Extension Bulletin E-1717

# ENVIRONMENT

## *How does misuse of toxic chemicals threaten your health? What can you do about it?*

Environment encompasses all of our surroundings. It includes a wide variety of elements: the soil beneath our feet, the air we breathe, the food we eat, the water we drink, living things and manmade objects. All of these may have an influence on our health.

At various times in history, particular aspects of our environment have been perceived as major health threats. At one time, people considered water to be a very serious hazard because it carried and spread infectious disease. Many people now view synthetic chemicals as the main environmental threats because of the variety of possible health effects they may cause.

With the growth of industry, synthetic chemicals—especially plastics, drugs and pesticides— have become increasingly numerous and, in some cases, potentially hazardous. More than 50,000 new chemicals have been introduced in the past 25 years. They are an integral part of everyday life and have contributed to two of the most significant changes during this period—the computer revolution and modern medicine. Unfortunately, because some people have misused these chemicals and abused our environment, health problems may result.

As a result of their usage, these chemicals are widely distributed and may be found in many parts of our environment; e.g., as a part of a product that is in use, as part of a product that is no longer in use, as part of the air or water or as part of the soil.

The same chemical may be found in many different compartments of the environment. For example, a pesticide may be found as a residue on a crop as a result of normal use. It may also be found in the air and soil as a result of spillover during pesticide application. This chemical may later be found in lakes and rivers as rain washes it out of the air or off the soil. Such wide distribution may result

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not only from industrial or agricultural pesticide practices but may also arise from ordinary usage of pesticides by the average person.

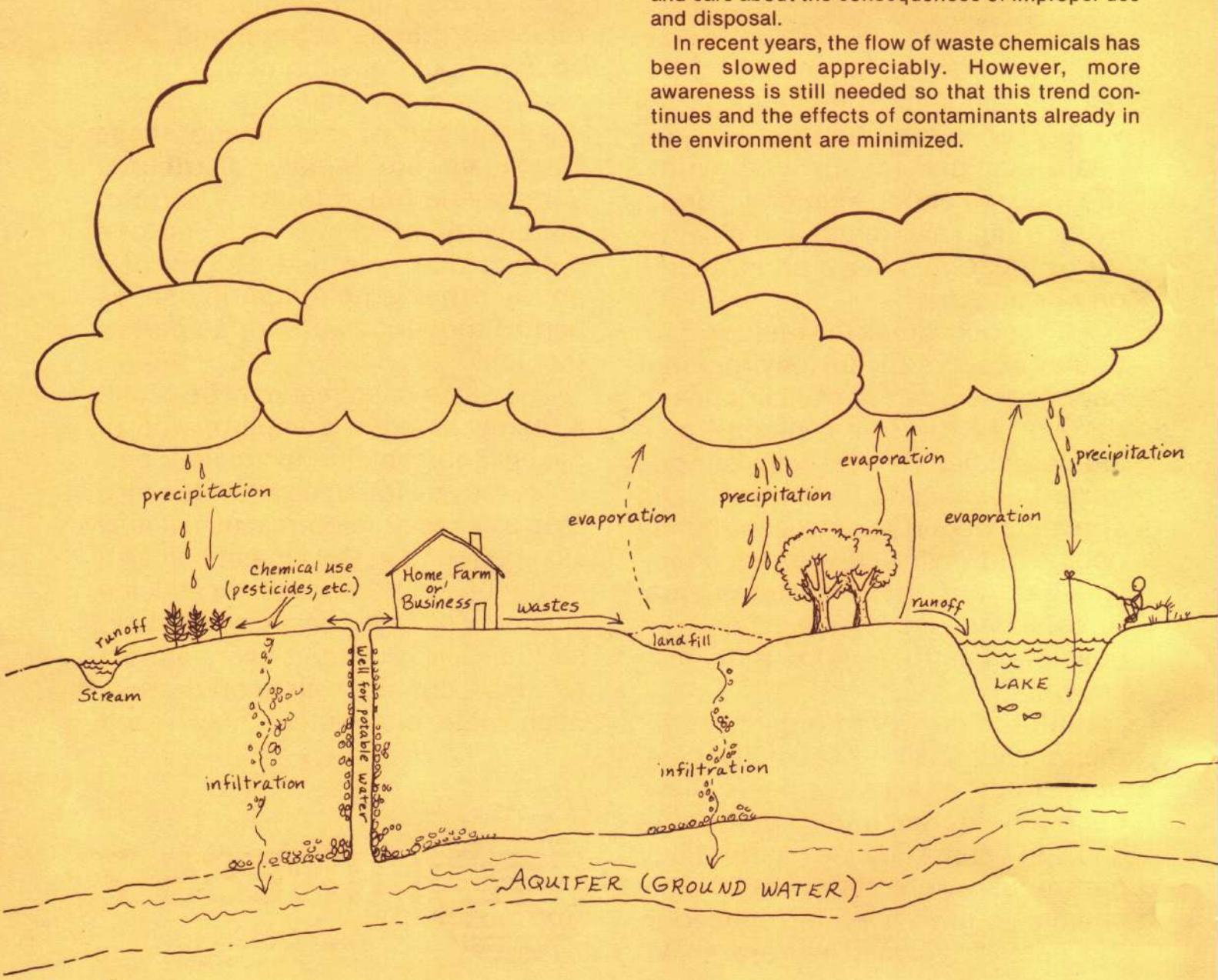
Recognizing the places where these chemicals may be found is the first step people can take in protecting themselves from adverse health effects due to toxic chemicals. In addition, individuals can learn how these chemicals enter the body and what effects they may have. Lastly, the public can understand the proper use and disposal of toxic chemicals. With this knowledge, citizens can protect their own health and also assure that future generations are spared the effects of such materials in our environment.

***Hazardous chemicals move through the environment and may end up in food, water and air.***

## Chemicals in Air, Water and Soil

Industry and agriculture and motor vehicles are the major sources of hazardous chemicals in the air, soil and water. In the main, these chemicals are waste products and have been distributed in the environment because of a lack of knowledge and care about the consequences of improper use and disposal.

In recent years, the flow of waste chemicals has been slowed appreciably. However, more awareness is still needed so that this trend continues and the effects of contaminants already in the environment are minimized.



**Air** pollution is the result of both public and private activities. Two of the most significant contributors to this type of contamination are electric power plants and motor vehicles. Some steps have been taken to reduce the amounts of pollutant generated, such as controls on power plant emissions and lead in gasoline, but further efforts will be necessary if adverse health effects are to be eliminated.

**Soil** is most often contaminated as a result of improper disposal of solid and liquid waste. Industrial by-products constitute the greatest fraction of this waste in most areas although agricultural chemicals (fertilizers, herbicides, pesticides, etc.) can be significant in rural areas. Although visible soil pollution is on or near the surface of the soil, contamination often extends many feet below the surface, making clean-up efforts very difficult.

**Water** pollution from potentially hazardous chemicals has come about through two main routes: the direct dumping of wastes into the surface water and the seepage of toxic chemicals downward through the soil into the **groundwater.** Because groundwater is very slow-moving and hard to reach, groundwater contamination is likely to be the more serious problem in the future.

The health significance of any particular toxic chemical in the environment depends on the amount of the chemical, its toxicity, and what happens to it once it enters the environment. Some chemicals are rapidly broken down and destroyed by sunlight, chemicals or living organisms.

Others, however, are resistant to destruction and remain in the environment for very long periods of time. These persistent chemicals may be contained in one part of the environment; e.g. tightly bound to soil, or may move from one part of the environment to another. The hazardous chemicals which are persistent and which are mobile are the ones which are the greatest threats to the environment and to human health.

## Chemicals and the Food Supply

Of increasing concern in recent years is chemical contamination of the food supply. The contamination of food by small amounts of foreign chemicals is possible because use of chemicals is so widespread.

Industrial, agricultural and other kinds of chemicals are present in the environment and may gain entry into crops and food animals through the air, soil and water. Herbicides and insecticides, which are applied to agricultural crops, and feed additives or medications, which are administered to food animals, may also contaminate our food sources.

Certain toxic chemicals, especially those known as halogenated hydrocarbons, such as PCBs, PBBs and DDT, are very persistent and possess properties which cause them to be of special concern. They are insoluble in water, but dissolve easily in fat.

Such fat- or **lipid-soluble** chemicals are not readily metabolized or excreted, but instead accumulate in the body fat. This accumulation in a cow can contaminate both the body fat and the milk fat. This is one way meat, milk and other food animal products become contaminated with residues of toxic chemicals and thus expose humans who eat these foods.

Although toxic chemical residues may occur in foods, federal and state governments have passed laws to protect consumers from obtaining such foods. These laws are strictly enforced through random sampling and testing. However, they do not apply to foods which are home grown and consumed. Thus, continued vigilance is necessary, particularly in the agricultural setting, to assure a safe food supply.

***Some toxic chemicals affect the body where they enter and some may affect the whole body.***

## Chemicals and the Body

In addition to **ingesting** chemicals in food or water, we may **inhale** them with the air we breathe or they may get into the body through the skin. If these chemicals are toxic they may have an effect at the place they enter the body. For example, spilling a chemical (e.g. bleach) on the skin may cause a rash or burn on the skin. Ingesting this same chemical may cause burns to the mouth and throat. Inhaling the gaseous form of this substance may cause burning in the lungs.

In addition to these localized effects, some toxic materials can affect the whole body. In order for this to happen, the substance must first be **absorbed** into the bloodstream. Then it is **distributed** throughout the body by the blood flow.

Some organs of the body, in addition to other functions, have the capability of altering foreign chemicals. These changes, known as **metabolism,** most often make the chemicals less harmful than

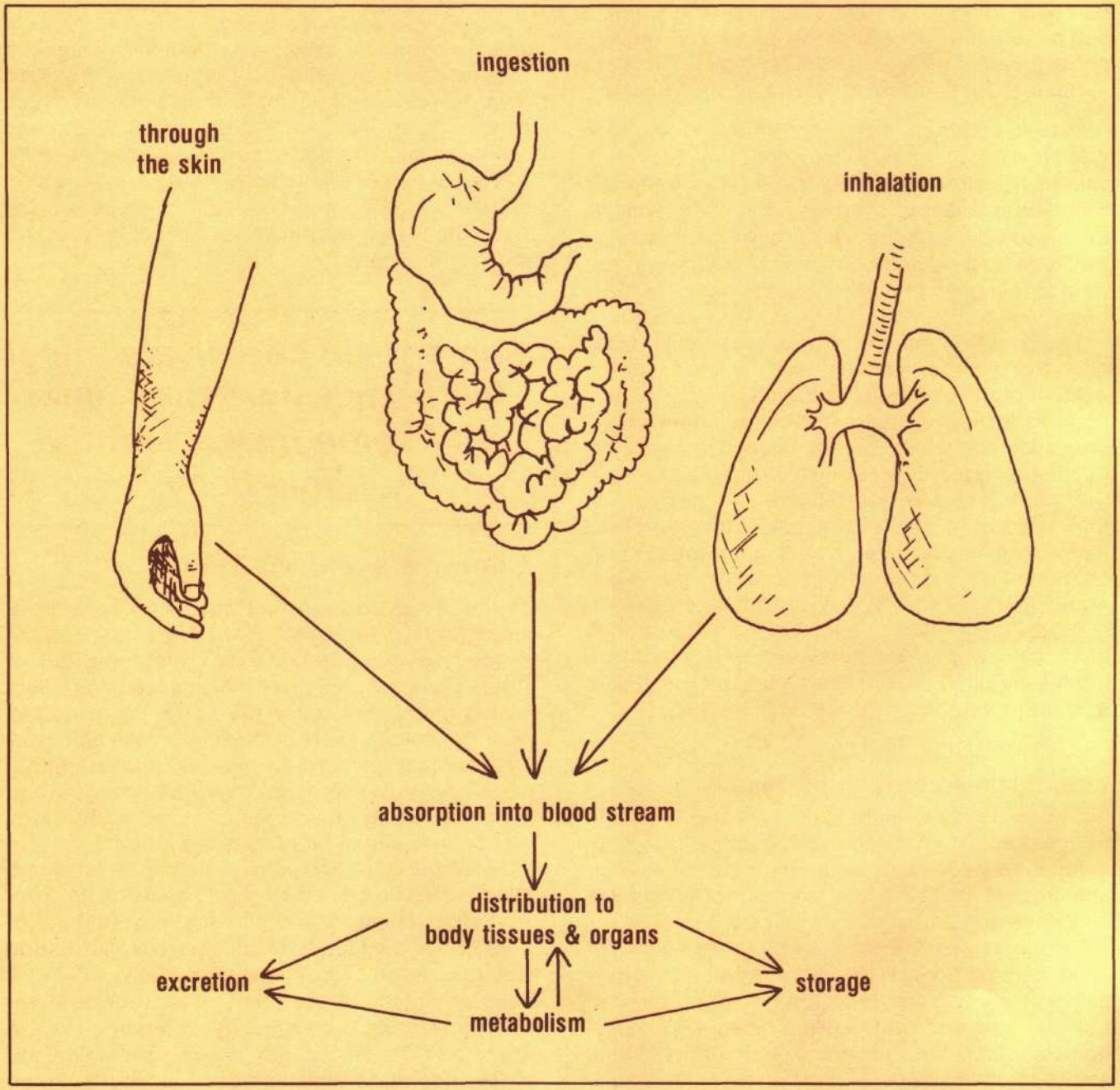
they were when they entered the body. However, it is also possible that metabolic changes can result in greater toxicity.

Ultimately, the chemicals we are exposed to, whether metabolized or not, have two different fates: they may be **excreted;** i.e., removed from the body in urine, feces or expired air; or they may **accumulate.** If they accumulate, they are usually stored in particular parts of the body; the storage site depends on the particular chemical.

The effect of any chemical on the body depends on all of the factors just described. For example, a substance that is completely metabolized to a harmless form or completely excreted, will not produce any effect on the body. Thus, being exposed to a chemical is not the same as being affected by it.

In addition, even if there is an effect, the severity is generally determined by the amount of material you are exposed to and how often you are exposed.

A single exposure to a very small amount of a toxic material may cause no noticeable effect on health; a little more may cause very little effect; a large amount may cause serious health problems and a huge amount may be fatal.



On the other hand, repeated exposure to these same amounts may have much greater effects, and even a small amount may cause serious harm over a long period of time.

Thus, the effect of any chemical is determined by the amount taken in, how often it enters the body, and what happens to it once it is in the body. It is difficult for scientists to experimentally determine all of these factors. For one thing, scientists do not really understand what happens to different chemicals in the body. Some evidence has been provided by studies on animals, but even these are incomplete, and it is difficult to say how applicable they are to humans.

Another problem is that since people cannot be controlled and monitored the way laboratory animals are, it is often not possible to say what chemical any particular individual is exposed to or how often the exposure accurs. If there is an obvious situation, such as inhalation of large amounts of cigarette smoke daily, it is possible to make some reasonable conclusions as to cause (cigarettes) and effect (lung cancer). However, with small amounts of invisible chemicals, the problem is much more difficult.

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Two other factors should be mentioned. People differ chemically just as they do in appearance and personality. As a result each individual reacts to foreign chemicals in a unique way and what might affect one person will not affect another.

A second factor is that people are always exposed to a mixture of chemicals which might interact with each other. Such interactions may give rise to effects which are quite different from what occurs with each chemical separately. These two factors compound the problem of predicting the possible adverse effects of environmental chemicals.

Thus, although scientists understand in basic terms how environmental chemicals can affect health, they often cannot predict how any particular exposure episode or occurrence will affect any specific individual or group of individuals.

This does not mean, however, that nothing is known or that these chemicals should be ignored. Evidence from animal studies provides clues as to which substances might be harmful and which not. Although these are just clues, they do provide guidance as to prudent practices that citizens can use to safeguard their health. In the following section some of these are described.

***Use toxic chemicals properly; read the label and follow directions.***

## Citizen Practices

It is well to remember that it is neither possible or desirable to eliminate all human exposure to environmental chemicals. Chemicals are necessary for the maintenance of our health and an adequate, reliable food supply. It is the misuse of these substances which causes problems and which should be the focus of citizens' efforts to protect their health.

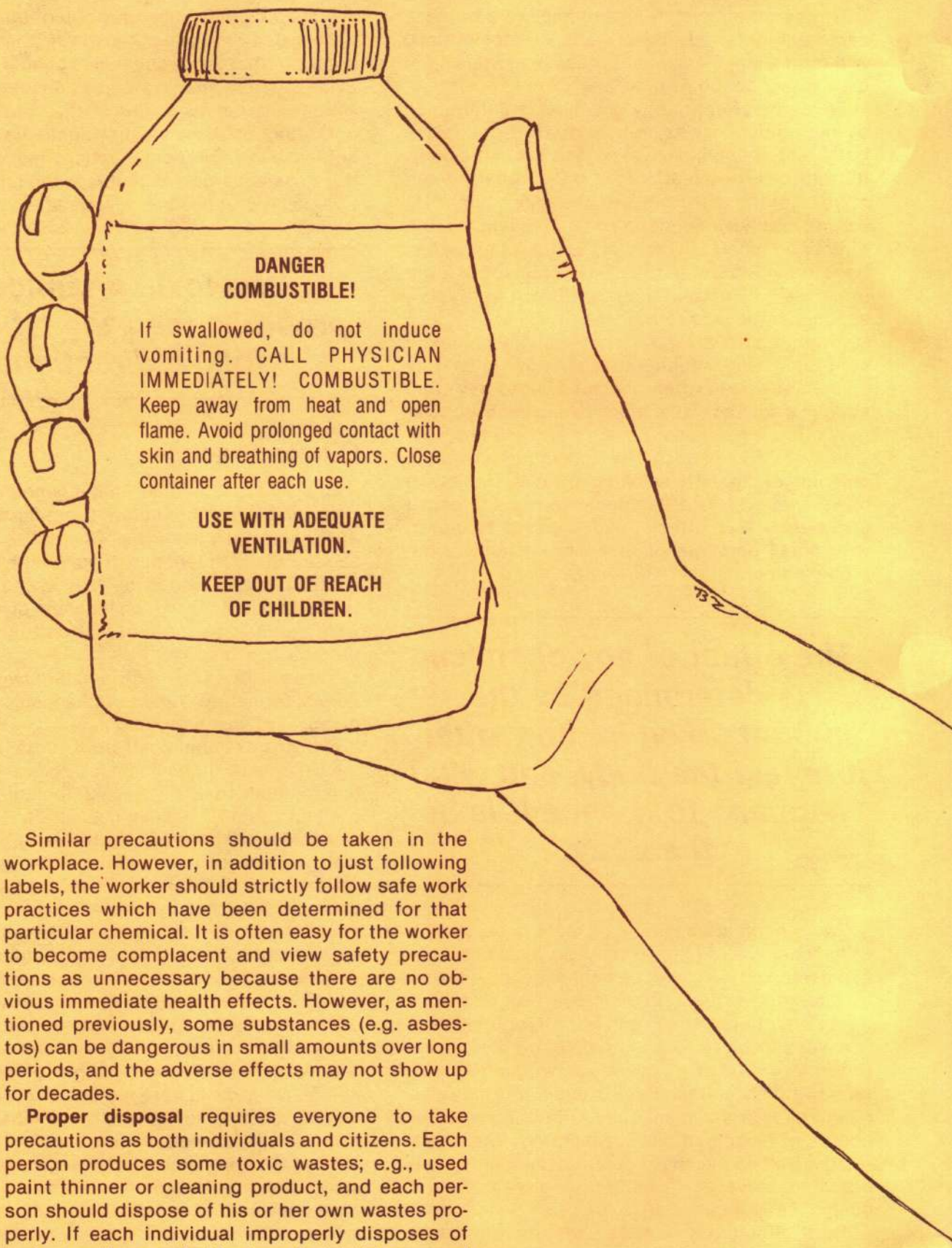
These efforts can be divided into two main categories; proper **utilization** of chemicals and proper **disposal** of waste products.

Citizens use chemicals both in the home and in the workplace. In the home, a large variety of products contain toxic chemicals, including cleaning products, medicines and cosmetics.

In order to minimize exposure to such chemicals, an individual should first make sure that the product is actually needed and that a less toxic alternative is not available. If the product is necessary, it is very important that it be used in strict accordance with label instructions.

This can minimize exposure in two ways. The label indicates the proper amounts that should be used and informs the user as to the proper precautions to take during use. These precautions may include the use of gloves to reduce skin absorption (e.g. oven cleaner), the use of proper ventilation to reduce the possibility of inhalation (e.g. paint) and utilization of the product distant from sites of food preparation to prevent ingestion (e.g. insect spray). Some chemicals also are dangerous when mixed, such as chlorine mixed with ammonia.

In addition, if accidental exposure occurs, the label contains advice on how to minimize the adverse effects with proper first aid.




Similar precautions should be taken in the workplace. However, in addition to just following labels, the worker should strictly follow safe work practices which have been determined for that particular chemical. It is often easy for the worker to become complacent and view safety precautions as unnecessary because there are no obvious immediate health effects. However, as mentioned previously, some substances (e.g. asbestos) can be dangerous in small amounts over long periods, and the adverse effects may not show up for decades.

**Proper disposal** requires everyone to take precautions as both individuals and citizens. Each person produces some toxic wastes; e.g., used paint thinner or cleaning product, and each person should dispose of his or her own wastes properly. If each individual improperly disposes of just a small amount of toxic material, this can end up in a landfill with many other small amounts which can add up to a sizable amount.

This large amount may not only pollute the soil but may also percolate through the soil and contaminate the groundwater. Since this groundwater is often a source of drinking water, what someone throws away one day may come back later as a water contaminant. Thus, what appears to be disposal may turn out instead to be recycling.

In addition to proper personal practices, individuals can protect their own and others health by their actions as citizens. People can see to it that present rules for use and disposal are rigorously followed. This includes informing the proper authorities when improper actions are discovered and also following through to make sure that the situation is corrected.

In addition, the citizen can work for improved control of toxic environmental chemicals through better legislation. Individuals can also band together to promote better environmental education in their local school districts so that future generations are more environmentally aware and less likely to make errors out of ignorance.

In summary, people can protect themselves from harm due to hazardous environmental chemicals in a number of ways. First, they can educate themselves about what is and what is not known about the hazards of specific chemicals. They can understand the present limitations of our knowledge and act accordingly.

With this background, they can take the proper steps as individuals to protect themselves from often invisible chemicals which may have immediate or long-term effects. They can use and dispose of such chemicals according to sound environmental practices.

In addition, they can take actions as citizens which will help society as a whole to take greater precautions with those chemicals which are the most significant threats to our environment and our health.

## Emergency Contacts and Information Sources.

**To alert the Department of Natural Resources (DNR) on toxic chemical spills, illegal waste dumping, old waste sites call:**

DNR Hotline
Pollution Emergency Alert System
(800) 292-4706

**For information on health risks due to toxic chemical contamination contact:**

Local Poison Control Center

Center for Environmental Health Sciences
Michigan Dept. of Public Health
3500 North Logan
P.O. Box 30035
Lansing, MI 48909
(517) 373-8050

**For information on chemical products in agriculture and chemicals in food call:**

Toxic Substances and Emergency Services
MI Dept. of Agriculture
Lewis Cass Building
Lansing, MI 48909
(517) 373-0440

You may also contact your local firemaster, County Extension Director, or the Center for Environmental Toxicology at Michigan State University, (517) 353-6469.

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Nutrition, Stress and Toxic Chemicals by Arthur J. Vander, The University of Michigan Press, Ann Arbor.

Assessment of Health Effects at Chemical Disposal Sites. William W. Lowrance, Rockefeller University (Distributed by William Kaufmann, Inc.



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