



Lesson Plan 010106

Plastic Poison (Target: Grades 5-8)

Objectives:

1. Create awareness of processes used in the making polyvinyl chloride (PVC).
2. Create awareness for the types of pollution caused in the manufacturing and use of PVC products, and the problems caused in disposal of PVC.
3. Create awareness for multitude of products in our day-to-day lives that are made of PVC.
4. Challenge students to ask parents/adults questions about the safety of PVC manufacturing and products and the long term environmental and health risks related to continuing to allow PVC to be part of life.

Materials/Sources:

1. 3-Page PVC Information & Activity Worksheet.
2. Rustle the Leaf Classroom Comic - "The Green Avenger," with associated web links
3. Samples of everyday items made from PVC (suggestions: piece of PVC plumbing pipe, piece/remnant of carpet with vinyl-backed padding, vinyl flooring tile, extension cord, garden hose, shower curtain, piece of plastic/vinyl wallpaper, bath toys, credit cards, plastic pens, garden chair/furniture)

Methods:

1. On a table in the front of the classroom, place the PVC sample items. Ask students to get up and walk past them. After students have walked past them, ask if anyone knows what all the items have in common. After a student has answered correctly (or you have revealed the answer), ask for a show of hands for several questions:
 - How many of you have garden hoses at home?
 - How many of you have extension cords at home?
 - How many have plastic shower curtains at home?
 - How many have seen credit cards at home?
 - How many of you have a pen with a plastic casing?
2. After you have asked these questions, pass out the 3-Page "PVC Information & Activity Worksheet."
3. Worksheet: Ask students to read the Question & Answer section, and to complete the Word Find and Fill In The Blank sections in class. Have them take the worksheet home and, with the help of a parent or adult, find examples of PVC products at home and list them on the sheet.
4. The next day, review the types of PVC products students found at home. Ask students to discuss their experiences and reactions to the prevalence of PVC manufacturing.

Lesson Information:

1. In the last 100 years, several advances in manufacturing technology have made chemical production and synthesis much more efficient and affordable. This has led to the creation of 'non-natural' chemical compounds that have been incorporated into all types of manufacturing processes, industrial products and consumer products. One large family of these recent, 'non-natural' chemicals is known as

organochlorines. These are complex chemicals in which chlorine is used as a key ingredient.

2. For many years, chlorine was known only as a scarce, gaseous element that was very difficult and expensive to isolate. In the early 20th century, a process for using high electrical current to extract chlorine from common salt (sodium chloride) was developed, and the age of cheap chlorine was born.
3. Because of the unstable nature of the chlorine atom, it is easily combined with other atoms to form complex, very diverse molecules and compounds. Among these is polyvinyl chloride, also known as PVC. In the decades since PVC was (accidentally) discovered, it has become a favorite material for applications where an inexpensive, versatile plastic compound is desired. Among these are building materials such as vinyl flooring, carpeting (backing), siding, windows, electrical wiring (jacketing) and plumbing pipes. PVC is also used in all types of containers and bottles, as well as in garden hoses, shower curtains, product packaging, credit cards, and even children's toys.
4. Unfortunately, PVC is as dangerous and toxic as it is versatile. The chemicals used to make PVC and the by-products created in the process represent some of the most poisonous and hazardous chemicals known to mankind. Among the by-products are dioxins, the very worst of all persistent organic poisons (POPs). Dioxins are highly carcinogenic and are known to interrupt human cellular functions in concentrations as small as one part per trillion. Once dioxins are absorbed into the body, they lodge in fatty tissues and remain permanently. Every person and animal on Earth now carries dioxins in varying amounts, and the dioxins are concentrated as they are passed upward through the food chain via predator and human consumption of animals.
5. Not only are dioxins produced as PVC is manufactured, they are released when PVC products are disposed of by incineration, a common practice. Other by-products produced in the manufacture and disposal of PVC include heavy metals such as lead, which also cause illness and death.
6. Remember the process through which electricity is used to extract chlorine from salt? Worldwide, the electricity used to produce chlorine is the production equivalent of 20 nuclear power plants. PVC production accounts for 40% of all the chlorine produced on Earth.
7. Although there are numerous alternative, nonchlorinated plastics and other materials available to replace PVC, industry has become so addicted to its low cost and formulation flexibility that a decades-long lobbying battle has been waged to maintain its manufacture and use.
8. Of course, the environmental and human tolls are not factored into PVC's 'low cost.' Every nation in which PVC is manufactured—and every manufacturer making PVC—knows that people working in and living around PVC facilities have higher rates of cancer and other chronic or fatal illnesses. However, legislators and other elected officials, beneficiaries of untold campaign contributions, have allowed PVC to continue polluting, poisoning and wreaking havoc in ecosystems around the world.

PVC Information & Activity Worksheet

Questions & Answers About PVC

Q: What is PVC?

A: PVC is the shortened, common name for polyvinyl chloride, a type of plastic that is made from two chemicals, ethylene and chlorine. The process by which PVC is made involves a complex series of chemical reactions and heat treatment, the result of which is a fine white powder that can be combined with other chemicals to make plastics with a wide range of performance properties.

Q: How popular is PVC?

A: PVC is the second most common plastic produced on Earth. Because the raw materials are inexpensive compared to other plastics, it is the fastest-growing plastic in production.

Q: What kind of products are made with PVC?

A: Thousands of business and consumer products are made with PVC, including building materials such as vinyl flooring, carpeting, siding, windows, electrical wiring (jacketing) and plumbing pipes. PVC is also used in all types of containers and bottles, as well as in garden hoses, shower curtains, product packaging, credit cards, and even children's toys.

Q: Can I tell if something is made of PVC?

A: On some products, yes—especially on bottles and other types of containers. There is an identification system for plastics that is related to how easy they are to recycle. The identification is three recycle arrows, forming a triangle, with a number inside the triangle. Underneath, you'll see either the letter 'V' or the word 'VINYL' or the letters 'PVC'.



However, simply because PVC can be recycled, it is a mistake to believe it is practical or wise to do so. In the US, just 1% of PVC is recycled. In Europe 3% is recycled. Why? Each PVC product is formulated to perform a certain way. A PVC shampoo bottle that is clear is made differently than a PVC shampoo bottle that is white. PVC is so adaptable to various needs that hundreds of variations exist, and separating the chemicals results in vinyl of inferior quality. So, new PVC has to be added to make 'recycled' PVC usable, defeating the purpose of recycling. In Europe, which has a more aggressive PVC recycling plan than the US, it's estimated that only 9% will be recycled by 2020.

Q: Why are people worried about PVC?

A: At every step of the way, from the raw materials used to make PVC through the different formulations of PVC plastics to the thousands of products containing PVC to the discarding of PVC in landfills or through incineration, serious environmental and human health risks occur. The primary ingredients in PVC are extremely toxic and dangerous to produce and transport. The by-products of making PVC include various flammable and toxic chemicals, the most deadly of which are dioxins. Dioxins are chemicals that are stored in human and animal tissue, and which are known



to cause cancer and to interrupt hormonal functions. Dioxins stay in tissue for decades and are passed along through the food chain. The highest concentration is found in human breast milk. In addition to the chemical by-products left behind as PVC is being manufactured, many of the chemicals used as stabilizers or softeners slowly escape (leach) from the plastic once it's made. These chemicals pollute the air and water in homes, offices and retail space, putting everyone who breathes or ingests them at risk.

Q: Are there other dangers and environmental consequences?

A: There are many. The most disturbing are the amount of energy used to make PVC's key ingredients, and the amount of pollutants that are released into the environment every year from over 1 million accidental house and building fires. First, let's consider the energy cost. Chlorine accounts for more than 50% of the ingredients in PVC. Chlorine is made by passing salt through extremely high electrical current, so every bit of chlorine made for commercial use requires a shocking amount of energy. How much? Worldwide, the electricity used to produce chlorine is equal to the annual production capacity of 20 nuclear power plants! And over 40% of all chlorine made is used to make PVC. To put it another way, the electricity required to make the world's chlorine represents 1% of the energy used by the entire population of planet Earth.

Now, about the pollution caused by PVC materials burned in accidental fires. When a building burns, chlorine and carbon atoms in PVC rearrange to become dioxin.

Hydrochloric acid is also generated, as well as many other toxins carried in the resulting black smoke. PVC burned in accidental and planned incineration represents millions of pounds of airborne pollution each year.

Q: Are we doing anything to reduce or stop the use of PVC?

A: Because so many products are made with PVC, more and more governments, scientists and doctors are becoming concerned about the long term effects on people and on ecosystems around the world. However, because the PVC industry is so large and profitable, there has been a constant battle to keep PVC legal and to discredit any studies that show it causes major health problems. As of January 2006, nations in Western Europe have established guidelines for reducing PVC in many key products. The goal is to drastically reduce PVC over the next 20 years. Some European countries are actually phasing out all PVC. In the US, efforts to ban or reduce PVC have largely failed, with elected officials choosing to side with the PVC industry until further proof is provided.

PVC Information & Activity Worksheet

Read page 1 of this 3-page handout and fill in the blanks below:

PVC is the shortened name for _____. Two of the many products made with PVC are: _____ and _____. The chemical ingredient that makes up more than 50% of PVC is _____. Manufacturing this chemical ingredient in PVC requires an incredible amount of energy in the form of _____. Many products made of PVC carry a symbol shaped like a triangle, with the number _____ in the middle of the triangle. Even though PVC can be technically recycled, it almost never is. In the US, just _____% of PVC is recycled and in Europe just _____% is recycled. During its manufacture and disposal by incineration, PVC results in the production of _____, a highly toxic chemical that is stored for decades in animal tissues and causes several kinds of _____, as well as interruption of _____ functions.



Plastic Poison Word Find

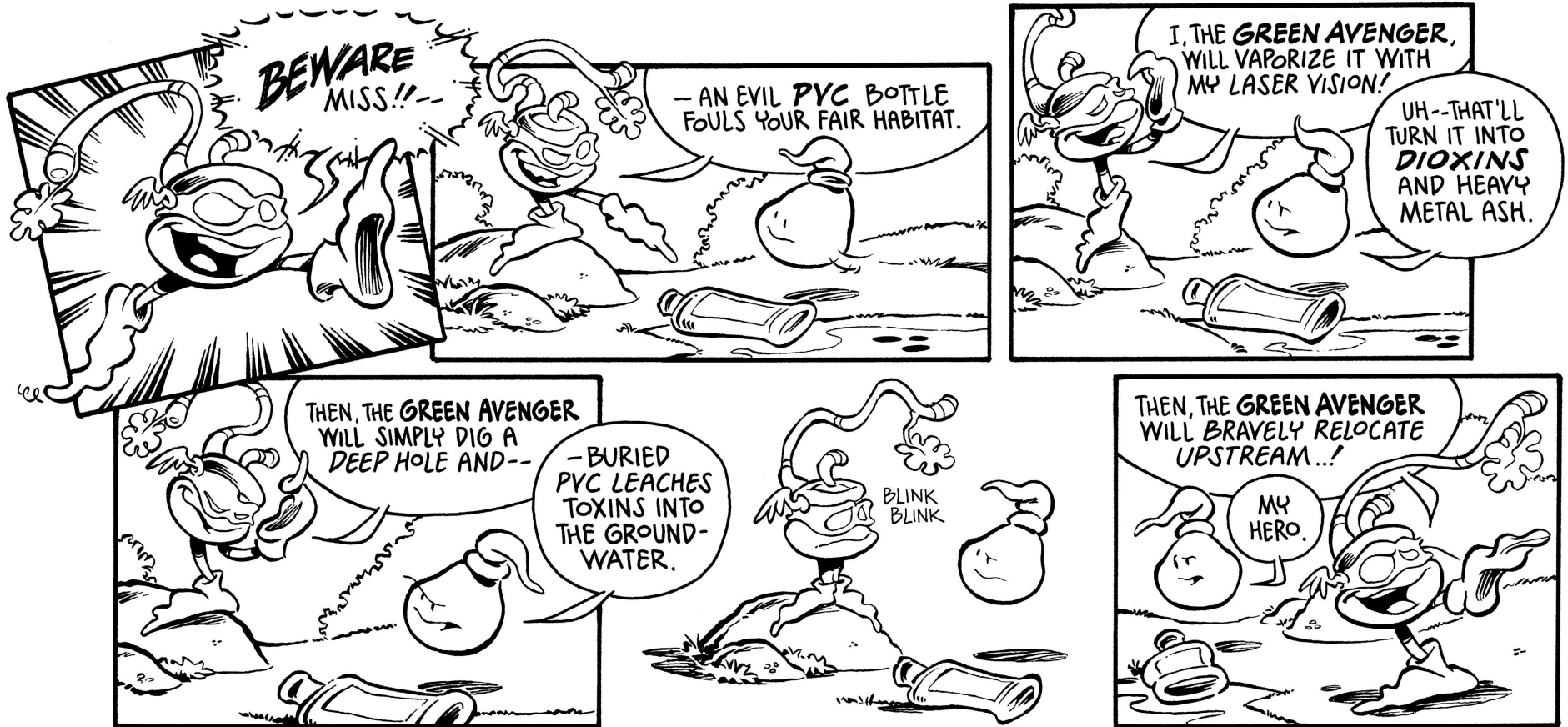
(Words below do not have spaces in puzzle)

- BOTTLES
- CARCINOGEN
- CHLORINE
- CREDITCARDS
- DIOXIN
- ELECTRICITY
- ELEMENT
- ETHYLENE
- FLOORING
- PLUMBING
- POLLUTION
- SHOWERCURTAIN
- TOXIN
- TOYS

RUSTLE THE LEAF™

BY PONCÉ & WRIGHT

CLASSROOM COMIC



© 2005, GO NATU'R'L STUDIOS, LLC. RUSTLETHELEAF.COM

Find out more about PVC/Plastic Poisons by visiting:

<http://www.healthybuilding.net/pvc/ThorntonPVCSummary.html>
<http://www.besafenet.com/pvcfactsheets.htm>
http://www.besafenet.com/PVCDisposalReport_2-Column_R6.pdf
http://en.wikipedia.org/wiki/Polyvinyl_chloride

http://www.checnet.org/healthhouse/education/articles-detail.asp?Main_ID=185
<http://www.mindfully.org/Plastic/Polyvinylchloride/polyvinylchloride.htm>
<http://www.mindfully.org/Plastic/Vinyl-Chloride-9thROC.htm>
<http://www.healthybuilding.net/pvc/alternatives.html>
http://archive.greenpeace.org/toxics/toxic_pvcdb.html
<http://www.oriononline.org/pages/om/05-3om/Steingraber.html>

NOTICE: The web sites listed here display content relating to this month's Rustle the Leaf comic strip. We make no claim of responsibility for content on these web sites. The opinions and content published on these sites does not necessarily reflect the opinions of GO NATU'R'L STUDIOS, LLC., or the creators and supporters of Rustle the Leaf.