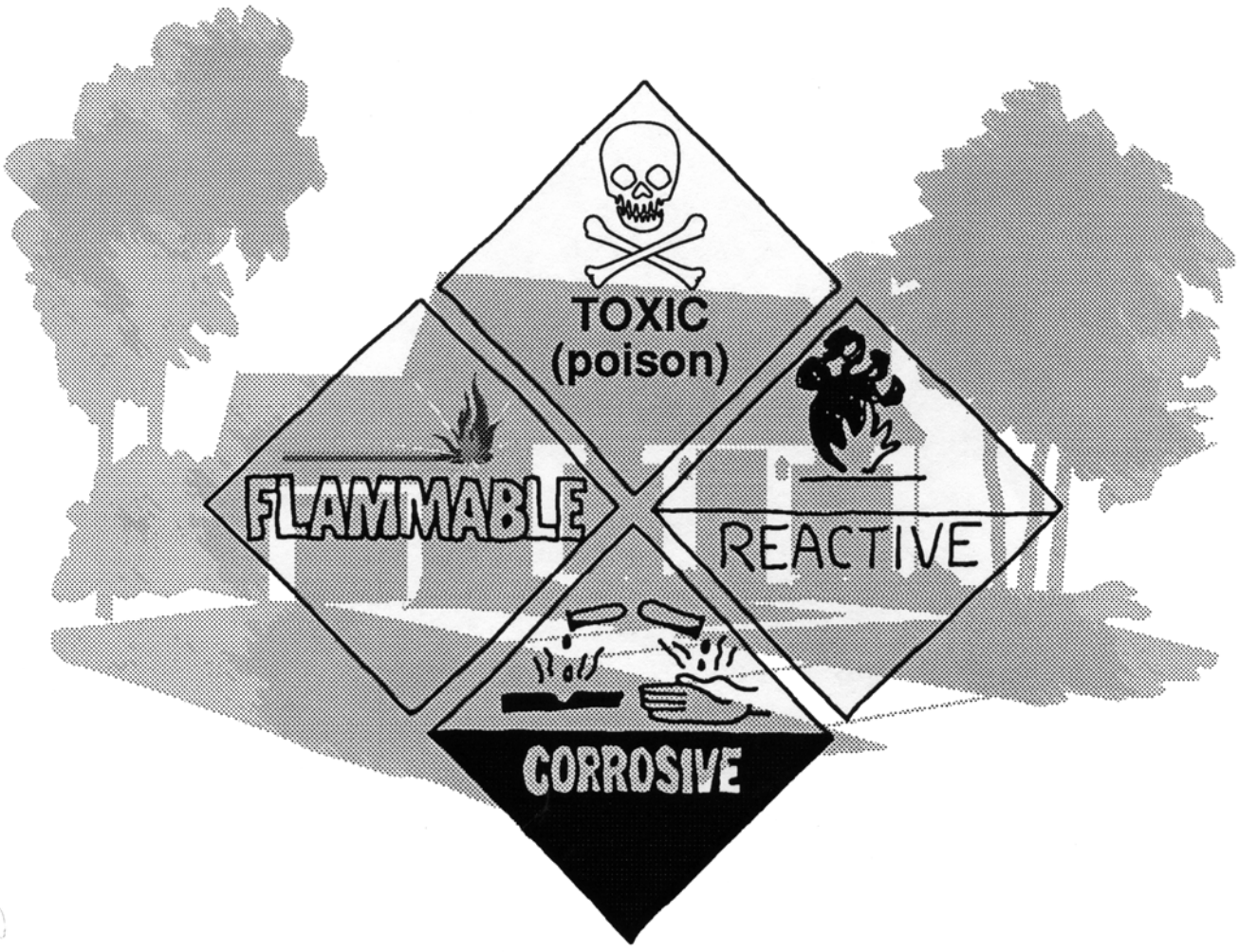
# Household Hazardous Products and Hazardous Waste: A Summary for Consumers




PENNSTATE

College of Agricultural Sciences
Agricultural Research and Cooperative Extension

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## A. Hazardous Waste—Not Your Ordinary Pile of Trash

Hazardous waste. The term brings to mind images of Love Canal (New York) residents forced to leave their homes and clean-up crews dressed like astronauts in protective clothing. This is scary stuff. A total of 32,000 hazardous waste sites have been logged in the U.S. Environmental Protection Agency (EPA) inventory (1990). Hazardous waste generated by industry has gained national attention. As a nation, we have begun to take steps toward proper management of these materials. In the last ten years the disposal of industrial hazardous waste has become highly regulated. Although the problem is far from resolved, progress has been made.

### How Is Hazardous Waste Regulated?

The term hazardous waste has a legal meaning. Any waste that is toxic, flammable, corrosive, reactive, radioactive, infectious, or has been specifically identified by the EPA is considered hazardous. Basically, the amount of hazardous waste generated, not the type, determines how strictly the waste is regulated. *Large quantity generators* are those industries and businesses that generate more than 220 pounds of hazardous waste and/or 2.2 pounds of acutely hazardous waste per month. Large quantity generators are highly regulated by both federal and state hazardous waste laws.

*Small quantity generators (SQGs)* are those businesses, institutions, and agencies that generate less than the above amount. The types of SQGs are surprising. Examples include farms, some craft businesses (pottery, glass working), auto dealerships, service stations, transportation services (bus, taxi fleets), cleaning services (carpet and upholstery cleaning, dry cleaning), printing companies, photography labs, golf courses, and even some schools.

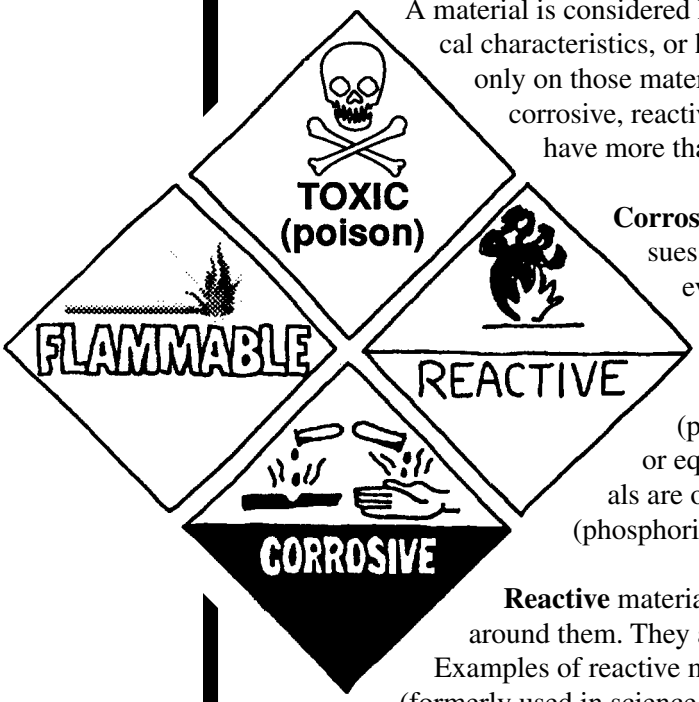
A lesser-known crisis, however, is just beginning to unfold. Upon examining the types of household and small business waste, we are becoming aware that these wastes are the same type of hazardous waste generated by large industry. Although the actual amount of hazardous waste coming from one house or business may be small, the cumulative amount from all the households and small businesses in the U.S. adds up to a profound threat to the environment. There are few laws governing hazardous waste from households. Therefore, this waste may legally enter disposal facilities that are not equipped to treat it.

Household hazardous waste (HHW) is becoming the next focus of municipal waste management. As we look for ways to reduce the volume of the trash we generate, we must also examine how we can reduce its toxicity. The exact amount of household hazardous waste generated per person is unknown. Estimates put the range at 3–10 gallons per household per year (or the equivalent of approximately 6 pounds of household hazardous waste per person per year). Some states have taken initial steps to reduce the environmental impact of household hazardous waste by banning certain types from landfills, educating consumers on hazardous products, and requiring product manufacturers to decrease the amount of hazardous substances in consumer products.

## B. Household Hazardous Waste and Products

Household hazardous waste is the unwanted portions of those products that contain hazardous ingredients. Hazardous products generally fall into five categories: **automotive, cleaning and polishing, paint and related solvents, pesticides,** and **miscellaneous items** (examples include batteries, fingernail polish remover, some cosmetics, and shoe polish). These products are considered hazardous because they can be toxic, flammable, corrosive, and/or cause violent chemical reactions.

## What Makes Something Hazardous?




A material is considered hazardous if it is radioactive, has dangerous biological characteristics, or has certain chemical properties. This guide focuses only on those materials that are considered hazardous because they are corrosive, reactive, flammable, and/or toxic. Many hazardous products have more than one of these hazardous characteristics.

**Corrosive** materials destroy metal surfaces and living tissues. They chemically change what they touch. Practically everyone in the northern states has seen corrosion in one form or another. Road salt used on icy roads is famous for its ongoing "corrosive" relationship with automobiles. Corrosive substances are acidic (pH less than or equal to 2) or caustic (pH greater than or equal to 12.5). Some examples of corrosive materials are oven cleaner (sodium hydroxide), bathroom cleaner (phosphoric acid), and pool chemicals (hydrochloric acid).

**Reactive** materials are very unstable and interact with the substances around them. They are explosive, and can sometimes create toxic fumes. Examples of reactive materials found in the home or school are picric acid (formerly used in science labs), welding material (calcium carbide), and certain rodenticides (zinc phosphide).

**Flammable** materials will burst into flames if they come into contact with sparks or flames at certain temperatures. The temperature at which this happens is referred to as the flash point. Flammable liquids have a flash point of 140° Fahrenheit. Examples of ignitable materials found in the home are nail polish (acetone), paint remover (toluene, xylene), and hair spray (butane).

**Toxic** materials cause immediate or long-term negative health problems. Exposure to toxic materials may result in injury, illness, or death. Examples of toxic materials found in the home are paint stripper (methylene chloride), pesticides (chlordane), and wood preservatives (pentachlorophenol).

In some cases, the only difference between some of the hazardous chemicals used in some industrial processes and those used in consumer products is that consumer products contain smaller amounts and/or dilute concentrations. For example, the industrial-strength solvent methylene chloride (suspected to cause cancer) is sometimes used in oven cleaners but is regulated when used as a pesticide in larger quantities.

Household hazardous products cause problems in both their use and disposal. They pose health risks during use. If the unwanted portions of these products go down the drain, into the trash, or get burned, they may threaten the environment.

# II. The Route of Household Hazardous Waste

## A. Household Hazardous Waste and the Environment

### Improper Disposal of Household Hazardous Waste

Most household hazardous waste is eventually landfilled or incinerated, dumped directly on the ground, or poured down drains (entering septic systems or sewers). Disposing of household hazardous waste in these ways threatens environmental quality.

### 1. Into the Trash

Anything that gets thrown away with the regular trash is landfilled, incinerated, or composted.

#### *Landfills*

Landfills are not isolated; they are connected to the environment. Rain, snow, and other precipitation enters landfills and mixes with the landfill contents, including hazardous wastes. If the hazardous waste is water soluble, then it will be dissolved and carried wherever the water takes it. If it is not water soluble, it will probably remain intact and travel suspended in the water. This contaminated water (called leachate) trickles down through the layers of trash and can enter the environment if it does not encounter any type of barrier.

Even lined landfills are not designed to treat hazardous waste. Some types of hazardous wastes can destroy the synthetic liner, making it ineffective. Leachate contaminated with hazardous waste cannot be completely cleaned at the wastewater treatment facilities to which it is sent. Leachate, contaminated by hazardous waste, can potentially enter the water cycle.

Landfill conditions influence what happens to household hazardous waste. The amount of oxygen and moisture in the landfill and the surrounding soil characteristics affect how fast household hazardous waste containers or metal battery casings will degrade. Water in a landfill may also react with different types of hazardous waste. For example, lithium, found in a type of dry cell battery, may react violently with water found in a landfill.

Since the chemical makeup is vastly different among the different types of household hazardous waste, one cannot make a general statement about what happens to household hazardous waste in a landfill environment. The long-term effects of household hazardous waste in landfills are unknown because studies are so recent.

#### *Incinerators*

Although incinerators are equipped with pollution control devices, some pollutants found in hazardous waste are difficult to capture. Some components of the household hazardous waste stream are particularly troublesome. For example, at the high temperatures that occur during incineration, mercury (found in some dry cell batteries, fluorescent light bulbs, and old paint) can change into a gas and be emitted through the stack of the incinerator. There is controversy about how effective incinerators are in capturing all pollutants. Some believe that existing air pollution control equipment, such as "scrubbers," is effective at capturing pollutants before they leave the stack. However, the most efficient technology (spray dry/fabric filter) can only remove 75–85 percent of the mercury. Airborne mercury is soluble in water and finds its way into lakes, streams, and groundwater, where it can enter the food chain. Also, the ash left over from incinerator burning may contain concentrated amounts of some hazardous chemicals.

Once airborne, hazardous substances may react with other contaminants and form a new substance, become dissolved in water droplets, and eventually fall to the earth as rain or as larger particles (dry precipitation). The amount of time a material is in the atmosphere depends on how stable it is. Unstable compounds, such as carbon monoxide, are short lived in the atmosphere. Stable compounds remain in the atmosphere for long periods of time and can cause much damage.

#### *Co-composting*

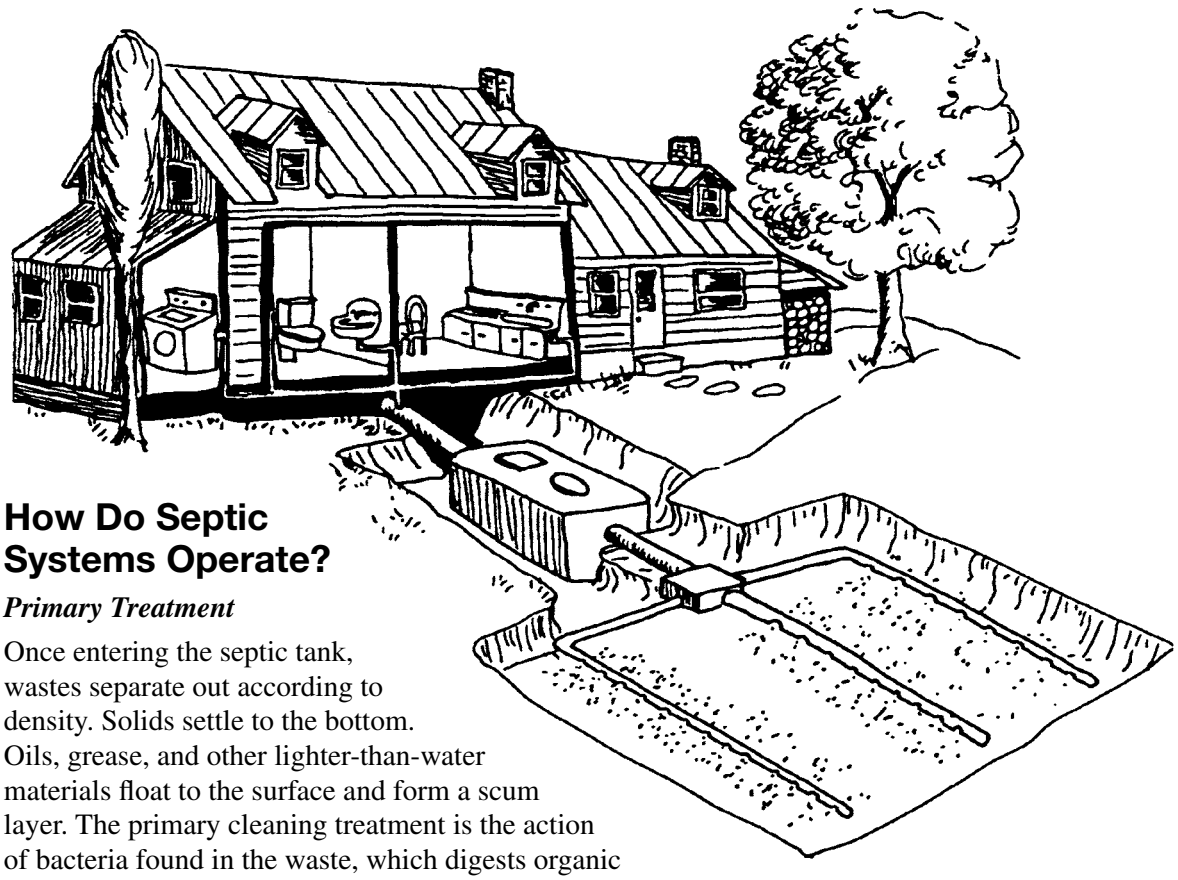
Many towns are considering co-composting (composting "regular trash" with "traditional compost material").

## 2. On the Ground

If dumped directly on the ground, the first thing household hazardous waste will encounter is soil. Hazardous materials must be dissolved or suspended into liquid before moving through soil. How thick this solution or mixture is (its viscosity) determines how fast it moves. Soil type also influences how fast and how far household hazardous waste will travel. Soil characteristics such as porosity (the amount of space between the soil pores) influence the contaminated water's movement. The larger pore spaces found in sandy soils permit easier movement of moisture than do the smaller spaces of clay soils. Geological factors (rock formations, fractures, faults) also affect the direction and extent of hazardous waste movement. Thus, household hazardous waste that is dumped may contaminate the surrounding soil or percolate down and potentially contaminate groundwater.

## 3. Down the Drain

Anything that is poured down the drain enters either a septic system or a wastewater treatment facility and ultimately enters the water cycle.



### How Do Septic Systems Operate?

***Primary Treatment***

Once entering the septic tank, wastes separate out according to density. Solids settle to the bottom. Oils, grease, and other lighter-than-water materials float to the surface and form a scum layer. The primary cleaning treatment is the action of bacteria found in the waste, which digests organic compounds. Wastewater leaves the tank and drains into the leach field.

***Secondary Treatment***

The leach field consists of perforated distribution pipes, which distribute the wastewater beneath the ground's surface into the surrounding soil. Soil particles physically or chemically attract and retain sewage nutrients, metals, and pathogens. Microorganisms living in the soil further break down the waste. Periodically, septic tanks must be pumped out in order to operate effectively.

*Septic Systems*

The septic system, located "on site," treats a building's wastewater before releasing it back into the environment. However, like incinerators and landfills, septic systems are not designed to treat hazardous waste. Hazardous waste, including excessive amounts of drain openers and cleaners containing lye and strong bleach, may negatively affect the system's natural cleansing process by destroying bacteria needed to clean the water. Without these bacteria, certain pathogens will travel through the system unchanged. Since the system is not designed to treat chemical waste, household hazardous waste passes through the system unchanged and can potentially contaminate ground and surface water.

*Wastewater Treatment Facilities*

Wastewater treatment facilities operate on the same principle as septic systems, except on a much larger scale. Wastewater from residences and businesses is treated at a central location, rather than on site. At the central location, wastewater goes through a series of treatments before it is released into local water sources. Wastewater treatment facilities are not designed to treat hazardous wastes.

Treatment processes include:

- Screening to remove large objects and sand
- Primary settling to allow the solids to settle as sludge and to skim grease off the top
- Aeration to allow air to circulate, which facilitates the breakdown of wastes
- Final settling to remove sludge after it settles out completely
- Disinfection to further purify water by adding chlorine; further water treatment, such as adjusting the pH level, may be necessary

## How Long Will Household Hazardous Waste Be Hazardous?

How long a hazardous material remains active in the environment depends on its individual characteristics. If it is persistent, it will remain unchanged for significant time periods. Persistent chemicals move through food chains, concentrating in the tissues of organisms at each step in the food chain (called bioaccumulation). Heavy metals are persistent in the environment. The most common heavy metals found in the waste stream are **mercury** (dry cell batteries, fluorescent light bulbs); **lead** (batteries, motor oil and filters, lead solder on light bulbs and circuit boards); and **cadmium** (batteries, plastics, appliances, electronics, and some pigments). Nonpersistent chemicals (such as ethylene glycol, the primary ingredient in antifreeze) undergo physical and chemical changes in the environment. These chemicals may break down or become diluted to the point where they are no longer harmful to the environment.

### Septic Tank Additives

Septic tank additives, marketed as ongoing maintenance or remedies for septic tank problems, can actually do more harm than good. Some septic maintenance products are banned in many states, as they contain dangerous chemicals that can destroy a leach field and contaminate groundwater. Consult professionals about leach field problems, rather than using hazardous additives.

## Household Hazardous Waste and the Water Cycle

Ultimately, the improper disposal of household hazardous waste leads to its entrance into the water cycle. Precipitation falls to earth, entering oceans, lakes, and streams or trickling down through the soil. That water that enters the soil may travel until it reaches an impermeable barrier (such as bedrock). This water collects underneath the earth's surface and is called groundwater. It is stored in the surrounding sand, gravel, or other sediment.

Groundwater is not the final resting place for water. Although it moves very slowly, groundwater is constantly on the move. Groundwater eventually flows to the surface (streams, springs, swamps, ponds, or lakes), where it evaporates into clouds or is taken into living things. The whole process then starts over again. It is this constant cycle between surface water and groundwater that spreads water pollution.

### Why Should You Be Concerned About Groundwater Contamination?

Between 40 and 50 percent of the U.S. population depends on groundwater as its primary drinking water source. Over 37 percent of Pennsylvanians rely on groundwater for their primary source of water. In rural areas, almost everyone depends on groundwater.

## The Water Cycle

Groundwater contamination occurs when polluted surface water or precipitation percolates through the soil. Since groundwater constantly interacts with the entire water cycle, contamination spreads easily. Since this cycle is continuous, contaminated groundwater can also feed and contaminate lakes, ponds, and streams.

## B. Hazardous Products and the Human Body

Our bodies are constantly interacting with the environment. That environment contains both helpful and harmful substances. Hazardous products in our environment may contain toxic ingredients that may harm our bodies.

### How Do Substances Enter Our Bodies?

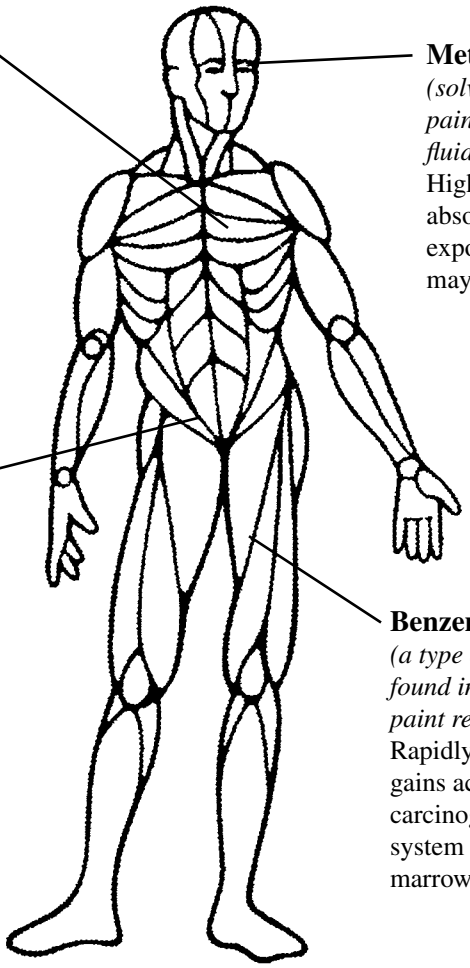
Substances enter our bodies through our mouths (ingestion), our skin and eyes (absorption), or our noses (inhalation). All these ways bring toxic substances into our bloodstream. Once in the bloodstream, toxic substances are carried to cells all over our bodies.

If we ingest toxic substances, they enter our digestive system. After passing through our stomach and intestines, substances enter our bloodstream. Substances that directly contact our skin and eyes can damage them at the point of contact or pass into our bloodstream. Inhaling toxic substances causes the most damage to humans. After substances are inhaled, they travel to our lungs. Since the lungs are composed of highly permeable tissues, toxic substances are easily absorbed into our bloodstream.

#### Consider This

Almost every chemical can be toxic in excessive amounts or in high concentrations. It is often the dose that determines a substance's lethality (the amount that causes death). For example, the "average-size adult" would die if he/she ingested at one time 32 gallons of water or 100 cups of coffee (caffeine) or between 100 and 400 pounds of potatoes (solanine).

## Toxic Substances and the Human Body



**Methylene Chloride**
*(organic solvent found in paint and varnish removers, pesticides, and degreasers)*
Suspected human carcinogen; aggravates heart conditions, possibly causing heart attacks

**Methanol (wood alcohol)**
*(solvent found in antifreeze, paints, and windshield wiper fluids)*
Highly toxic and readily absorbed through all routes of exposure; blindness or death may occur following ingestion

**Cadmium**
*(heavy metal found in paint pigments, rechargeable batteries)*
Causes kidney and bone damage; persistent in the body; accumulates in the food chain

**Benzene**
*(a type of petroleum distillate found in some varnishes, lacquers, paint removers, and gasoline)*
Rapidly absorbed by blood; gains access to vital systems; carcinogen; causes central nervous system disorders; powerful bone marrow poison

### Toxins in the Body

A toxic substance can either affect the place where it enters the body **(local)** or have far-reaching effects all over the body (**systemic**). A skin rash is one example of a local effect, and a change in heart rate or mental confusion are examples of systemic effects. When the combined effect of two toxic substances is different from the sum of their individual effects, this is a **synergistic reaction**.

It is often difficult to know the true effects of a particular toxic substance in the body because the effects may not appear right away. A **chronic**, or long-term, health effect usually results from repeated exposure to small amounts or low concentrations of a toxic substance over the years. In contrast, an **acute** reaction is a short-term effect and usually results from a single exposure to a high dose of a toxic substance.

Our bodies have several ways of dealing with ingested, absorbed, or inhaled toxins. Some toxins can be **excreted** in unchanged forms and leave the body through exhaled air, perspiration, feces, urine, tears, vomit, hair, and breast milk. Toxins can also be modified so that they are water soluble and can be removed by the kidneys. Some toxins, in small doses or low concentrations, are **metabolized** and their toxic properties are lessened. Some toxins do not leave the body and accumulate in various parts of the body, such as fat tissues and bones. This process of accumulation in bodies is how some toxic chemicals are able to move through the food chain. These toxins become more concentrated as they move up the food chain from prey to predator.

### Toxicity: A Relative Term

Toxicity is a relative term. The effects of hazardous substances vary greatly. Our reaction depends on how much of the substance we were exposed to, the concentration of that substance, the length of exposure time, and our individual characteristics. Characteristics influencing toxicity include:

1. **Genetic factors**—For example, the efficiency of the kidney can affect the ability to excrete toxins.
2. **Lifestyle of the individual**—Smoking, alcohol consumption, obesity, and previous medical history all affect how the body handles toxins. In general, healthier individuals will be better able to fend off some toxins.
3. **Gender**—Some toxins have different effects on males and females. Generally, women have a larger percentage of fat in their total body weight, meaning they can accumulate more fat-soluble toxins in their bodies than men.
4. **Age**—The very old and the very young are more susceptible to the effects of toxic substances. Infants and young children have incompletely developed systems. Since children have higher respiration rates, they are more susceptible to toxins through inhalation.
5. **Allergic sensitivity**—Many individuals who are particularly sensitive to chemicals experience an allergic reaction to some toxic chemicals, even in low amounts and concentrations.

# III. Household Hazardous Products: Problems and Solutions

## A. Looking at Labels

Federal regulations require that certain information appear on hazardous product labels. The **Federal Hazardous Substances Act (FHSA)** established labeling requirements for consumer products containing hazardous substances, except for pesticides. The following information is required to appear on hazardous products:

- Signal words (**danger, warning, caution, poison**). These three words give some hint of how hazardous a product is. Products labeled "Danger" are the most hazardous and those labeled "Caution" are the least hazardous
- Description of the hazard associated with the product (for example: flammable, poison)
- Common chemical name for the hazardous ingredients
- Instructions for safe use and handling
- First aid instructions
- Name and location of manufacturer or distributor
- "Keep Out of Reach of Children" statement or the equivalent

Hazardous products are regulated only in terms of their acute health effects. Chronic health effects are not taken into consideration, and very few studies have been conducted to determine just how dangerous those effects are.

Trade secrecy laws allow manufacturers to omit listing or specifically defining ingredients on labels if doing so would cause them economic loss. Manufacturers are required to disclose the exact product ingredients to physicians treating a patient. While this law protects manufacturers, it prevents consumers from knowing exactly what they are buying.

#### *Vague Language*

Manufacturers sometimes use generic terms or vague language rather than reveal the specific chemical identity of their products. Two common generic terms are **petroleum distillates** and **organic solvent**. Petroleum distillates are a broad range of compounds that are made when crude oil is refined. Petroleum distillates have varying degrees of toxicity, ranging from highly toxic benzene to petroleum jelly (generally accepted as nontoxic). Specific organic solvents similarly have a wide range of toxicity and flammability. Organic solvents include acetone, isopropyl alcohol, and methylene chloride.

Some "ingredients" listed on labels describe the function of the chemical ingredient (grease cutter, corrosion inhibitor, polishing agent) rather than telling the consumer what specific chemical ingredients are used.

#### *Misleading Terms*

Some terms may be deceptive, such as "active" and "inert." The term "active" refers to those ingredients that actually do what the product is intended to do. "Inert" refers to any other substances in the product, usually the "vehicle" that makes the active ingredient easy to apply and allows it to perform the job. Consumers often assume that "inert" means nontoxic. Inert ingredients may be just as hazardous as the active ingredients, or even more so. For example, methylene chloride, a carcinogen, is often an inert ingredient in disinfectants.

Another misleading term that is used is "nontoxic." It is important to note that "nontoxic" has no regulated definition and therefore the manufacturers may use it as they desire.

#### *Incorrect First Aid Advice*

Consumers should never assume that first aid information listed on labels is correct. A study conducted by the New York Poison Control Center found that 85 percent of the product warning labels studied were inadequate or incorrect. Call your local poison control center for thorough first aid information.

### Selling Alternative Products—It's Not Easy Being Green

It is difficult to determine if "green products" are truly environmentally safe because many advertising claims ("green," "environmentally friendly," "nontoxic") have no legal definition. Many of these products have not been analyzed for their long-term health and environmental effects.

### Consumer Protection

Consumers do have some legal protection against hazardous products. The **Consumer Product Safety Act** (1972) established the Consumer Product Safety Commission, an agency that is empowered to "protect the public against unreasonable risks" associated with consumer products, including chemical hazards. The EPA also has the authority to ban products that are proven to be too hazardous under the **Toxic Substance Control Act** (1976).

## B. Specific Types of Household Hazardous Products

## 1. Automotive Products

In the U.S. there are about 180 million cars, buses, and trucks on the road. There are hundreds of products associated with motor vehicle operation and maintenance that contain hazardous substances. People who do their own repair work ("Do-It-Yourselfers" or DIYs) need to be aware of those hazardous products and what to do with them. Whenever the number of DIYs increases (for instance, when the cost of having a car repaired and maintained rises), the likelihood of improper disposal of these hazardous fluids soars.

#### ANTIFREEZE

### What Are the Problems?

The primary ingredient in antifreeze is ethylene glycol, a highly toxic substance. Pets are particularly susceptible to ethylene glycol poisoning because they are attracted to its sweet taste. Antifreeze eventually becomes ineffective in a radiator and needs to be changed. If the resulting waste antifreeze is dumped on the ground, it can contaminate ground and surface waters.

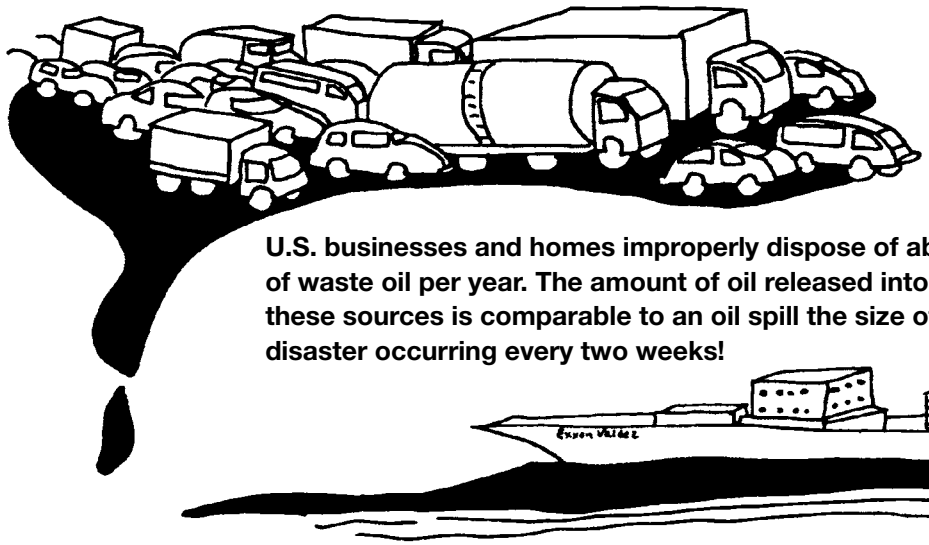
### What Are Some Solutions?

#### *Less Toxic Antifreeze*

Less toxic antifreeze has propylene glycol as the active ingredient, rather than ethylene glycol. There is a question, however, about propylene glycol's effectiveness in extremely cold climates.

#### *Recycling Antifreeze*

Used antifreeze can be recycled, and its original properties can be reclaimed. Recycled antifreeze can be used again as engine coolant or the ethylene glycol can be extracted and reused in the plastics industry. Gas stations may accept small amounts of household antifreeze. Most household hazardous waste collection programs accept waste antifreeze.



**U.S. businesses and homes improperly dispose of about 260 million gallons of waste oil per year. The amount of oil released into the environment from these sources is comparable to an oil spill the size of the *Exxon Valdez* disaster occurring every two weeks!**

## MOTOR OIL

### What Are the Problems?

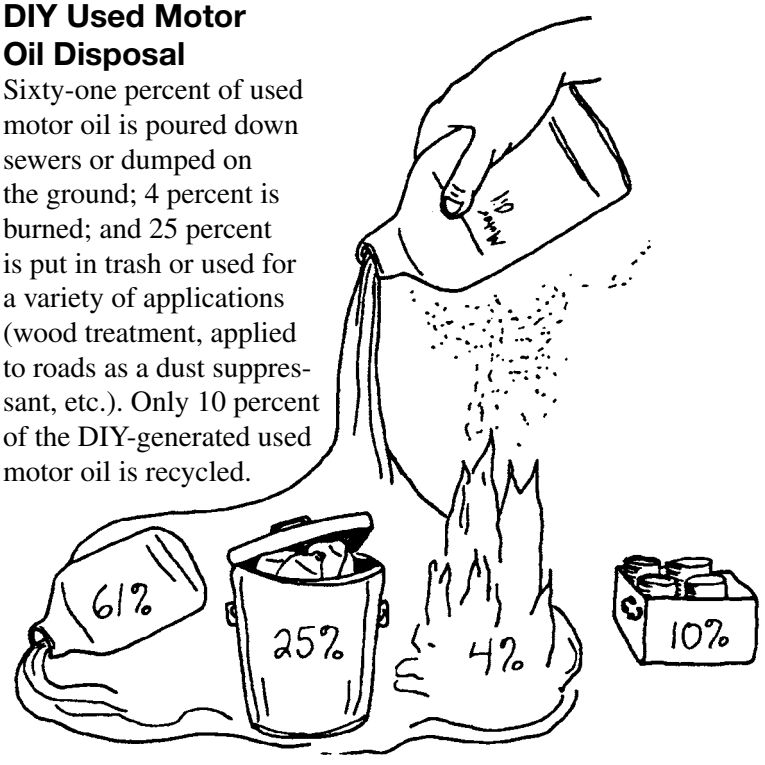
Motor oil contains many hazardous substances. The most significant ones are petrochemicals (benzene, xylene) and certain additives. As motor oil is used in the vehicle, it picks up heavy metals: lead, arsenic, cadmium, and chromium. Due to contamination, cars require oil changes; therefore, a hazardous waste results.

In addition to cars, waste motor oil comes from many sources. Some of these sources include boats, farm and construction equipment, and lawn mowers. Changing a vehicle's motor oil is probably the most common task done by DIY mechanics. About half of all the U.S. automobile owners change the oil themselves, adding up to a big problem. **If allowed to enter water used for drinking, the amount of used oil from a single oil change (4 quarts) can ruin a million gallons of water—one year's supply for 37 people!**

The majority of used motor oil disposal methods are environmentally unsound. Direct dumping or sending it to a landfill threatens groundwater quality, while burning used motor oil may result in high levels of hazardous emissions into the atmosphere.

### DIY Used Motor Oil Disposal

Sixty-one percent of used motor oil is poured down sewers or dumped on the ground; 4 percent is burned; and 25 percent is put in trash or used for a variety of applications (wood treatment, applied to roads as a dust suppressant, etc.). Only 10 percent of the DIY-generated used motor oil is recycled.




### What Are Some Solutions?

#### *Recycling Used Motor Oil*

Although there aren't any less hazardous substitutes for motor oil, there are recycling opportunities. Once collected, used oil is either reprocessed or re-refined. Both methods remove contaminants. However, re-refining produces a cleaner product, a lubricating oil, while reprocessing produces a lower grade fuel oil. In today's economy, it is cheaper to reprocess used oils than to restore them to meet the higher specifications of lubricating oil.

### Used Oil = Energy

- If all used oil improperly managed by DIYs in the U.S. were recycled, enough energy to power 360,000 homes each year or 96 million quarts of high-quality motor oil could be produced.
- If all the used oil improperly disposed of were recycled, we could save 1.3 million barrels of oil per day!

Therefore, most used motor oil collected in the U.S. is reprocessed. Neither method, however, is 100 percent environmentally safe. Both reprocessing and re-refining generate some hazardous waste.

**For used motor oil recycling opportunities in your area, contact your local solid waste authority or your regional Department of Environmental Resources office (DER).**

Collection centers will not accept contaminated used motor oil. Make sure the collection containers are covered, so dirt and other foreign substances are prevented from entering. *Do not mix used oil with water, solvents, or other materials!*

***Burning Used Oil***

There is a big difference between burning used oil in wood stoves and burning it in used oil furnaces. Used oil contains heavy metal contaminants that are released into the atmosphere if burned in a wood stove or brush pile. Used oil furnaces, such as those used in some gas stations, burn at higher temperatures and are designed to meet emissions standards for various air pollutants.

#### WET CELL BATTERIES

### What Are the Problems?

Vehicle and marine batteries ("wet cell" or lead-acid batteries) contain lead and sulfuric acid. In fact, the average battery contains 17.5 pounds of lead and 1.5 gallons of sulfuric acid. That's a lot of hazardous material! Nationwide the lead from these batteries accounts for two-thirds of all the lead entering landfills.

### What Are Some Solutions?

There are opportunities to recycle wet cell batteries. As much as 80 percent of wet cell batteries in the U.S. are recycled because the lead is easily recovered. Recycling wet cell batteries represents an effective "closed loop" system, as 60 percent of the lead used in making new batteries is from recycled lead. In Pennsylvania, retail stores that sell car batteries are required by law to accept used batteries for recycling at the time of purchase.

#### OTHER HAZARDOUS VEHICLE MAINTENANCE SUBSTANCES

Other hazardous products associated with vehicle maintenance include automatic transmission fluid, brake fluid, and windshield wiper fluid. Before disposing of any automobile fluids, check with your service station to see if they will accept small amounts. Although gasoline generally does not generate any waste, it is considered one of the most hazardous substances to store in the house because it is highly flammable and toxic. Gasoline is easily absorbed into the body, especially through inhalation. Gasoline can cause a variety of health problems, including blood and kidney damage, developmental disorders, and cancer. Extreme caution should be used when pumping gas into vehicles.

## 2. Cleaning and Polishing Products

### What Are the Problems?

The average house contains a wide variety of brightly colored cleaning products that promise to make life easier. These time-saving products also have a dark side, as many contain hazardous ingredients. Use of cleaning products is probably the most common way we come in contact with hazardous substances. Since they are so common, their hazardous nature is often ignored. They are often used and stored in ways that can make poisoning more likely.

## Potential Health Hazards of Common Household Cleaners

| Product Type | Possible Hazardous Ingredients | Potential Health Hazards |
|---|---|---|
| air freshners | formaldehyde | toxic; carcinogen |
| bleach | sodium hypochlorite | corrosive, causes burns; mixing with ammonia creates a deadly gas |
| disinfectants | phenols | very toxic; flammable; respiratory, circulatory, or cardiac damage |
| drain cleaner/ oven cleaner | sodium or potassium hypochlorite | corrosive; causes severe burns and tissue damage if swallowed |
| floor cleaner/wax furniture polish | diethylene glycol | toxic; central nervous system depression, kidney and liver damage |
| | petroleum distillates | highly flammable; some are carcinogens |
| spot removers | perchlorethylene | suspected carcinogen |
| | ammonia hydroxide | corrosive; irritates skin, eyes, respiratory tract |
| toilet bowl cleaner | hydrochloric acid | corrosive; ingestion may be fatal |
| window cleaners | ammonia | toxic vapor irritating to lungs, eyes, and skin |

There is a wide spectrum of toxicity associated with cleaning products, ranging from less hazardous window cleaners to highly toxic furniture polish. Those products of greatest concern include drain openers/ cleaners, furniture polish, oven cleaners, rug and upholstery cleaners, and cleaning products containing organic compounds and solvents.

In comparison to other hazardous products (paints, batteries, motor oil, etc.), cleaning products pose less of a disposal problem. This is in part due to how cleaning products are used. Most people use up the product completely before throwing the container away. Cleaners that are washed down the drain are generally diluted to the point where they are not harmful. Excessive amounts, however, may pose environmental problems, especially where houses use septic systems.

### Key Ingredients for Effective Alternative Cleaners

- Prevention
- Elbow grease

Health risks associated with using hazardous cleaning products are of greater concern. Since cleaners are so common in our lives, people frequently do not regard cleaners as hazardous and do not follow the label instructions. Hazardous products are rarely used with adequate ventilation. Toxic cleaners stored in unlocked cabinets are the cause of many poisonings of young children. Each year 5 to 10 million household poisonings are reported, usually the result of accidental ingestion of common household cleaners.

Hazardous cleaners in aerosol form are of particular concern. A person using an aerosol spray is surrounded in a fine mist of the hazardous product. The mist can remain airborne for hours and can easily be inhaled into the lungs. If the aerosol spray is misdirected, chemical burns and eye injury can result.

We know the health effects of acute exposure to hazardous products. We do not know, however, the long-term health effects of using small amounts of hazardous cleaning products over a lifetime. Most people using toxic household cleaners are exposed to them for years and years. For example, small amounts of furniture polish with methylene chloride (a possible carcinogen) may be inhaled by a user once a week over a period of 60 years. What effect this may have on an individual's health is unknown.

### What Are Some Solutions?

One way to reduce or eliminate hazardous cleaner "headaches" is to make homemade cleaners from simple ingredients. These alternative cleaners are made with common kitchen items, but the two main "ingredients" are preventive cleaning and elbow grease. Frequent cleaning and cleaning up immediately as spills occur prevents buildup. In addition to being less toxic, these homemade cleaners are less expensive. The per-ounce cost of homemade cleaners is about half that of commercial products. If you choose to use hazardous cleaners, please try to reduce risks associated with their use.

See Alternative Household Cleaning Solutions (pp. 22–23) for specific suggestions.

## 3. Paint and Related Products

### What Are the Problems?

Paint and related products have toxic characteristics that threaten human health and environmental quality. Paints are especially problematic because such large quantities enter the waste stream, accounting for about half of the household hazardous waste generated. Hazards associated with paint vary with the type of solvent, pigments, and additives used.

#### *Solvents*

Two types of solvents are used in paints: water based (referred to as latex paint) and oil based. Oil-based solvents are considered more hazardous than latex paint. Oil-based solvents may contain mineral spirits (naphtha) or petroleum distillates (toluene, xylene) that are toxic and flammable. Chemicals using oil-based paints tend to be persistent in the environment, and therefore may enter the food chain. Highly volatile solvents used in some oil-based paints build up in the air, increasing exposure to our lungs when we breathe. The EPA determined that paint fumes are the number one indoor air pollutant. As oil-based solvents evaporate, inside air pollution can soar to 1,000 times greater than outside air quality. In addition to their toxic nature, most oil-based solvents are flammable.

#### *Pigments and Additives*

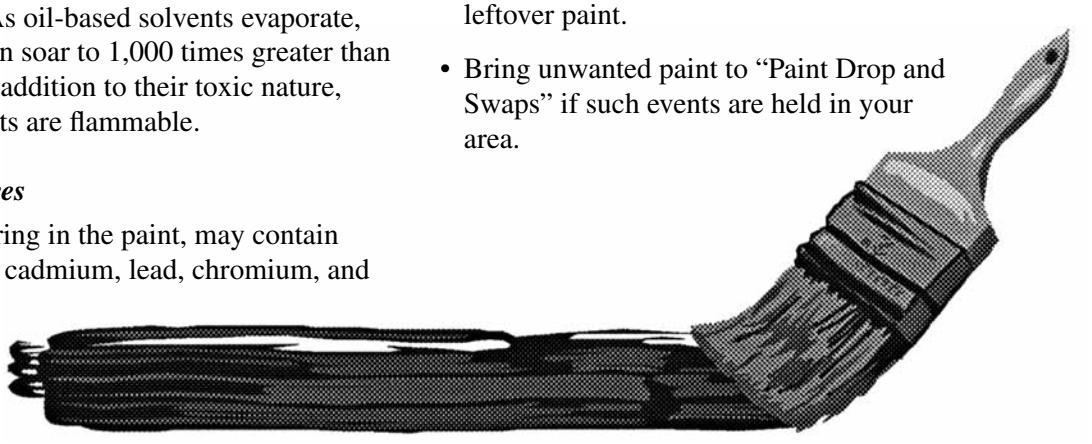
Pigments, or the coloring in the paint, may contain heavy metals, such as cadmium, lead, chromium, and zinc. Paint additives include fungicides, which also may contain heavy metals. Heavy metals remain in the environment and enter food chains.

The paint industry has recently decreased its use of heavy metals. Mercury is no longer used as a fungicide. As of August 20, 1990, mercury was banned from use in indoor latex paints. By May 1991, all paint manufacturers had voluntarily discontinued using mercury in exterior latex paint and coatings. However, older paints (the kind found in basements) may contain significant amounts of lead and mercury.

### What Are Some Solutions?

The following are ways to eliminate or reduce problems associated with paint use and disposal:

- Use water-based paints whenever possible. Since latex paint uses water as its solvent, it is safer to use than oil-based paints.
- "Natural" paints are now being manufactured. Most "natural" paints are manufactured with substances such as beeswax, plant waxes, and linseed oil rather than petroleum-based solvents and use less toxic pigments.
- When using oil-based solvents, use the least hazardous. If you choose to use an oil-based paint or related product, look for those ingredients that are *moderately toxic* (alcohols, ketones, esters, petroleum distillates, and acetone). Avoid *highly toxic* ingredients (benzene, toluene, xylene, methylene chloride, and trichlorobenzene).
- Buy only as much paint as you need to do the job. Calculating the exact amount of paint needed to do the job will avoid the problem of what to do with leftover paint.
- Donate leftover usable paint to groups in need. Please don't dump your problem on someone else. Make sure the groups *truly* have a use for your leftover paint.
- Bring unwanted paint to "Paint Drop and Swaps" if such events are held in your area.



**To help identify the contents of old latex paint, call the National Pesticide Information Center (1-800-858-7378). Houses painted before the lead paint ban may have poisonous paint on the walls. Call your local Health Department or Penn State Cooperative Extension office to find out how to have the paint tested for lead.**

***Paint-Related Products***

Hazardous products associated with paint include thinners, lacquers, turpentine, stains, and strippers. Many of these products contain organic solvents that are flammable and toxic. Other "hardware" products, such as sealants and adhesives, may also contain hazardous ingredients. *Wood preservatives*, technically classified as pesticides because they kill fungus, are one of the most hazardous products found in the home.

## 4. Pesticides

Pesticides are classified according to "target" organisms, or those pests that they are "out to get." For example, insecticides target insects, fungicides target molds and fungi, rodenticides target small mammals such as rodents, disinfectants target microorganisms, and herbicides target various plant species. The most dangerous pesticides are not available for general household use by consumers. Those that are available are more strictly regulated than other household hazardous products. The **Federal Insecticide, Fungicide, and Rodenticide Act (1947, amended most recently in 2008)** regulates pesticide manufacture, labeling, use and disposal for agricultural, forestry, household, and other activities.

### What Are the Problems?

There are both health risks and environmental concerns associated with pesticides. These poisons have become widely accepted in our homes. They are frequently used on food that we grow and eat, and in places where we spend our leisure time. Ninety-five percent of the U.S. population use some type of chemical pest control in their homes, lawns, and gardens every year. About one out of ten homes uses some type of lawn care pesticide.

The most frequently used household pesticides are disinfectants, mothballs/flakes, pet flea collars, "no-pest strips," and lawn/garden care products. Many disinfectants contain toxic solvents (toluene, methylene chloride). Mothballs' strong toxic vapors (naphthalene) easily enter the body by inhalation. Some pet flea products often do more damage to the pets than to the fleas. Especially problematic are those products containing organophosphates and carbamate compounds. As with mothballs, "no-pest strips" constantly emit vapors. The largest growing sector of the pesticide industry is commercial lawn care products.

***Concerns Surrounding Pesticide Use***

**Pesticides work overtime.** Once in the environment, pesticides may do more than their intended purpose. Pesticides can kill not only the pest but its natural predator as well. Thus the natural balance between predator and prey is disrupted.

**Pesticides move away.** Winds blow pesticides hundreds of miles from the original spraying location. Little of the pesticide applied actually reaches its intended victim. Of the approximate 2.5 pounds per acre of pesticide applied each year in the U.S., often less than 0.1 percent reaches the target organism.

**Pesticides can be persistent.** Although natural processes break some pesticides down into nontoxic compounds, some are dangerous for a long time. These persistent pesticides can enter the food chain and travel all over the world. In fact, DDT has been found in the cells of animals in Antarctica.

**"Superpests" are created.** No matter how effective a pesticide is, some pests will survive and reproduce. This next generation will be even more resistant to the pesticide. More than 400 insect species are now resistant to some chemical insecticides.

### A Poison By Any Other Name

Pesticides are poisons by definition and have far-reaching effects on an organism's health. In fact, some pesticides can cause cancer, genetic mutations, or birth defects. A 1987 study by the National Cancer Institute found that children living in homes where household and garden pesticides were used had as much as seven times greater chance of developing childhood leukemia than children who lived in pesticide-free homes.

*What we don't know CAN hurt us!* Some authorities believe that many pesticides have not been adequately tested for their chronic health effects. The EPA is reevaluating the 50,000 registered pesticides (containing about 1,400 different active ingredients) presently on the market. Approximately one-third of commonly used lawn care pesticides have not been adequately tested. This enormous task may take the EPA until the twenty-first century to complete.

*Banned pesticides may still be around.* Banned pesticides still cause problems. Old, unused pesticides are still found in many basements. If you find old pesticides in your house, call the manufacturer to help identify any banned chemical ingredients. If you have banned pesticides, contact your solid waste authority or the Department of Agriculture.

Banned pesticides also come back to haunt us in foods imported from developing nations. Although banned from use in the U.S., many pesticides are still legally manufactured in the U.S. and exported for use in other countries.

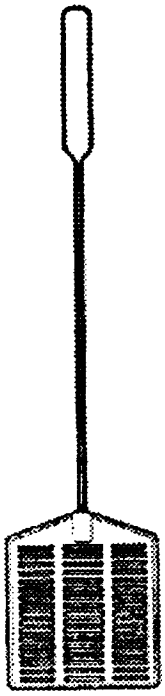
## What Are Some Solutions?

There are many ways to keep the home, garden, and lawn from being overrun by "pests" without using pesticides. An important step in natural pest control is to reassess values. How important is a perfect, round, red apple? What are the health and ecological consequences of a dandelion-free lawn?

The very definition of "pest" needs to be examined. A pest is defined as a plant or animal that is "detrimental to humans." This definition leaves a question about who decides what is detrimental. For example, dandelions are considered by some to be weeds, and by others to be a wildflower and an ingredient for a salad or wine. Dandelions are an integral part of an ecosystem, providing habitat and food to other species in that system. Every "pest" has a role in nature, even though it may interfere with some human activities.

### *Home Hints*

In order to avoid using pesticides, a home must be maintained so that it is unattractive to pests. Some easy ways to achieve a "unattractive" home are to keep the house clean and free from food crumbs, store food in tight-fitting containers, eliminate sources of free-standing water, and fill cracks in the house. Before resorting to pesticides, try mechanical means of pest control, such as fly swatters or window and door screens. Use natural repellents for certain insects species. Basil, dried lavender, cedar chips, or pyrethrum daisy flowers can be used to deter moths. There's no doubt that these nontoxic repellents certainly smell better than moth balls!



### *Garden Ideas*

Gardens, too, can be transformed into places that pests naturally avoid. What is in your garden and its placement help control pests. Some basic ideas include avoiding monocultures (planting one species), planting different species together (companion planting), rotating crop species from one year to the next, and planting species that attack predator species.

*Lawn Care*

Lawn care pesticides are often used for aesthetic reasons. It is important to weigh the possible environmental and health consequences of using lawn care pesticides against the value of a lawn free of crabgrass. Lawns are essentially monocultures, not natural systems, and deplete the soil of nutrients. They are inherently weak and prone to disease. In order to achieve a "perfect golf course look," lawns require lots of energy and chemicals. By accepting a less than "perfect" lawn, one can significantly decrease the use of pesticides. Natural lawn care methods include mowing less frequently, growing a mixture of grass species, watering deeply, and creating a habitat for insect-eating birds and beneficial insects.

## 5. Miscellaneous Household Hazardous Products

### Example: Dry Cell Batteries

### What Is the Problem?

Although dry cell batteries are generally considered safe to use, the sealed heavy metal components (mercury, cadmium, silver) pose a serious disposal problem. Mercury and other heavy metals tend to be persistent in the environment and work their way up the food chain. Chronic exposure to mercury causes kidney, liver and brain damage, as well as birth defects. Air exposure to cadmium may cause lung and kidney damage. Cadmium is also a suspected human carcinogen.

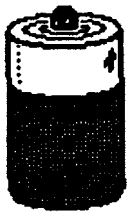
U.S. consumers use many batteries. Battery manufacturers estimate that two billion dry cell batteries are sold in the U.S. each year. The Waste Watch Center estimates that each person in the U.S. generates an average of 1.7 pounds of waste dry cell batteries each year. However, perhaps of greater concern is the quantity of waste batteries generated by commercial, military, medical, and industrial sources. For example, households account for only about 27 percent of the total 172.6 tons of waste button cell batteries (mercuric oxide) disposed of yearly (1988).

It is possible to collect and reclaim some of the heavy metals in dry cell batteries. But, this is easier said than done. Since dry cell batteries contain different types of heavy metals, the batteries need to be separated by specific type of battery. Telling battery types apart can be a very confusing task for the general public. Most people are not aware that the battery used in a flashlight is very different from the battery used in a watch.

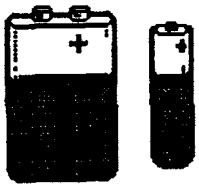
### Types of Dry Cell Batteries

The following list will help you identify types of batteries. Those listed require the most attention due to their contents or volume.

**Mercuric oxide** (button cell) batteries contain significant amounts of mercury (30–40 percent). They are commonly used in hearing aides, medical devices, watches, cameras, etc. Another type of button cell battery is the silver oxide battery.



**Nickel cadmium** (rechargeable) batteries are the top contributor of cadmium (52 percent) to the municipal solid waste stream. "Ni-cads" are commonly used in rechargeable tools, smoke alarms, inside household appliances, and telephones. In theory a nickel cadmium battery can be recharged up to 1,000 times. Generally, one ni-cad battery is recharged enough times to replace 150 alkaline batteries. By using ni-cad batteries, you reduce the amount of mercury entering the waste stream but increase the amount of cadmium.



**Alkaline** batteries (the "long-life C and D cells") contain some mercury. Although the amount of mercury has been steadily decreasing in recent years, the sheer volume of their use raises some concerns. Alkalines are found in numerous products—(toys, flashlights, radios) and have been replacing the **carbon zinc** batteries.

### What Are Some Solutions?

*Source Reduction*

The battery industry is working to decrease the heavy metal content of some batteries. For example, in the past ten years the amount of mercury in alkaline batteries has decreased dramatically. In the early 1980s, batteries reportedly contained 1 percent mercury. By 1992, most major manufacturers had low-mercury brands of batteries containing from 0.025 to 0.1 percent mercury. A "cadmium-free" battery to replace the nickel cadmium rechargeable battery is being developed. Solar batteries are also becoming available.

*Recycling*

At present, very few types of dry cell batteries can actually be recycled. Heavy metals from button cell batteries and ni-cads are collected for reclamation in this country. Collection programs that accept all types of batteries are probably not recycling them. It is often too difficult and dangerous to separate different battery types; therefore, mixed batteries are often disposed of as hazardous waste.

## C. Reduction Begins at Home

Minimizing the use of hazardous products reduces the amount of hazardous waste a household generates. Here are some general guidelines to follow to maintain a less hazardous home.

- **Before you buy a product, read the label.** Look for the words "caution," "danger," and "warning." If the product label has those words, you know you're buying a hazardous product.

### Ask yourself:

- **Can I use something else?** If you find yourself buying a hazardous product, see if you can use another product that does not include hazardous ingredients.
- **Do I really need this hazardous product?** If you do not know of any less hazardous alternatives, weigh the risks of using a hazardous product as opposed to not doing the job at all. Asking this question will help you establish and examine your values. Each person must make this decision based on his/her own priorities.
- **Do I know how much of the product I need?** To avoid the problem of leftover hazardous products, be sure you know exactly how much of the product you need to do the job.
- **Can I safely store and dispose of what I'm buying?** If you decide to buy a hazardous product, make sure you have a place to store it. Flammable products need to be stored away from heat sources; all hazardous products need to be kept dry to prevent corrosion and out of the reach of children. Also, ask yourself if disposal of its excess contents requires special household hazardous waste collection, and if that option exists in your community.

## D. Reducing Risks: General Safety Guidelines for Hazardous Products

At times it is unavoidable to use a product with hazardous ingredients. You can, however, minimize the risks. If you choose to use products that contain hazardous ingredients, be aware of the following safety rules.

**Read labels.** Although product labels do not always give complete information, some precautions may be listed. It is important to understand the directions before using a hazardous product. Please note, however, that antidotes listed on product labels may be inadequate or incorrect. Consult your local poison control center for correct antidote information before using any hazardous product.

**Wear protective clothing.** Gloves, safety glasses, and respirators may be required in order to safely use a hazardous product. Wear clothing other than your everyday clothes when working with hazardous products, and line-dry your clothes if possible (higher dryer temperature could ignite remaining flammable vapors). Also avoid wearing soft contact lenses while using volatile solvents. These lenses can absorb the chemical and hold it next to the eye, causing irritation, burns, or extensive damage. Volatile substances are liquids that evaporate easily into a gaseous form.

**Do not eat, drink, or smoke when using hazardous products.**

**Avoid the "more is better" syndrome.** Do not assume that using more of a product will increase the product's performance. This is especially true when using pesticides. Excessive applications will wipe out beneficial insects as well as pests and cause more harm than good.

**Understand the statement "Use in a well-ventilated area."** This statement is commonly seen on product labels but is rarely defined clearly, and it frequently is disregarded. A well-ventilated area does not mean a workroom with an open window, especially if the wind happens to be blowing in. Work outdoors whenever possible, and if you cannot, be sure to take fresh air breaks during your job. An exhaust fan that removes the fumes (be careful not to recirculate them) from the area is ideal. Wear a respirator if the fumes are toxic.

**Never mix chemicals.** Do not be fooled into thinking that combining two different extra-strength cleaners will produce a super cleaner. Manufacturers are not required to list the exact chemical ingredients on the label; therefore, you can never be sure what it is you are mixing.

**Always replace the caps on containers while using products.** Many products may contain chemicals that are extremely volatile and evaporate quickly into their surroundings. Airborne fumes can be harmful to human and animal health.

**Clean up after using the product.** Remember that the rag you used to clean up the spilled hazardous product now contains those same chemicals. Rags used to soak up solvents become fire hazards. They should be stored in a covered metal container for your protection.

**Keep products in their original containers and out of the reach of children.** The container provides necessary information about the product's use and storage. If placed in another container, the product has a high potential of becoming a "mystery" product. Such mysteries are dangerous. Storing hazardous products in former food containers increases the likelihood of accidental poisonings.

**Use aerosols with caution.** Never puncture the can, as this may cause an explosion. Never place the can near a high heat source. Never throw a partially full or full can in with regular trash; it may explode in a garbage truck when compacted.

**Use it up.** Make sure the entire contents are used up before throwing hazardous products away. If you are unable to do this, call your solid waste authority for information on household hazardous waste collection in your community.

# IV. How Is Household Hazardous Waste Managed?

There are many steps individuals can take to reduce the amount of hazardous waste they generate. However, no matter how much reduction is practiced on an individual level, hazardous waste will not be completely eliminated. Reduction and proper management of hazardous waste needs to be regulated on the state and federal levels.

There is a long road ahead to properly manage hazardous waste, even though progress has been made in the last 15 years. Hazardous waste management is evolving from focusing on waste disposal to exploring source reduction and finding ways to reduce hazardous waste by altering the manufacturing process.

## A. Hazardous Waste Management

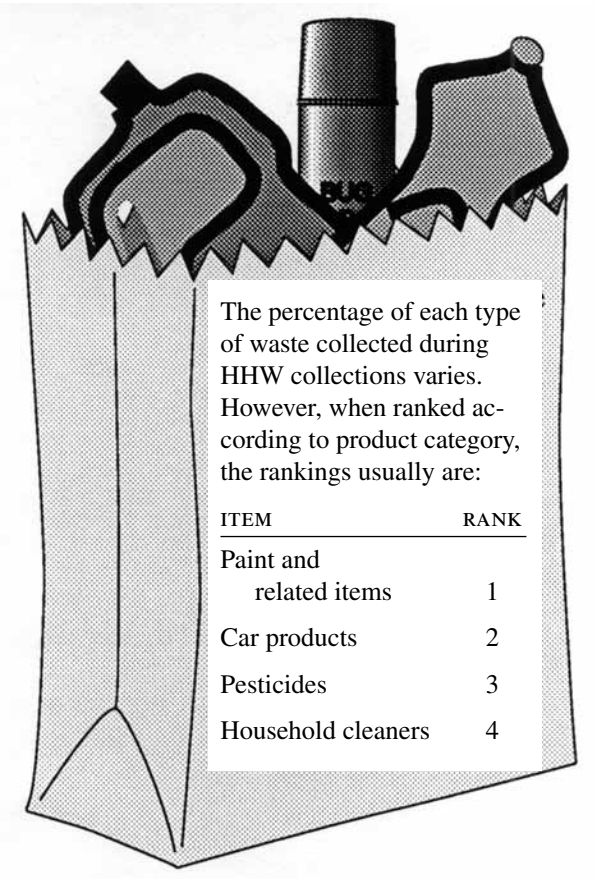
The first recognition of the hazardous waste crisis came with the passage of the Resource Conservation and Recovery Act (RCRA) in 1976. Before RCRA, hazardous waste disposal was not federally regulated. RCRA created federal definition and standards for hazardous and solid waste. RCRA established a "cradle-to-grave" disposal system for hazardous wastes. "Cradle-to-grave" means that hazardous waste generators are responsible for tracking their waste from the moment it leaves the building (its "cradle") to a government-approved hazardous waste disposal facility (its "grave"). Basically, hazardous waste generators must let the federal government know what types of waste they are producing, how much waste they are producing, and how they are disposing of it. The generator's liability does not end at the disposal facility. Hazardous waste generators are accountable for their waste even after it has been disposed. If, for any reason, the hazardous waste disposal facility should cause environmental damage, all those who sent waste there are responsible for the cleanup. These disposal facilities are also regulated by the federal government.

To further refine the system, the **Comprehensive Environmental Response, Compensation, and Liability Act (also known as "Superfund")** was passed in 1980. This law gives the U.S. EPA the authority to clean up groundwater contamination caused by hazardous waste sites and accidental chemical releases. This law empowers the U.S. EPA to fine the companies or persons responsible for the hazardous waste site.

### Hazardous Waste Disposal

No single method can safely handle all the different types of hazardous waste. Wastes, sorted by treatment or disposal category, are shipped to hazardous waste disposal facilities in several states and Canada. States with facilities are becoming increasingly reluctant to accept hazardous waste from states that do not have their own facilities.

### What Is Brought to a Household Hazardous Waste Collection Day?



The percentage of each type of waste collected during HHW collections varies. However, when ranked according to product category, the rankings usually are:

| ITEM | RANK |
|---|---|
| Paint and related items | 1 |
| Car products | 2 |
| Pesticides | 3 |
| Household cleaners | 4 |

Disposal methods for hazardous waste depend on its individual characteristics. Methods include:

***Biological and Chemical Treatment***
These types of treatment are commonly used for watery wastes. Methods involve biological decomposition (with the help of microorganisms), neutralization with other chemicals to decrease acidity, and precipitation to remove suspended solids. Any resulting sludge may be further treated, incinerated, or sent to a hazardous waste landfill.

***Recycling/Reclaiming***
Some types of hazardous waste may be recycled or their constituents reclaimed so that they can be used again. For example, some solvents and lead/acid and dry cell batteries may be reprocessed into useful products.

***Solidification and Stabilization***
Hazardous wastes are made more solid and impermeable through chemical reactions. The resulting mixture is sent to a hazardous waste landfill.

***Fuel Blending***
Solvents and other flammable liquids not suitable for recycling can be blended to make fuel for industrial kilns or boilers.

***Incineration***
Hazardous waste incinerators are designed differently from those used to burn household trash. Hazardous waste incinerators burn at much higher temperatures and are able to destroy some types of hazardous waste. The resulting ash must be sent to a hazardous waste landfill. There is much controversy about an incinerator's ability to completely control pollution. Some believe that toxic emissions are not completely avoided during incineration and are still emitted despite pollution control devices.

***Landfilling***
Any hazardous waste that enters hazardous waste landfills must have already undergone some type of pretreatment. These landfills are designed with pollution control devices, including three impermeable liners, groundwater monitoring systems, and leachate collection systems. Even with these pollution controls in place, some are skeptical about the ability of a lined landfill to control pollution. Many hazardous wastes have been banned from landfills, including PCBs (polychlorinated biphenyls), dioxin, toxic metals, and most organic solvents.

## B. Household Hazardous Waste Management

Household hazardous waste (HHW) is becoming an essential component of solid waste management. Different types of HHW collection programs are being tested to find out which ones work best. Thus far, the cost for collecting HHW has been high and the percentage of the population participating has been low. Given the reality of the high cost of hazardous waste disposal, the management challenge is to target the most dangerous hazardous waste and keep it out of disposal facilities that are not equipped to handle it.

### Single-Day Collections

The first attempt to separate out HHW in the U.S. was sponsored by the League of Women Voters in Lexington, Massachusetts, in 1982. Since then about 2,900 collection days have been held in 46 states. Community groups began the trend by sponsoring events. Government agencies are now also taking responsibility for managing HHW. Collection events have mainly been held for area residents only. Since waste generated by small businesses is regulated differently, they are unable to participate in local collection events.

Although single-day collections are the most common, they may not be the most effective method. Participation rates are generally low, with only 2 to 5 percent of the residents participating. Collection days are expensive: the average cost for a one-day event ranges between $35,000 and $250,000. Unacceptable materials (explosives, dioxin-containing waste, etc.) are sometimes brought to the event. This presents organizers with a dilemma: whether to accept the waste (and the liability that accompanies that waste) at an extremely high cost, or not to accept the waste, leaving its owner frustrated and possibly leading to its improper disposal.

### Permanent Collection Facilities

Permanent collection facilities are becoming more common means of collecting HHW. Permanent facilities are specially designed to store HHW for short periods of time. It is hoped that permanent collection facilities will increase citizen participation because they are more convenient than one-time events. If convenience is the key to successful collection, then mobile collection units may be the best bet yet. Mobile collection units are trailers designed for temporary HHW storage. They are able to travel to various

locations within a community. Some cities even pick up HHW right at the curb. Curbside motor oil collection is the most common type of program. Unattended toxics on the curb, however, are a potential hazard as children and animals could easily spill them or be injured by them.

Once household hazardous waste is collected, it is subject to the same regulations as hazardous waste generated by industries and is disposed of in the same hazardous waste disposal facilities. The ultimate destination of HHW depends on its individual characteristics. For example, many paints and oil-based solvent products are burned in fuel blending.

## C. Source Reduction

### Reduce It; Don't Produce It

The evolution of hazardous waste management continues. The "hot" question is this: is it best to reduce hazardous waste at its source or try to manage a difficult waste problem? The logic is simple: if you don't produce hazardous waste, you don't have to get rid of it.

### Consumer Reduction

Consumer education to increase the awareness of hazardous product use is an essential part of management. Getting consumers to participate in reduction strategies eases the burden of expensive household hazardous waste disposal. A few states across the nation have passed legislation to establish consumer education programs.

### Manufacturing Source Reduction

Industry can also participate in solving the problem at its source. There are many benefits to producing a less hazardous product, including decreasing factory workers' exposure to dangerous chemicals and decreasing the amount of hazardous waste produced. Although manufacturers may have to spend money initially to change processes, they may save money in the long run by reducing hazardous waste disposal costs.

Many industries have already taken steps to reduce their use of hazardous materials. Others may need more convincing. To help them move in this direction, governments can provide incentives (subsidies for less hazardous production methods) and disincentives ("pollution tax").

#### Source Reduction

**Product substitution** is finding nontoxic or less toxic alternatives for the hazardous ingredient(s) in products.

**Product reformulation** is developing new products with fewer hazardous materials that still serve the same function.

**Equipment modification** is improving the efficiency of equipment or buying new machines in order to produce fewer hazardous wastes.

**Process redesign** is changing an industrial process to reduce the output of hazardous effluent by using less water, reusing solvents (making more efficient use of solvents), and other similar approaches.

**Recycling** is using materials within the production cycle more than once, whenever possible.

**Waste exchange** is using one manufacturer's wastes in another manufacturer's production process.

# Alternative Household Cleaning Solutions

Many of the ready-made solutions we purchase to clean and maintain our homes contain poisonous or toxic chemicals. While the labels on these products contain signal words *(caution, warning, danger,* or *poison)* to alert us about proper use or potential harm, many do not list the chemical ingredients in the product or hazards associated with the chemical. In most cases, safer alternatives are available. The basic ingredients listed below can be mixed or used alone for many household cleaning tasks. Also, in the event of an accident, these ingredients can be identified by most consumers and health care professionals.

## Selected Basic Cleaning Ingredients

| INGREDIENT | GENERAL USE |
|---|---|
| baking soda | cleaner, deodorizer, fire extinquisher, scouring powder |
| boiling water | drain cleaner |
| borax* | cleaner, disinfectant, laundry aid, water softener |
| lemon | cleaner, deodorizer, stain remover |
| salt | cleaner |
| soap | cleaner |
| white vinegar | cleaner, deodorizer, grease cutter |
| washing soda* | cleaner, laundry aid, grease cutter, stain remover, water softener, disinfectant. It can be found in the laundry section of grocery stores near the dry bleach. |

*These products are not completely nonpoisonous but are less toxic than their ready-made counterparts.

## Cleaning Hints

- Wear gloves to protect hands.
- Use the simplest, mildest cleaner that will complete the job.
- Never mix bleach with ammonia or products that contain these ingredients. A poisonous gas will be produced.

Use these and other cleaning solutions with caution. Keep cleaners out of the reach of children during storage and use. Penn State assumes no responsibility for the effectiveness of these alternatives.

**Key to Abbreviations**

**c. = cup**
**gal. = gallon**
**T. = tablespoon**
**t. = teaspoon**
**qt. = quart**

## All Purpose Cleaners

1. Mix 1 t. borax with 1 qt. of warm water. Add a splash of lemon juice or vinegar to cut grease.
2. Mix 2 t. borax and 1 t. soap in 1 qt. of water. Can be stored in a spray bottle.
3. Mix 3 T. of washing soda per qt. of warm water.

## Air Fresheners

1. Place desired amount of baking soda in closed areas such as refrigerator and closets.
2. Put 2 to 4 T. of baking soda or vinegar in desired location throughout rooms that need deodorizing.
3. Boil cinnamon, cloves, or your favorite spice.
4. Burn matches or a candle.

## Carpet Deodorizers

1. Sprinkle carpet with baking soda. Wait 15 minutes or longer and vacuum.

## Disinfectant

1. Mix ¼ c. borax in ½ gal. hot water.

## Drain Cleaners

1. Prevention is the best method. Use a drain strainer. Do not pour grease down the drain.
2. For maintenance, pour about 1 gal. of boiling water down the drain weekly.
3. Use a plunger or metal snake (snakes may be available at rental stores).

## Floor Cleaners

1. Wood or vinyl floors. Mix ¼ c. oil soap with 1 gal. of warm water.
2. Use a mild detergent. Add a few drops of vinegar to help remove grease.

## Copper

1. Apply catsup; wash off quickly.

## Silver

1. Rub with a paste of baking soda and water.
2. Place a piece of aluminum foil to cover the bottom of a pan. Add 2 to 3 inches of water, 1 t. baking soda, and 1 t. salt per quart of water and bring to a boil. Add silver pieces and boil 2 to 3 minutes. Make sure the water covers the silver pieces. Remove silver, rinse, dry, and buff with a soft cloth.

## Oven Cleaner

1. Prevention. Put a sheet of aluminum foil on the oven floor. Be careful not to touch the heating element. Clean up spills as soon as they occur.
2. Mix 3 T. of washing soda per quart of warm water. Spray on and wait 20 minutes. Scrub with a fine steel wool pad if necessary.
3. Mix thoroughly 2 t. of borax, 2 t. liquid soap, and warm water. Put in a spray bottle. Spray it on and leave for 20 minutes. Scrub with a fine steel wool pad if needed.

## Tile/Tub/Toilet Cleaner

1. Use soap and sponge or a stiff brush and one of the following: baking soda or borax.

## Window and Glass Cleaners

1. Mix 1 part water to 1 part vinegar in a spray bottle. Wipe off with cleaning cloth. (Note: If unusual streaking occurs during the first time you use this solution, it is due to the wax that some chemical glass cleaners contain. Remove wax with a little rubbing alcohol and then clean with above solution.)

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