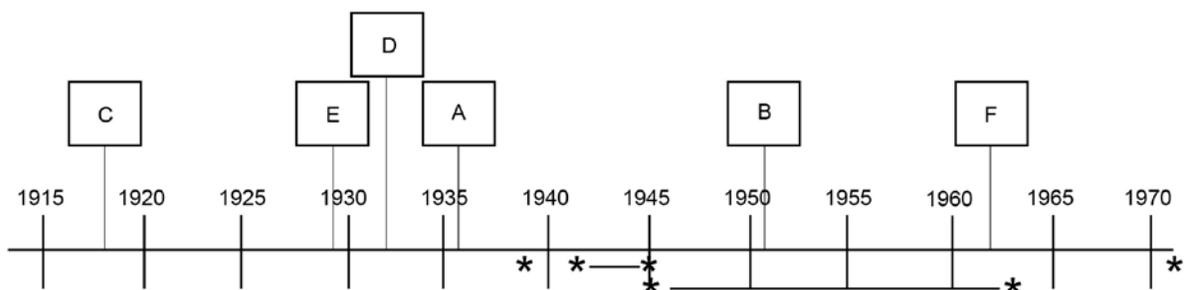
## The Legacy of Rachel Carson's Silent Spring Answer Guide History Exercise

### History Exercise: Chronology of Carson's Work and DDT

Rachel Carson's background helped to make her someone uniquely suited to produce a work like *Silent Spring* that presented in-depth scientific information in a way that the general public could grasp. It also overlapped with events related to the use of DDT.

1. Using the handout provided, identify the year of the events from Carson's life listed below and indicate their chronological order using numbers 1 through 6. Then place them in their correct location on the timeline by writing the event letter in the corresponding box.

	Event	Year	Order
a.	Began work for U.S. Fish and Wildlife Service as field scientist and writer	<u>1936</u>	<u>4</u>
b.	Published award-winning nonfiction book <i>The Sea Around Us</i>	<u>1951</u>	<u>5</u>
c.	Won writing competitions by age 11	<u>1918</u>	<u>1</u>
d.	Received degree in zoology	<u>1932</u>	<u>3</u>
e.	Received degree in biology	<u>1929</u>	<u>2</u>
f.	Published book <i>Silent Spring</i>	<u>1962</u>	<u>6</u>



## The Legacy of Rachel Carson's *Silent Spring* Answer Guide

### History Exercise

2. Although DDT was first synthesized in 1874, its potential as a highly effective insecticide was not revealed until 65 years later. For each of the key DDT events listed below, make an appropriate mark on the lower part of the timeline to show how DDT's history aligned with Carson's.

1939: Research reveals DDT's potential as a highly effective insecticide.

1942–1945: DDT used during World War II to fight diseases transmitted by insects.

1945–1963: Widespread domestic use of DDT in U.S.

1972: Domestic use of DDT banned.

**See timeline.**

3. Briefly discuss how events a–e listed in question 1 above positively impacted Carson's ability to write *Silent Spring*.

**Carson honed her writing skills throughout her life, winning writing competitions at an early age, using it in her work at the U.S. Fish and Wildlife Service (USFWS), and writing an award-winning nonfiction work before writing *Silent Spring*. Her degrees in biology and zoology were put to practical use at the USFWS and would also be used in her research on DDT's effect on the environment.**



## ***The Legacy of Rachel Carson's Silent Spring Answer Guide Science, Society and Silent Spring Exercise***

b. Our view of the environment

**It is now a mainstream view that nature is a network of interconnections and interdependencies, including humans and their actions.**

c. Chemistry as a discipline

**Chemistry now includes green chemistry, with a goal of reducing or eliminating the use of substances hazardous to human health and the environment. The book established a new role for chemists in investigating the impact of human activity on the environment.**

## The Legacy of Rachel Carson's Silent Spring Answer Guide Science and Decision Making Exercise

### Science and Decision Making

Technology and other materials that we use have benefits as well as drawbacks. We may decide that the benefit of using something outweighs the drawbacks or the potential risks associated with it. Considering both sides can be complex. For example, the long-term effects of something cannot be known right away, and changing one variable in an interconnected system such as nature can have unforeseen results.

1. Some of the qualities that make DDT desirable for use as a pesticide also have an associated drawback. For each benefit below, identify a drawback related to it.

<b>Benefit</b>	<b>Related drawback</b>
DDT kills multiple types of insects, including those that transmit diseases such as malaria and typhus.	<b>DDT kills a wide range of insects, including those that are beneficial.</b>
A single application of DDT can remain effective for a long period of time.	<b>DDT (and its associated toxicity) remains in the environment for a long time.</b>
DDT is not water soluble, so it does not get diluted and washed away by rains.	<b>DDT is soluble in fat and can accumulate in fat tissues.</b>

2. Scientist Paul Müller won the Nobel Prize for Physiology or Medicine in 1948 for his discovery that DDT is a highly effective insecticide, particularly against insects that transmit malaria and typhus. DDT's domestic use was banned over two decades later. Should the discovery have received the Nobel Prize? Make an argument in support of it and against it.

a. In support of the Nobel Prize:

**Answers will vary. Students might argue that DDT made a valuable contribution to fighting disease during World War II and that its long-term effects were not known at the time. It was not a common view at that time that parts of nature were interconnected and interdependent.**

b. Against the Nobel Prize:

**Answers will vary. Students might argue that while DDT provided a benefit, its drawbacks should have been weighed more carefully before its widespread use.**

3. Green chemistry seeks to reduce or eliminate the use of substances that are hazardous. One example of this is finding a replacement for perchloroethylene (PERC) in the dry cleaning industry. PERC is a solvent that removes grease from clothing. However, it can be harmful to humans and the environment. Liquid carbon dioxide together with a polymer is one possible replacement. What information would you want before making a decision about whether to use PERC or liquid CO<sub>2</sub>?

## ***The Legacy of Rachel Carson's Silent Spring Answer Guide Science and Decision Making Exercise***

**Answers will vary. Some possible information students may wish to know:**

- **Effectiveness of CO<sub>2</sub> as a cleaner compared to PERC**
- **Potential effect of release of CO<sub>2</sub> into the atmosphere**
- **Any potential health hazards (immediate and long-term) of working with liquid CO<sub>2</sub>**
- **Cost of CO<sub>2</sub> versus PERC**

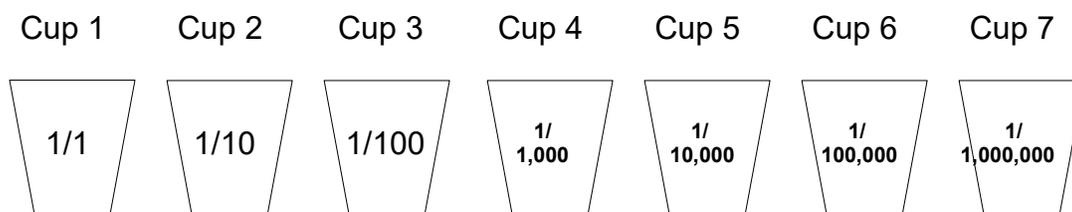
## The Legacy of Rachel Carson's Silent Spring Answer Guide Concentration and Solubility Exercise

### Concentration and Solubility

A common example of the concentration of a chemical compound is dissolving sugar and a packet of unsweetened powdered drink mix in water. You can add different amounts of sugar—the full amount listed on the packet, or much less for a not-so-sweet drink, or somewhere in between. The solution with the largest amount of solute (sugar) dissolved in the solvent (water) would have the highest concentration, and the solution with a much smaller amount of sugar with the same solution volume would have a lower concentration.

When measuring the concentration of small amounts of dissolved substances, a typical unit of measurement is parts per million, or ppm.

1. To help envision how small a concentration of 1 ppm is, imagine diluting food coloring as described below. Cup 1 represents undiluted food coloring. If you took a teaspoon of food coloring from cup 1 and mixed it in cup 2 with 9 teaspoons of water, the concentration would be 1 part food coloring to 10 parts solution (1/10), and the color of the solution would be lighter. If you then took a teaspoon of the cup 2 solution and mixed it in cup 3 with 9 teaspoons of water, the concentration would be 1 part per 100, and the color would be lighter still. Continue with the remaining cups, filling in the concentrations.



- a. Which cup represents 1 part per million? **Cup 7**
- b. At that concentration, the naked eye does not detect a noticeable color to the solution. Do you believe it still contains food coloring molecules? Why/why not?

**Answers may vary. Yes, the solution still contains food coloring molecules. There are still a large number of food coloring molecules, but not enough in relation to the water molecules for the color to be visible.**

Contaminants that are soluble in water, that is, can be dissolved in it, can easily be flushed from the body by the kidneys. Contaminants like DDT are practically insoluble in water, but soluble in fats. Because of this, DDT can accumulate in fat tissues of organisms instead of being more easily flushed from the body. This can lead to problems within a food chain/web. When one organism eats another, it is also ingesting this accumulated DDT, which it retains in its own fat tissues. This is called bioaccumulation.

## The Legacy of Rachel Carson's Silent Spring Answer Guide Concentration and Solubility Exercise

2. A marshy area might contain the following simplified food chain:

plankton living in the water → small fish eats plankton →

bigger fish eats small fish → bird eats bigger fish

Consider if the area was sprayed with DDT to control the insect population, with a small DDT concentration remaining in the water. A very small concentration of DDT is found in the plankton.

a. Which organism in the food chain would have the highest concentration of DDT in its fat tissues? Explain your answer.

**The bird would have the highest concentration of DDT in its fat tissues. As you move up the food chain, each organism would have an increased concentration of DDT, since the DDT accumulated in the tissues of the food it eats then accumulates in its fat tissues. When the bird eats a bigger fish, it is also ingesting DDT that accumulated from the smaller fish and the plankton below that.**

b. DDT can cause birds' eggshells to become thinner and break more often, resulting in the death of the embryo and a decrease in the bird population. How would a decreased bird population potentially affect the food chain?

**If there are fewer birds, the population of the bigger fish could increase. This could affect the small fish and plankton populations in the area as well.**