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ABSTRACT

Common household hazardous substances include cleansers, drain cleaners, automotive products, paints, solvents, and pesticides. This handbook was designed to serve as a resource for people frequently contacted by the public for information on household hazardous substances and wastes. Included in the handbook are: (1) an introduction to Michigan's household hazardous waste problem; (2) recommendations on purchase, use, and disposal practices for household products containing hazardous ingredients; (3) suggested less-toxic or non-toxic alternatives; (4) a directory of agencies, organizations and recycling, treatment and disposal firms; and (5) a bibliography of sources of additional information. Brief discussions of some issues associated with household hazardous waste are included to heighten awareness among waste management, public health and community service professionals, and to initiate furthur education of the general public. (TW)

MICHIGAN HOUSEHOLD HAZARDOUS SUBSTANCE HANDBOOK

PUBLISHED BY: The Ecology Center of Ann Arbor

IN COOPERATION WITH:

The Michigan State Cooperative Extension Service
The Center for Environmental Internship Programs
The Michigan Environmental Health Association
The Charles Stewart Mott Foundation

COOPERATIVE EXTENSION SERVICE
Michigan State University

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Written by Janet Senior and Nancy Stone in cooperation with the Michigan State Cooperative Extension Service, The Center for Environmental Internship Programs, The Michigan Environmental Health Association, and The Charles Stewart Mott Foundation.

Production of the handbook was made possible in part by a grant from CEIP, Inc.

Preface and Acknowledgements

This handbook is designed to serve as a resource for people frequently contacted by the public for information on household hazardous substances and wastes. Common household hazardous substances include cleansers, drain cleaners, automotive products, paints, solvents and pesticides. Public health officials, county extension agents, Michigan Department of Natural Resources (MDNR) representatives, environmental organizations, librarians and others will find this directory helpful in coordinating information and disseminating it to the public.

Included in this handbook are an introduction to Michigan's household hazardous waste problem; recommendations on purchase, use and disposal practices for household products containing hazardous ingredients; suggested less-toxic or non-toxic alternatives; a directory of agencies, organizations and recycling, treatment and disposal firms; and a bibliography to guide you to sources of additional information. Brief discussions of some issues associated with household hazardous waste are included to heighten awareness among waste management, public health and community service professionals and to initiate further education of the general public.

The handbook has been purposely published in a three-ring binder to encourage additions and adaptations to meet your own local needs. Generic information, applicable statewide, has been provided. All pages may be photocopied as long as credit is given to the Ecology Center of Ann Arbor (or original source, if already cited).

Each community will need to decide upon its own best recommendations for household toxic products disposal according to local needs and waste disposal facilities. Likely, the most appropriate disposal recommendations will change over time -- as technologies change, as facility availability changes, as consumer buying habits change, as regulations change, and as the products themselves change. The adaptability of this handbook will allow you to keep up with these changes in an organized and useful way.

Your comments, suggestions and questions about this directory are welcomed and encouraged. Please let us know how this handbook is helpful to you and how it might be improved. The comments page located at the end of this handbook can be folded, stamped and returned to us with your comments.

The compilation of this handbook was made possible by the cooperative efforts of many individuals and organizations. A grant to the Ecology Center from the Environmental Protection Agency for a "Great Lakes RegionalHousehold Hazardous Waste Conference: Coordinating Local Collection Days," initiated a clearinghouse function for the Center on this topic. The research and writing of the handbook by Janet Senior was made possible by a grant from the Center for Environmental Internship Programs. The Charles Stewart Mott Foundation has provided support to develop and present additional educational programs on household hazardous substances to community service professionals, community leaders and teachers.

Ongoing support in the search for solutions to household toxics disposal and alternatives have come from the Michigan State University Cooperative Extension Service, the Michigan Environmental Health Association, the Washtenaw County Public Health Department, and The Charles Stewart Mott Foundation. The following individuals helped review the handbook in part or entirety. Their volunteer professional assistance in this project is greatly appreciated.

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Michigan Household Hazardous Substances Handbook

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How to Use This Handbook

This handbook is meant to be used as a ready reference for information on household hazardous substances and as a means to develop recommendations for your own community. The handbook can be used in at least four different ways:

1. You can skim the handbook to quickly acquaint yourself with the household toxics problem.

2. You can use specific information on household toxics to answer questions from the public about recommended toxics use and disposal or about alternative products and methods. Information can be provided over the phone or pages can be photocopied and mailed out.

A response form is included on the next page. Photocopies of this form can be kept on hand to help remind you of what information might be necessary to properly respond to questions. The form could also be used to help keep track of the types and numbers of public inquiries.

3. The directory section provides you with names, addresses and phone numbers of other agencies and organizations working on this problem throughout the state and around the country. These lists and descriptions will provide you with resources and experts to help answer questions you are not prepared to answer on your own. The lists can also facilitate interaction among people around the state who are working to develop creative and scientifically-sound solutions to the household hazardous waste problem. (If your organization is not mentioned and you have resources/expertise available to answer questions, etc., please contact the Ecology Center of Ann Arbor so that a reference can be included in directory updates.)

4. You can also use the annotated bibliography to locate more specific or detailed information that might be helpful to you. These recommended publications could be inserted into this notebook for ready access or could be put in your office reference library or files. We encourage you to purchase *Toxicants in Consumer Products* ($4.50) as a companion technical reference to this handbook. (Write to Seattle Metro, Household Toxicants Project, 821 Second Ave., Seattle, WA.) If your office budget is small, your local public library may be able to purchase a few titles for public access.

Telephone Response Form: Household Toxics

Initials _____ _____ Date_____

Information on the caller:

Name _____

Address _____

City, Zip _____

Phone number _____

Where did you hear about us?_____

Type of Material:

Type of product _____

Brand name(s) _____

Manufacturer _____

Active ingredient(s) _____

Quantity _____

Problem: (circle) disposal, use, regulations, other

Disposal method recommended _____

Alternative recommended _____

Advice given _____

Referral agency given _____

Questions to ask yourself or the caller:

Is it possible to use up, donate or recycle?

What information is given on the label about safe use and disposal?

What ingredients are listed?

How is the caller using the product?

Where does the caller live?

Suburban, urban or rural area?

Combined or separate sewer system?

Proximity to collection center/hazardous waste facility?

What is the caller's willingness to take action?

Chapter 1
Overview of the Household Hazardous Substance Problem in Michigan

More than 1100 sites of groundwater pollution due to the mishandling and improper disposal of hazardous chemicals have been identified in Michigan (Michigan Department of Natural Resources, Groundwater Quality Division). Hazardous waste is commonly considered, by both the public and regulators, to be an industrial problem. However, many common household products (such as pesticides, paints, solvents, cleansers and automotive fluids) contain poisonous, explosive or flammable ingredients and are contributing to local hazardous waste problems.

The management of hazardous waste generated by households was largely ignored until 1981 when an EPA-sponsored project began in Seattle, Washington (see bibliography for case study). Although the number of household toxics awareness programs around the country has continued to grow since then, most people still either don't recognize the hazards associated with using and disposing of these products or are comforted by the idea that they generate only a very small amount relative to a typical industrial source.

Although each household does not produce much waste, when the estimated one or two gallons in each home is multiplied by the more than 83,918,000 (1983 Census) households in the United States, the numbers are significant. Conservative estimates of the amount of these products used in a city the size of Ann Arbor, Michigan, are listed in Figure 1-A. A public health official in Washtenaw County, Michigan, estimates that local households generate a total of 4000 pounds (two

tons) per year of hazardous waste and could be the fourth largest generator of hazardous waste in the county (Figure 1-B). An EPA-sponsored research project in Seattle estimated that half the volume of household toxics purchased by American consumers is eventually thrown away.

1-1 Toxicity

In addition to the volume of waste, the toxicity, flammability and other hazardous properties of these products are also not adequately considered. Many of the products, although designed and formulated to be safe for household use, contain exactly the same chemicals or byproducts found in the waste streams of industry—caustics, acids, organic solvents and metals.

Many household substances can cause problems if used improperly or discarded carelessly. A substance is legally hazardous if it has any of the following properties: flammable, explosive, toxic, caustic or carcinogenic. Notice that the term "toxic" is one of several properties of a "hazardous" substance, although the terms are commonly used interchangeably.

Toxicity is a measure of the damage to living systems caused by substances. Almost any substance, even common table salt or water can be toxic if consumed in large enough quantities. Some substances, however, can be toxic in very small quantities. When a substance is inhaled, absorbed or consumed and a response occurs immediately or within a few minutes, hours or days, it is considered *acutely toxic.* When the response takes months or years to occur, the substance is called latently or *chronically toxic.* Many federal and state regulations are intended to reduce or eliminate the incidence of acute toxicity. These substances are easier to regulate because the cause is so closely associated with the effect. Chronic toxicity is, however, more difficult to regulate. Since scientists still do not have enough information about the long-term effects of low-level exposure in many cases, we do not really know very much about which chemicals cause latent effects and about what levels are necessary to cause the effects. In addition, cumulative exposures to more than one toxic substance can increase the overall toxicity of each one—a phenomenon called synergism.

1-2 Human Routes of Exposure

When hazardous products are used, they can enter the human body in a variety of ways: absorption through the skin (solvents), inhalation into the lungs (dusts and vapors), and ingestion into the digestive tract (contaminated food and water). Once the substance enters the body, it will eventually reach the bloodstream and be

distributed to other parts of the body. Some of the substance will be excreted in the breath, perspiration and other waste products. Often, however, hazardous substances will accumulate in the body and be stored in the bones, fatty tissue and organs, especially the liver or kidney. Excessive accumulation of these substances in sensitive tissues can cause dysfunction, disease and death.

The diagram in Figure 1-C shows how toxins are absorbed, distributed and excreted.

1-3 Ways to Limit Exposure

Once the products have been purchased, care should be taken to use them cautiously and according to directions. The following general precautions are applicable for most household hazardous substances:

1. Keep hazardous products in their original, labelled containers. Do not pour them into unmarked containers or food and beverage containers. Do not store these products near food items.

2. Read the labels and follow the directions closely.

3. In general, do not mix hazardous products together; even a mixture of common substances can be very dangerous. Bleach and ammonia mixed together will produce a lethal chloramine gas.

4. Ventilate the work area with at least two open windows and a fan and use suggested safety equipment: gloves, masks or goggles, etc.

5. Products that have been banned should not be used or given away for use by someone else. Consult the product disposal recommendations section in this handbook for advice.

6. Store hazardous products in locked cupboards. Keep them out of reach of children and pets.

7. Clean up immediately after every use. Do not leave products open and unattended.

1-4 Determining Consumer Use

It is important to determine how a substance is being used in the home when considering methods to limit exposure. Some products are used in the home with greater frequency than the "typical" consumer rates covered on the household product label recommendations. Materials used for hobbies or home businesses include furniture strippers, solvent-based paper whitener, 3-in-1 lubricating oil,

photographic chemicals, household cleansers, lead solder or spray paint.

When a person is exposed to toxic materials on a regular basis, it is termed chronic exposure and may range between low and high levels, depending on the way the product is used. In some cases, a person may be exposed to toxic substances as much as in the workplace setting. It is then appropriate to use precautions and control measures recommended for occupational exposure to chemicals, such as local ventillation, approved chemical cartridge respirators, impermeable gloves, etc. When answering calls on household hazardous substances, determine how the caller uses the product and how often. For the "serious hobbiest," consult the occupational health agencies listed in the directory section.

1-5 Environmental Concerns

Toxic chemicals from households are often discarded in the trash and end up in regular sanitary landfills, the same kind of landfills that have leaked and caused groundwater contamination problems in many areas all over the United States. Public officials are concerned that regular landfills are not designed for the disposal of hazardous products. Groundwater contamination is a very real possibility (Figure 1-D). Household hazardous products are poured down drains into sanitary sewers, stormwater sewers or septic tanks. Since the treatment processes associated with these disposal routes are not designed to deal with most toxic materials, they can pass untreated into lakes, rivers and streams.

1-6 Need for Information on Household Toxics

People seeking information on the proper disposal methods for hazardous materials are calling the Michigan Department of Natural Resources (MDNR) offices, poison control centers, county health departments, Cooperative Extension agents, educators and local environmental groups. Because household toxics pose a relatively new concern, the advice coming from the various offices is usually different and is sometimes even conflicting.

It is useful for community leaders and officials to discuss household toxics disposal recommendations with all agencies and groups involved. It may be unrealistic to expect a consensus of opinion, but cooperation and awareness of the relevant concerns will be increased and the public will be better served with more consistent information.

In Washtenaw County, ongoing discussions on toxic substances

occur in several formats. A "Toxic Waste Coalition" of county health department staff meet as needed with local environmental and community service group representatives to discuss community education projects on toxic substances. This coalition has created brochures, slide shows, and helped promote toxics collection days. A "Hazardous Substances Panel" of department heads of public works, health, planning, sheriff, road commission, drain commission and emergency response meets monthly to exchange topical information, discuss policy and determine long-term hazardous substance planning directions. A County Commissioners Advisory Committee established the panel and has requested quarterly public reports. These mechanisms allow for an ongoing review of local policies and recommendations.

1-7 Regulatory Framework

Household hazardous waste is not directly regulated as a "hazardous waste." The household waste stream is specifically exempted from federal regulations (the Resource Conservation and Recovery Act) and from Michigan law (Act 64, the Hazardous Waste Management Act). Instead, it is dealt with as a "solid waste" under Michigan Act 641 (the Solid Waste Management Act) and is allowed to go to local, licensed sanitary landfills. Some state governments are beginning to recognize the need to deal with household hazardous waste as a "hazardous waste" but are hesitant to impose regulations that would necessitate enforcement at the household level, which would be nearly an impossible task. Instead, states like Michigan are devoting money and agency expertise to public education programs and to the promotion of toxics collection days.

1-8 Collection Days

Household hazardous waste collection days are community-based efforts to collect hazardous household products at a central location. Successful collection operations have been undertaken at various locations around the country and in several Michigan communities. Participants are allowed to bring in a limited amount of wastes, usually free-of-charge, to the collection center. The wastes are then safely separated, categorized, packaged and disposed of in a safe and environmentally-sound manner. In this way, wastes can be collected in large enough quantities to make recycling, incineration or transport to a hazardous waste disposal facility possible.

Collection days are expensive, and without more reliable funding sources such as taxes or user fees, they will be unable to adequately meet the needs of community members who wish to dispose of their wastes in a safe manner. (See Directory and Bibliography

sections for references on how to organize a collection day.)

1-9 Buying Habits

A major problem contributing to the magnitude of household hazardous waste is that these products are often sold in inappropriately sized containers. Sometimes products are sold only in quart or gallon sizes even though only a small amount, a teaspoon or two, is needed at any one time. By the time the product is needed again, it has become contaminated or an active ingredient has degraded and is no longer effective. Consumers are also persuaded to buy more than they need when the larger containers are so much cheaper per unit than the smaller ones. Unfortunately, the remaining contents of these containers are put away and used slowly or not at all.

Specific products, useful only for specific tasks and projects, collect in the home. The material can also get transferred out of its original container into an unmarked jar or can. When a family moves, they must decide what they should do with this conglomeration of bottles, cans, bags and aerosol containers. If neighbors or relatives don't want them, the materials may get thrown away or poured down the drain. Even more likely, the containers are left in the basement for the next occupants. Not only does this process pose a disposal problem, the chance of fire or accidental poisoning increases, too.

1-10 Possible Steps Toward a Solution

The best way to approach the household hazardous waste problem is to reduce the amount used of these products. This can be done by 1) purchasing only what is needed or jointly purchasing and sharing products with a neighbor; 2) using alternative, less-toxic or non-toxic products; 3) giving selected products away to neighbors; or 4) reusing and recycling the products which have no appropriate alternative. Community networks can be set up to distribute leftover products to neighbors or community service agencies: paints, fertilizers, cleansers, etc. Similar networks could be organized to buy these products cooperatively so that over-buying is kept to a minimum.

In addition, we can design mechanisms and programs, such as household hazardous waste collection days and transfer stations, to separate hazardous waste from the regular solid waste stream and channel it to treatment and disposal facilities capable of eliminating or at least greatly reducing the public health and environmental risks associated with these wastes. A deposit system on pesticides containers or aerosol cans is a possibility; the deposit would provide an incentive for collecting these cans and then disposing of them properly. A sales tax on hazardous substance containers could be used to encourage the

purchase of less-toxic alternatives and to finance disposal operations.

1-11 Product Purchase

Since reduction of household hazardous waste at the source is the most promising management solution, education of the public about more appropriate product purchase becomes very important. If consumers are informed about how to read labels and about what alternatives are available, they are more likely to consider less-toxic products.

1-12 Contribution to Industrial Waste

It is important to remember that products purchased by the consumer that contain hazardous components make a contribution to the industrial hazardous waste problem: chemicals used in manufacturing, processing and packaging, for example. By creating a demand for these products, we are causing the production of hazardous waste. Industry has every right to complain about the costs of hazardous waste regulation *if* consumers refuse to contribute their fair share through willingness to pay higher prices for products produced in an environmentally-sound manner or willingness to help pay for programs and facilities to make proper disposal possible. Without such sharing of responsibility, companies who do use environmentally-sound practices may be penalized in the marketplace.

1-13 Labelling

Interpreting correctly the labels on household products is an important first step in learning how to use them safely and in becoming aware of what consequences might be involved in their disposal. In the Federal Hazardous Substances Act, the government defines a hazardous substance as one which "may cause substantial personal injury or illness as a result of customary or reasonably foreseeable use." Thus, a hazardous household product can be defined as one that contains a hazardous substance in sufficient quantity to create the possibility of harm or is hazardous by nature (e.g., explosive). The two categories are:

1. Pesticides (regulated by Federal Insecticide, Fungicide and Rodenticide Act), and

2. Other substances which can be toxic, corrosive, irritative, flammable or radioactive (regulated by the Federal Hazardous Substances Act).

Regulations require specific types of labelling depending on the nature of the product and the type and severity of the hazard. Signal words are required to indicate the relative toxicity, i.e., "Danger," "Warning" and "Caution." For example, with pesticides, a label of "danger" indicates that a taste to a few drops of the substance is lethal. "Warning" indicates a teaspoon is lethal and "caution" means a cup of the substance is lethal. The label often also includes precautionary statements, directions for use, an ingredients list and other safety information.

Though labels almost never provide information on disposal, these warning designations can be indicative of what hazards might be involved in disposal. Products marked with "Danger" are likely to require greater care in disposal than ones marked with "Caution."

1-14 Developing Guidelines for Your Community

Because no two communities are identical, the best disposal options and alternatives for your area may be different from those listed herein. The following guidelines are provided to help you adapt this directory to your own circumstances.

1. Arrange at least one meeting with representatives from your local fire department, solid waste department, public health department, public works department, cooperative extension office, county commissioners, planning department, environmental and consumer groups, university departments or any other appropriate offices. Discuss the disposal recommendations in this directory to determine which options are most appropriate for your community.

2. Call the state offices of the Department of Natural Resources/Hazardous Waste Division and the Cooperative Extension Service about problems and available services (reprocessing firms, disposal firms, collection operations) in your area. You might also investigate the possibility of combining a household collection operation with a program for small quantity commercial generators and schools or institutions.

3. Collect information about the distribution of septic tanks and sewer systems in your area. Revise your recommendations to protect these facilities from contamination.

4. Meet with or call the local wastewater treatment plant operators to determine which specific substances will damage their treatment processes. Caution people about disposing of these substances in sanitary sewers or septic tanks.

5. Contact the recycling, treatment and disposal firms in your area to determine their willingness to accept household hazardous wastes.

Consider calling small businesses, such as photo labs, to see if they would take small amounts of related household waste to be recycled with their own.

6. Try to reach a working agreement about the best disposal options for your community. Write guidelines and distribute them to all the people in the community who are likely to receive informational inquiries about household hazardous waste. Your state senator or representative might be able to print and distribute an informational brochure in a district mailing.

7. Continue to monitor the household hazardous waste problem in your community. Revise your recommendations as situations change.

Figure 1-A
Estimated Consumption

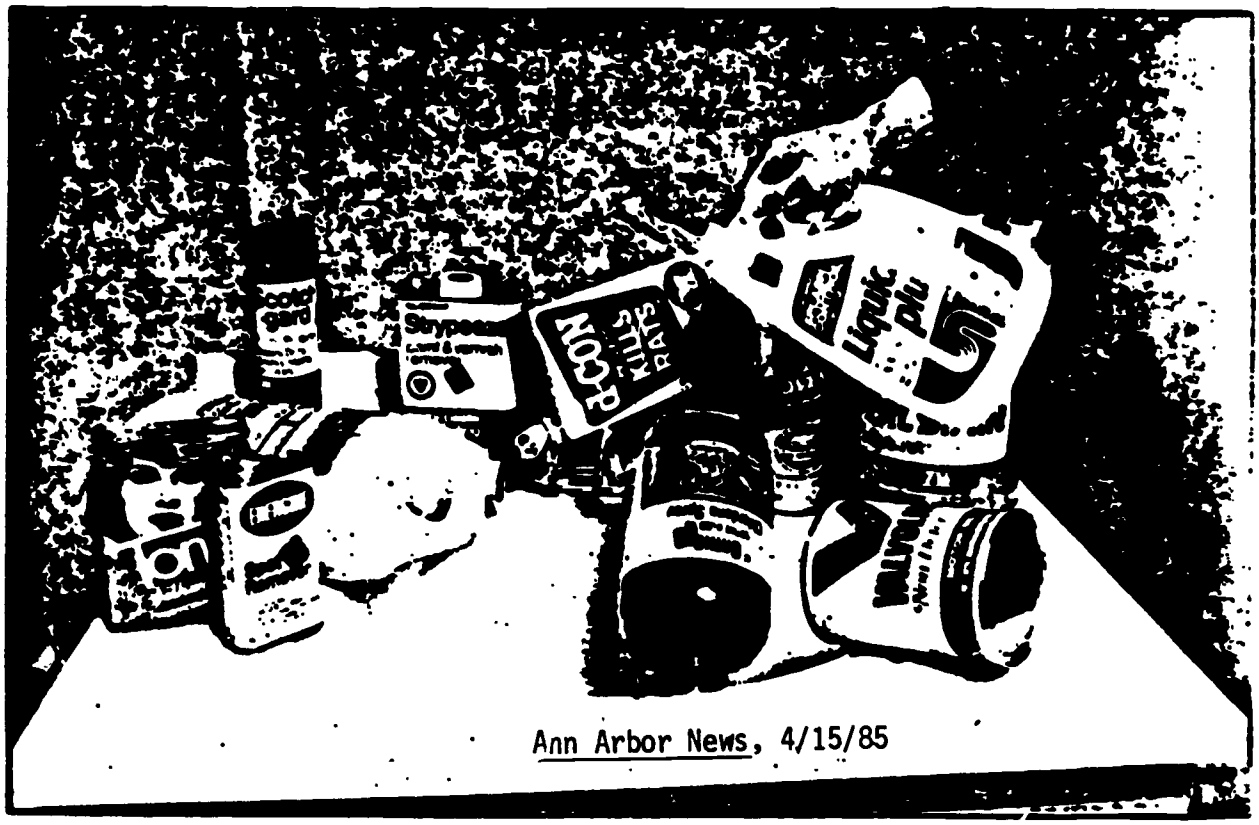
ESTIMATED CONSUMPTION OF HOUSEHOLD CLEANERS IN ANN ARBOR, MICHIGAN

Rates (g/c/d) are from Gurham et al. (1979). Estimated totals for Ann Arbor are based on 1980 population of 107,316 and are English (short) tons, not metric.

Product	grams/capita/ day	tons/ day	tons/ year
Abrasive cleaners	0.29	0.034	12.6
Disinfectants	0.30	0.036	13.5
Drain Cleaners	0.2	0.023	8.6
Liquid Household cleaners	4.15	0.486	180.0
Glass Cleaners	0.4	0.048	17.1
Toilet Bowl Cleaners	1.19	0.14	51.8
Liquid Dish Detergent	6.17	0.73	208.2
Dishwasher Detergent	3.62	0.43	157.5
Liquid Laundry Soap	4.40	0.52	191.0
Powder Laundry Soap	19.11	2.28	830.7
Fabric Softener	10.39	1.24	451.0
Bleach	9.92	0.89	431.0

Prepared for the Ecology Center of Ann Arbor, 1983

Figure 1-B
Generators in Washtenaw County



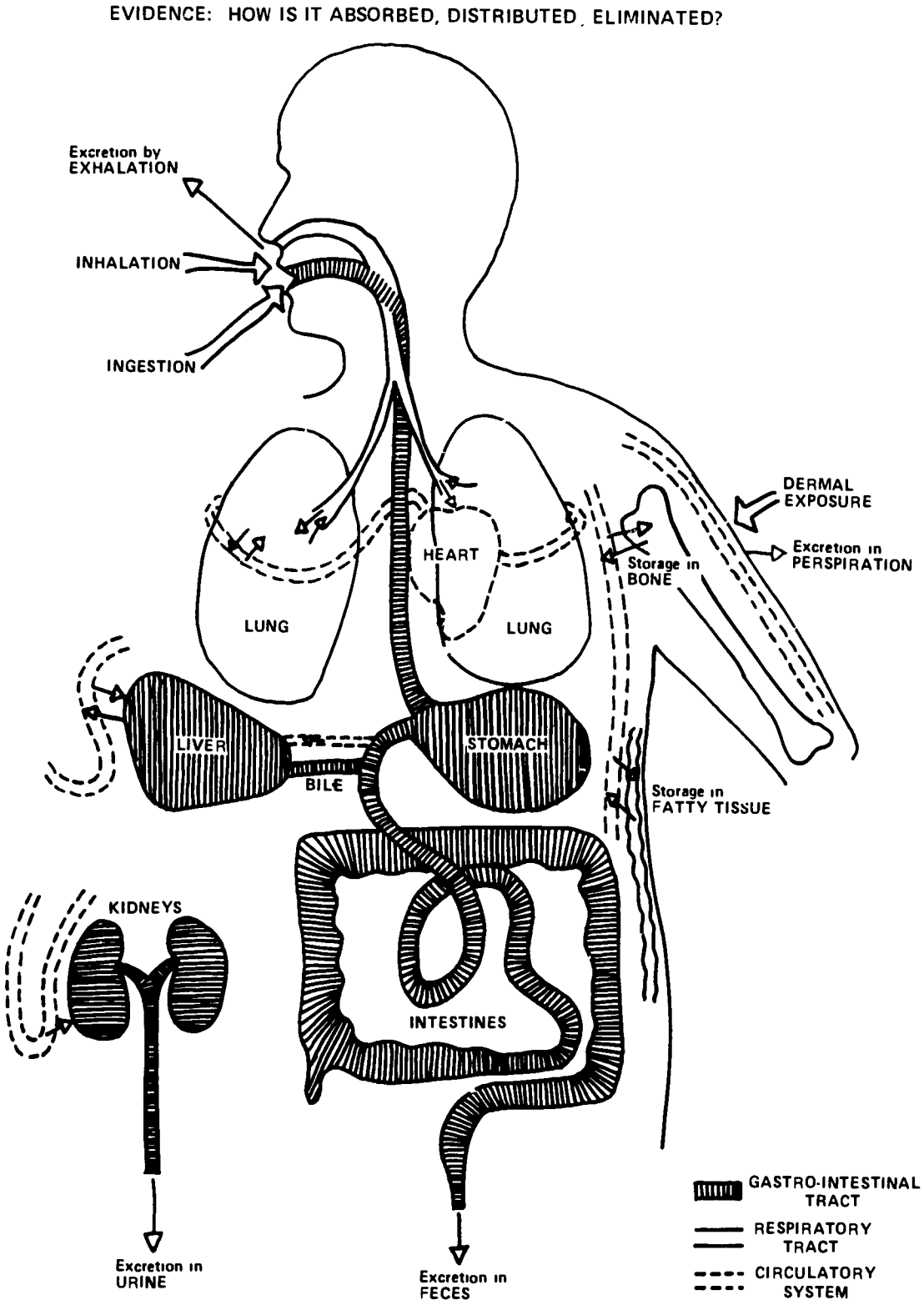
Each of these household and automotive products can be dangerous. For an explanation, see B2.

GENERATORS OF WASTE	HAZARDOUS WASTES IN WASHTENAW COUNTY—TONS/YEAR
1. Ford Motor Co., Saline plant	20,856 T/Y
2. General Motors Assembly Division, Willow Run plant	12,823 T/Y
3. General Motors Hydramatic Division, Ypsilanti plant	11,880 T/Y
4. Households	4,800 T/Y
5. Ford Motor Co., Rawsonville plant	1,296 T/Y

Local industries recycle toxic wastes or haul them to a specially equipped landfill.

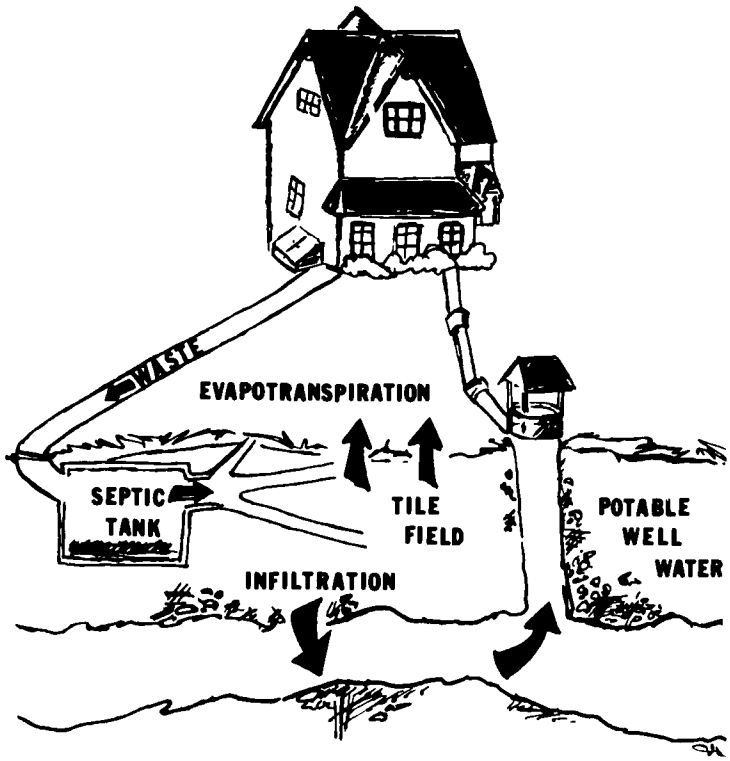
Householders normally put their waste products out with the trash or flush them down the drain.

Figure 1-C
Human Routes of Exposure



From Seattle Metro's Sleuth.

Chapter 2
Routes Now Used for Household Hazardous Waste—What are the Environmental Consequences?



The six most commonly used methods to dispose of hazardous household wastes include: solid waste landfills, incinerators, sewer systems, septic tanks, storm drains, and ditches or backyards. Usually, these routes are not appropriate for wastes with toxic or hazardous properties. Ground and surface water can become contaminated, and refuse collection and landfill workers can be injured.

The disposal routes and their corresponding environmental consequences will be discussed in this section to increase awareness of where the wastes go now and where they usually end up. Knowledge of how these routes are used in your community might help you make decisions about more appropriate disposal methods.

2.1 Landfills

When household hazardous wastes are thrown away with other household 'trash,' they are usually picked up and taken to a landfill. Sometimes, the waste is taken first to a transfer station where loads are consolidated and stored until the material is later transported to the landfill.

The solid waste is compacted and buried at the landfill. Typically, once the waste is buried, it becomes possible for rainwater to percolate through the landfill and carry toxic materials to the groundwater. Once the groundwater is contaminated, removal of the toxics is expensive and difficult, if not impossible.

Landfills can be designed specifically for hazardous waste. These landfills use thick clay layers, plastic liners, drainage pipes along the bottom and monitoring wells to reduce the possiblity of dangerous leaks. Even these designs are, however, not foolproof and can leak after they have been sealed over.

Since 1965, it has been illegal to dispose of liquids in Michigan solid waste or hazardous waste landfills. Therefore, liquid wastes must be solidified before being taken to a landfill. Solidification decreases the possibility of groundwater contamination by slowing the migration of pollutants from the landfill.

2.2 Incinerators

Incinerators are another option for disposal of solid waste. Although only one municipal solid waste incinerator is currently operating in Michigan (in Oakland County), other incinerators have been used in the past and are being used in numerous communities in other parts of the country. Some controversy exists over whether these incinerators are exchanging land use and groundwater problems for air pollution problems. For example, dioxin in the air can be one byproduct of burning plastics.

Specially-designed hazardous material incinerators, such as those developed by Dow Chemical, burn wastes at high enough temperatures to break down the hazardous wastes into less toxic compounds. With proper air emission controls, this type of incinerator seems to be a safe, though expensive, way to deal with highly toxic materials, including certain pesticides and solvent-based paints.

2-3 Sanitary Sewer Systems

In areas connected to sanitary sewers, household wastes poured

down a drain or flushed down the toilet flow into a system of underground pipes that receive waste from residences, office buildings, businesses and schools. These pipes are connected to trunk lines, which eventually drain into a wastewater treatment plant. Depending on the area, this waste is then treated in different ways. After treatment, the effluent is discharged into receiving waters: lakes, streams, or rivers.

Wastewater treatment involves primary treatment, usually secondary treatment and sometimes tertiary treatment. Primary treatment is basically settling and filtering out of the organic matter. Secondary treatment involves some type of biological processing; bacteria and aeration are used to increase the breakdown of organic material in the wastewater. The solids that settle out during the treatment process (sludge) are taken to a landfill, incinerator, or are spread on land as fertilizer. Tertiary treatment involves chemical, biological or physical processing to remove organic matter not treated at the secondary stage. Nutrients and inorganics can be removed using advanced treatment processes such as precipitation and ion exchange.

A large percentage of the waste products in the sewage is removed during this treatment, including some of the hazardous material. Advanced treatment processes, however, are not capable of neutralizing or breaking down all the hazardous material. Some pollutants such as metals and pesticide residues are still in the treatment plant effluent when it is discharged into the river or lake. In some cases, toxic components in the sewage can kill the bacteria at the treatment plant, thereby lessening the effectiveness of the treatment process.

2-4 Septic Tanks

In rural areas, it is often impractical to connect buildings to a sanitary sewer system. Instead, these households use septic tanks (usually large underground concrete containers) in combination with drainfields. During the 2-3 days the wastewater spends in the tank, solid materials settle out and greasy, oily components float to the top. These solid materials are trapped inside the tank and are gradually broken down by the aerobic and anerobic bacteria. The liquid from the tank then drains into the surrounding soil through the drainfield. As the wastewater percolates down through the soil, it is further broken down by aerobic bacteria and other microorganisms. Periodically, the sludge material in the septic tank is pumped out and is usually dumped in a licensed area by the pumping company.

Here again, some hazardous materials are broken down into less hazardous components by the septic tank processing and some are not. Toxic pollutants can, however, poison the bacterial action in the

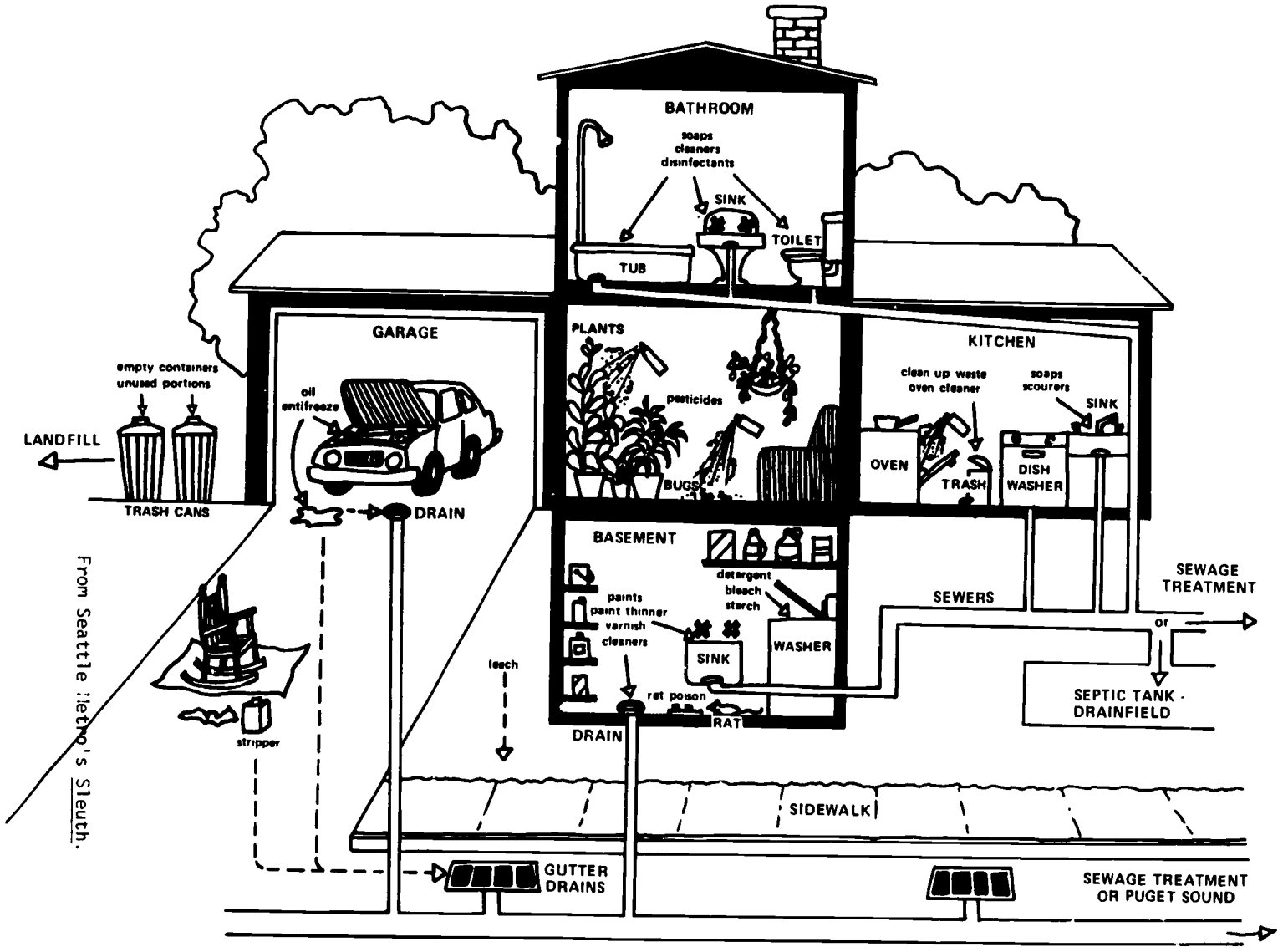
tank and, if not broken down, can leach into groundwater and contaminate drinking water wells.

2-5 Storm Drains

Storm drains are systems of ditches, culverts or underground pipes designed to collect stormwater runoff from streets, driveways and parking lots. Usually, the pipes empty the untreated water directly into lakes and rivers. In some cases, the stormwater system is connected into the sanitary sewer system and travels through the treatment plants. This is known as a combined sewer system. When the capacity of these combined sewers is overwhelmed by an unusually heavy rainfall, the storm drain systems can overflow and allow untreated material to reach lakes and rivers. The more toxic or hazardous the contaminants in the combined system are, the more serious an overflow incident can be.

2-6 Ditches or Backyards

In areas without storm drains, rainwater runs overland to the nearest ditch and then into the nearest stream. The water can also percolate into the groundwater. If the water is contaminated with pesticides, solvents, used motor oils or other wastes previously dumped in the ditch or yard, the ground and/or surface water can also become contaminated.



From Seattle Metro's Sleuth.

Figure 2-A
Household Routes to the Environment—Micro Level

Figure 2-B
Household Routes to the Environment—Macro Level

The Effects of Hazardous Waste

Until very recently, most hazardous waste was dumped or buried in landfills, with little regard for the geological suitability of sites. Failure to understand the basic geologic and hydrologic principles illustrated on these pages has led to an array of problems:

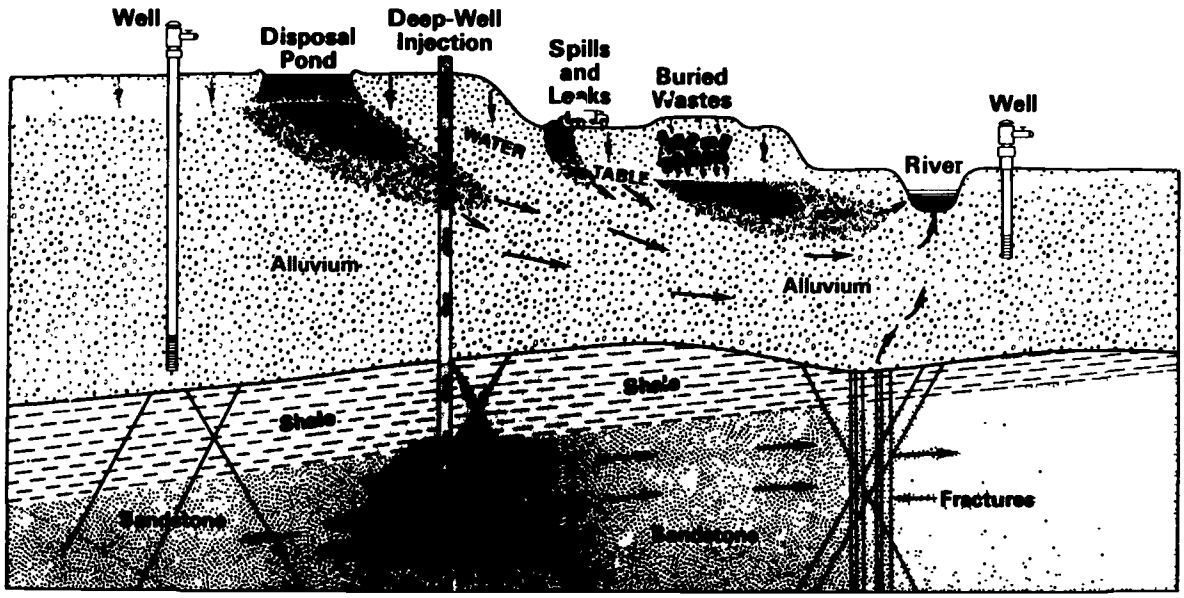
- Hazardous wastes *leach into groundwater* from improperly designed sites, contaminating the water for hundreds of years. (Ground water is the source of drinking water from municipal wells and private wells and springs—see illustrations.)
- Hazardous wastes also *leach into surface water*, contaminating streams, lakes, and affecting aquatic life, drinking water, and recreation.
- Hazardous wastes can cause *human, animal, and plant poisoning* ranging from flu-like symptoms and loss of hair, to cancer, to death. These problems may appear years after exposure.
- Hazardous wastes can *contaminate soil*, making it unsuitable for agriculture.
- Hazardous wastes *depreciate land values.*
- Hazardous waste *costs are vast*—to the waste generators, government regulators, and the public.
- Hazardous waste, when improperly disposed of, *creates problems that may endure for generations.*
- The bitter experiences of Love Canal, Times Beach, and other sites have *created public distrust* of the agencies and industries involved, inhibiting expansion of waste-disposal facilities.

EPA estimates that perhaps 90% of hazardous waste from about 750,000 sources in the U.S. is disposed of improperly, leading to the problems listed above.

These problems often result from lack of geologic study prior to disposal at the site.

From Hazardous Wastes, by the American Institute of Professional Geologists.

Industrial wastes are disposed of in many ways

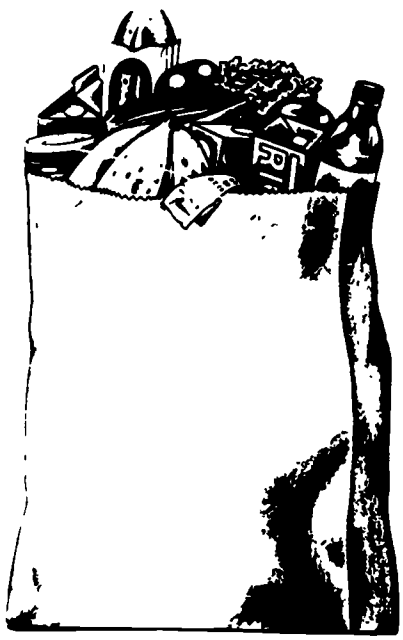


USGS Circular 875

KEY: FRESH WATER → CONTAMINATION → CONTAMINATED GROUND WATER

A vast array of industrial chemicals, including large volumes of liquid and solid toxic compounds, have been disposed of in seepage ponds and by shallow burial. By 1981 the inventory of toxic wastes was 6 billion cubic yards at 100,000 sites in the U.S. (Radioactive wastes are a special category of industrial wastes owing to their high toxicity. The amounts and number of sites are small.)

Chapter Three
Product Toxicity and Possible Alternatives



Consumers should be advised to read ingredients lists and warnings on the labels of the products. 'Inert' ingredients, though usually not listed on the label, can also be hazardous. Sometimes, some brands or formulations of a given product will be less toxic and therefore may be preferable. In many cases, less toxic alternatives can be found.

The product ingredients that are mentioned in this section are by no means a comprehensive listing. A reference book like Gosselin's *Clinical Toxicology of Commercial Products* (available in some libraries) can provide more specific information on toxicities and ingredients.

3-1 General Recommendations When Purchasing Household Products

These recommendations are provided to help consumers minimize the hazards associated with common household hazardous products.

1. Avoid buying highly toxic and hazardous products. Consider buying the least toxic product available.

2. Buy only what you need. Buy cooperatively to reduce waste, if possible. Share leftovers with neighbors, friends, relatives, public service organizations and institutions, hospitals, group homes, schools, community organizations, churches, etc.

3. Read labels to determine relative toxicities.

4. Avoid buying aerosols if possible. They are very expensive considering the small amount of active ingredient per container. Some aerosol products contain hazardous or toxic propellants, and the pressurized cans can explode when heated, crushed or punctured. The fine mist from the aerosol can penetrate into the lungs and coat respiratory passages. Consider buying paste, liquid, and pump spray products instead.

3-2 Automotive Products

Automotive products are usually flammable and can contain solvents and toxic additives. Antifreeze contains glycols, which are poisonous. Degreasers can contain xylenes, aromatic hydrocarbons, petroleum distillates, trichloroethylene, methylene dichloride and many other toxic substances. Leaded gasoline contains tetra ethyl lead, a nerve toxin. Oil treatments can contain lead soaps and napthalene. Car waxes contain aliphatic solvents and petroleum distillates.

Most of these products do not have alternatives. The consumer should be advised to choose the least toxic formulation, if possible, and to purchase only what is needed at the time.

3-3 Pesticides

The primary hazardous materials used on the lawn and garden are pesticides, especially herbicides to kill weeds and insecticides to control populations of pest insects. Pesticides are also used indoors to kill cockroaches, moths, molds, etc.

Pesticides are designed to kill living things. They are formulated to attack cells and organisms when and where they are most vulnerable. Because humans, pets and wildlife are also made up of living cells, they can also be harmed by pesticides.

Pesticides can contain carbamates, organochlorines and organophosphates. Older products might contain DDT, lead or arsenic.

Pesticides are regulated by the EPA under the Federal Insecticide, Fungicide and Rodenticide Act. Pesticides are often applied by a commercial applicator (required by law to have the owner licensed and responsible for training staff), or by the resident. Problems occur due to the inherent toxicity of these products and because these products can easily be misused or overused.

Pesticides are a very common household waste, especially since the products are sometimes very problem-specific, which necessitates

purchase of a large variety of products of which only small amounts are needed.

The solution to pesticide misuse is to use them more carefully and in smaller, more appropriate quantities. We can reduce our reliance on chemical pesticides by cleaning buildings more thoroughly and by using gardening methods which reduce the need for such products: organic gardening, integrated pest management or companion planting. A healthy lawn and garden, planted with diverse species, is the best defense against pests and disease.

See Appendices for information on pest life cycles and natural controls.

3-4 Home Improvement Products

This category includes products like paints, wood preservatives, paint thinners, adhesives and furniture strippers. These products can contain toxic solvents such as methylene dichloride, toluene, hexane, mineral spirits, benzene, turpentine and pigments containing various toxic metal compounds.

Choice of products is again important. For example, water-based products are less-toxic than oil-based. Thinners can be strained and reused. Asbestos in an unsealed form and urea formaldehyde products should be avoided because of the indoor air pollution hazard they pose.

3-5 Household Cleansers

Many of these products can be used for many different tasks. Consumers should be encouraged to use or donate old products before buying new ones. Aerosols should be avoided if possible.

This group of products can contain such toxicants as: pine oil, methyl salicylate, phenols, petroleum distillates, Stoddard solvent, ammonium compounds, naptha, chlorinated trisodium phosphate, sodium perborate, sodium hydroxide and hydrochloric acid.

3-6 Personal Products

The ingredients in these products vary by type. Many contain alcohol and sulfate detergents. Nail polish can contain acetone, xylene and toluene. Customers should be encouraged to use up what they buy.

3-7 Hobby Products

Photochemicals can contain ferrocyanides, silver compounds and hexavalent chromium. Some hobby paints and pottery glazes contain lead. Less toxic alternatives may or may not be available. The consumer should be encouraged to read the label to determine the toxicity of the product.

3-8 Miscellaneous Products

Swimming pool chemicals can contain muriatic acid. Some smoke detectors contain Americium-241, a radioactive product. A photoelectric smoke detector is a safer alternative. Heating oil is flammable and can contain toxic additives. (Also see the Disposal Section for additional recommendations.)

Figure 3A
Alternative Cleansers

The following products are simple, commonly available substances. Some are considered toxic (e.g., ammonia) but usually are not as toxic as the complex commercial products on the market. (From Wallace, D. *The Natural Formula Book for Home and Yard.* Rodale Press, 1982.)

Ingredient	What It Can Do
Household Ammonia	Clean carpets, copper, dishes, enamel, floors, formica, garbage cans, glass, grout, jewelry, linoleum, ovens, porcelain, refrigerators, showers, stainless steel, stoves, tubs, windows, woodwork (painted).
	Remove stains.
Baking Soda	Clean and deodorize carpets, countertops, drains, sinks, refrigerators, upholstery & vinyl.
	Extinguish grease fires.
	Freshen fabrics.
	Remove stains.
	Scour and/or polish aluminum, chrome, grout, jewelry, plastic, procelain, silver, stainless, steel and tin.
	Soften fabrics.
Bleach	Clean, deodorize and disinfect basins, concrete, grout, sinks, tiles, toilet bowls and tubs. Remove mildew and stains from carpets, clothes, concrete, upholstery and wood floors.
Borax	Clean wallpaper, walls and floors.
	Deodorize.

	Improve detergent power.
	Remove stains.
Cornstarch	Remove stains.
	Shampoo carpets and rugs.
	Starch clothes.
Lemon Juice	Deodorize.
	Clean windows and other glass.
	Remove stains from aluminum, clothes and porcelain.
Mineral Oil	Polish furniture.
	Wax floors.
Soap and Water	Clean cars, clothes, dishes, doors, floors, glass, jewelry, people, pets, sporting goods, tools, walls, windows and woodwork.
Steel Wool	Remove rust and rust stains and stubborn films.
	Scour barbeque grills and broiler pans.
Vinegar	Clean bricks, carpets, coffeepots, dishes, fireplaces, glass, grout, paint brushes, walls and windows.
	Polish metals.
	Remove mildew, spots (hardwater), stains and wax buildup.
	Soften fabrics.
Washing Soda	Clean and cut grease on barbeque grills, broiler pans, concrete, drains, fireplaces, floors, ovens and walls. Remove stains. Soften water. Improve detergent power.

Figure 3-B
Alternative Cleansers

Alternatives to Toxic Household Cleaning Products

KITCHEN

Oven Cleaner:
Best to clean right after use. Use a baking soda and water paste and scrub. One quarter cup ammonia in small dish left overnight in oven will help loosen spills.

Cleansers:
Baking soda and water work well on sinks, refrigerators and stoves. Water mixed with salt or Borax is preferred for formica. Bon Ami tested highest by Consumer Reports and is very low in toxicity.

Crusted Cookware:
Soak in solution of washing (sal) soda and water for 15 minutes (overnight for tough jobs), and scrub. This is also very effective on barbeque grills. A mixture of baking soda and vinegar boiled in the crusted pan will work too.

Cutting Boards:
Use a baking soda paste and let stand 15 minutes. This helps take out food odors such as garlic and onion.

Dishwashing:
Read labels to choose a nontoxic variety, such as Ivory.

Automatic Dishwashers:
Unfortunately, all commercial products contain some level of phosphates Cascade is considered the least caustic choice.

Tea Kettles & Coffee Pots:
Add 1 1/2 cups white vinegar, 3 tbls. salt, 1 1/2 cups water. Boil 15 minutes and then let stand overnight. Rinse thoroughly. Baking Soda will remove coffee stains in cups.

Glass Cleaners:
Mix 1/2 cup white vinegar with 1 gallon water. Put in spray bottle Very good for cutting through grease.

Flies, Ants and Roaches:
See Ecology Center's Integrated Pest Management fact sheets.

COMMENTS ON TOXIC ALTERNATIVES

Oven cleaners may contain sodium hydroxide (lye) or potassium hydroxide, both highly caustic substances. Serious burns to the skin or gastrointestinal organs if swallowed. Fumes are caustic and can damage the lungs if inhaled. Use soap instead of detergents whenever possible. Soap is an excellent cleaning agent in soft water, relatively non-toxic and biodegradeable.

HOUSEHOLD CLEANING CHORES

Floors:
A good all-purpose cleaner is 1/4 cup white vinegar, 1/4 cup washing soda mixed into 1 gallon warm water. For painted wood floors use 1 tbl. washing soda in 1 gallon warm water. Natural wood floors take nicely to Murphy's Oil Soap, available at most hardwares and supermarkets, which cleans and helps protect them. Vinyl floors, can also be cleaned with Murphy's Oil Soap. To remove wax buildup, mix 3 tbl. washing soda in 1 qt. warm water.

Commercial kitchen floor waxes may contain acrylics, resins and polymers (all plastics) and can irritate lungs, nasal passages, skin and eyes

Air Fresheners:
Keep kitchen counters, garbage pail, and bathrooms clean. Air house by opening the windows. Fish odors can be controlled by leaving a small bowl of vinegar out on the counter overnight. Baking soda is well-known for its deodorizing abilities.

Never use aerosol air fresheners; propellants may be toxic, and flurocarbons damage the atmosphere's ozone layer

Mold and Mildew:
Air rooms regularly. A borax and water solution sprayed onto surfaces has proven effective in hospitals as a disinfectant.

Leather Furniture:
Clean with Murphy's Oil Soap.

Upholstered Furniture:
Prevention: Vacuum or brush regularly. Shampoo with 6 tbl. soap flakes, 1 pt. boiling water, 2 tbl. borax.

Wood Furniture:
To polish, add 2 tbl. olive oil to 1 tbl. white vinegar and 1 qt. warm water. Store in spray bottle. Rub dry with soft, clean cloth. To wax, melt in double boiler, 1tbl. carnauba wax into 2 cups mineral oil and 3-4 drops lemon oil (optional). Apply with a soft cloth and then buff to a shine.

Carpet:
To deodorize, mix 2 cups corn meal to 1 cup borax and sprinkle on carpet. Leave there 15 minutes or longer, then vacuum. For carpet stains, solutions are too numerous to list here. See references on page six.

COMMENTS ON TOXIC ALTERNATIVES

Furniture and floor polishes may contain highly toxic ingredients such as nitrobenzene and denitrobenzene (carcinogens), oil of cedar (a central nervous stimulant), and naptha (petroleum distillate). Naptha can induce cardiac death, and the aspiration of petroleum distillates in general can induce a fatal form of chemical pneumonia. Avoid polishes which may entice children.

LAUNDRY

Washing:
Use pure soap, like Ivory Soap Flakes, with 1/3 cup borax or washing soda as cleaning boosters and whiteners. Borax is also a good grease cutter.

Bleach:
Instead of liquid bleach, use powdered bleaches which are less dangerous, and borax, which makes a good whitener. To wash out yellowish residues from detergents, prewash clothes in 1/4 cup washing soda and then wash with soap.

Fabric Softener:
Add 1/4 cup vinegar to the wash.

Starch:
Mix 1 tbl. cornstarch to 1 pt. water.

Stains:
Take care of stains as soon as they happen. Often, rubbing with a bar of pure soap and hand washing immediately in cold water, then laundering with regular wash is effective. Otherwise, the solution depends on the stain and the material it is on. See references on page six.

Washing Machine Cleaner:
Residues build up after many wash cycles. Add 1 cup white vinegar and run through entire cycle.

Detergents have many disadvantages; they require scarce petrochmicals, are less biodegradable, leave residues in clothes which require fabric softeners, and cause increased incidence of dermatitis. Detergents cause more poisonings than any other household product. They contain surfactants, cleaning agents or builders, optical brighteners, fillers, foam boosters, perfumes and enzymes. A few grains of synthetic detergent in the eyes can result in corneal burns which if left untreated can lead to severe eye damage. Ingestion can severely damage the upper digestive tract through chemical burns.

To save on water and soap, buy a washer with a suds saving cycle.

BATHROOM

Basin Tub and Tile:
Prevention for the tub. Wipe down just after bath before film can harden. For all scrubbing jobs use a mixture of either baking soda or borax in water. A plastic scrubber helps.

Toilet:
Brush regularly. Baking soda paste is effective for all parts of the toilet, and even deodorizes the bowl. For tough bowl stains, a paste of lemon juice and Borax can be rubbed onto the bowl and left to stand 2 hours. Scrub thoroughly. This will disinfect and deodorize.

Drains:
In the tub use a drain strainer to catch hair, and clean regularly. To maintain open drains pour kettle of boiling water down drain as needed. Slow drains can be reopened by pouring hot water down them and then adding 1/4 to 1/2 cup washing soda and waiting a minute or so before flushing again with hot water. If drain is already clogged, try using a plunger or wire snake. Or try putting 1/4 cup baking soda with 2 oz. of vinegar and cover tightly for a minute. Then flush with boiling water. Repeat if necessary.

Baking soda may work as well and there is no abrasion to the surface being cleaned or irritation to the skin of the person using it.

Most liquid toilet bowl cleaners contain hydrochloric acid, of which as little as 1 ml. has caused death. Granular cleaners form sulfuric acid when mixed with water, and are corrosive to body tissues. Toxic fumes are released, and inhalation can cause irritation of the lungs. Disinfectants can be classified as pesticides. A disinfectant reduces the number of germs present but does not kill all germs. Disinfecting is not the same as sterilizing. Common ingredients include phenol, which can cause severe burns on contact, and pine oil, which is irritating to the eyes and mucous membranes. Disinfectants can also cause kidney irritation and damage.

Drain cleaners pose the problem that if the cleaner does not work, the consumer is left with a drain that is now full of a dangerous, caustic solution.

Figure 3-C
Baking Soda Reprint

Baking Soda: A Home's Best Friend

Barbara Overton Christie

My dictionary defines baking soda as "a water-soluble powder, $NaHCO_3$" . . . but I call it a miracle worker Let me take you through a hypothetical day at the Christie household, just to show you how versatile this inexpensive, safe, eminently *useful* product is.

In the morning, I get up and—instead of reaching for a tube of synthetically flavored gel—take a small box of sodium bicarbonate from the medicine chest, sprinkle some of the powder on my toothbrush, and cleanse my teeth Baking soda's no more abrasive than toothpaste, so I use it daily

For breakfast, I offer my family hot-from-the-oven soda biscuits, fare that's far more delicious and much less expensive than canned pop-out biscuits. Afterwards, while washing the dishes, I sponge a little baking soda into the empty coffee cups to remove any stains. And I might put a spoonful of bicarb into our glass percolator, fill the container with boiling water, and let it soak for a few minutes to get rid of stale-tasting residues. When the dishes are done, I sprinkle a little soda on the countertops and in the sink, scrubbing lightly with a sponge and then rinsing Surfaces (even scuff-prone fiberglass tubs) come clean without a scratch

Now I'm ready to do some housework, so I mix up a batch of all-purpose cleaner by combining 1/2 cup of household ammonia, 1/2 cup of white vinegar, 1/2 gallon of water, and 1/4 cup of baking soda A stiff old nailbrush dipped in the solution makes fast work of rubbing out food spots on the dining room carpet . . . and a sponge saturated with the liquid gets fingerprints and smudges off painted walls and woodwork.

While I'm washing down the shower tiles with the solution, I remember this is the day to clean all the drains in the house . . so I pour 1/2 cup of soda followed by 1/2 cup of vinegar into each one (I sometimes also put a palmful of salt into the kitchen drain, to cut through grease) Half an hour or so later, I flush plain water down the drains, or if a drain is particularly sluggish, I use boiling water. By doing this once a week, I keep our pipes odorless and running free. And if you have a septic tank, flushing a cup of soda down the toilet once a week will help neutralize pH and often encourage the growth of waste-digesting bacteria.

Next, I go downstairs to do laundry. After pre-treating shirt collars and greasy spots with a spritz of my all-pupose soda cleaner (I keep some handy in a spray bottle), I throw in the clothes. add a little less detergent than is recommended on the box, and then make up the difference with some dry baking soda that I store in a jar by the washer. The laundry not only comes out cleaner but also softer.

That afternoon, my son comes into the house and says he has to remove some acid buildup on the terminals of his car battery A quarter.cup of baking soda mixed with a little water, applied with a rag, and left to stand for a few minutes allows him to simply wipe the encrustation away . . . no wire brush needed!

Later, our daughter arrives home from the beach, her face reddened by the sun . . . so I advise her to wash with a soothing solution of (you guessed it) baking soda and water. And when my husband comes in with a bee sting he got while working around the yard, I dab a thick paste of soda and water on the spot to relieve the pain "That reminds me," he remarks, "the grapes need spraying tomorrow" Every week or so when our grapes are ripening, he mixes 4 teaspoons of baking soda in a gallon of water and sprays the fruit to alkalinize the skins and keep fungus from developing.

At supper that night, while I'm cooking pork chops, some grease spatters on the burner and catches fire I grab a handful of soda from the jar by the range and throw it on the flames to extinguish them (When heated, soda releases carbon dioxide and prevents further combustion. Never throw water on a kitchen stove fire!) While washing the dinner dishes, I find that some mashed potatoes scorched and stuck to the bottom of the pot while I was tending to the fire . . . so I cover the gunk with a generous coat of baking soda barely wet with water and leave the pot in the sink overnight. In the morning, the scorch will be loosened for easier washing.

At bedtime, I'm feeling a bit queasy from the pork chops, but 1/2 teaspoon of trusty bicarb in a glass of water brings relief. (I know, though, that folks over 60 and people with high blood pressure should be particularly careful not to make this a habit, because of soda's high sodium content.) Then I draw a tub of hot water, dissolve 1/2 cup of soda in it, and—ahhhh—soak in soft, refreshing bath water

END OF COMMERCIAL

I know all this sounds like a TV ad, but the fact is that baking soda is one product that really is economical, environmentally safe, easy to use, and wonderfully versatile. I don't own stock in the baking-soda industry . . . I just happen to believe that plain old $NaHCO_3$ far outshines the so-called miracle cleaners and other products that it can so handily replace. And I say this simply because soda really *works*, not because I have any particular ax to grind

Why, I don't even own an ax. But if I did, I'd polish it with soda ●

Figure 3-D
Alternative Chart

Alternatives To Hazardous Household Chemicals
A Checklist For Your Home

Directions: Column 1: Check (✓) items below that you have in your home, garage or basement.
Column 2: Note how many cans, boxes, etc. you have of each.
Column 3: Review safer alternatives. Consider...will they work for you?

ITEM	QUANTITY	ALTERNATIVES TO THE PRODUCT
Kitchen/Bathroom		
____ drain cleaner		plunger; plumber's snake; flush with hot water, ¼ C baking soda & 2 oz. vinegar
____ toilet bowl cleaner		cleanser; soap; toilet brush
____ abrasive cleansers		baking soda; Bon-Ami; Chlorox Soft Scrub
____ disinfectant		open windows; air out bedding; open box baking soda; bleach if necessary
____ furniture/ floor polish		Murphy's Oil Soap; mineral oil
____ mildew remover		keep room dry; open box baking soda; bleach if necessary
____ oven cleaner		baking soda & water; sprinkle salt on spills & wipe
Laundry Room		
____ detergent		soap; use with washing soda (Arm & Hammer) if water is hard
* ____ dry cleaning fluid/ spot removers		soap; cornstach; vinegar
____ bleach		washing soda; Borax
____ other		
Garage/Basement		
**** ____ waste auto oil		
* ____ gasoline		
____ old antifreeze		
____ used brake or transmission fluid		
____ cans of old paint/ stain		latex paint
* ____ paint thinner/ turpentine/ paint stripper/ finish remover		latex paint; sand paper; sander
* ____ wood preservative		urethane
* ____ rat poison (DCon)		traps
* ____ pesticides (home & garden)		boric acid for roaches; soap sprays; salt water sprays; find source of problem (e.g. moisture)
* ____ herbicides (weed killers)		pull weeds; keep grass short
____ pet flea collars/ flea sprays & soaps		collar using pyrethrum
____ other		

To protect the health of your family & community - use alternatives - not chemicals which may pose health risks.

- Chemicals may leak & contaminate the environment.
- Children & pets may get into the toxics & poison themselves.
- The chemicals may break down & become useless for their intended purpose - but remain toxic.

Be sure your storage is secure.

For proper disposal methods, refer to our pamphlet "Disposing of your hazardous household substances."

*Highly toxic.
**Recycle centers available; see recycle pamphlet.

Prepared by:
Washtenaw County Health Department
Ecology Center
Pirgim

11/83

Chapter 4
Household Hazardous Product Disposal

Until recently, most people threw household hazardous products out in the trash or poured them down the drain without a second thought. Only with growing awareness of the consequences of toxic and hazardous industrial pollutants have we begun to recognize the hazards in our homes and garages. According to research done by the San Diego Environmental Health Coalition, the average household stores toxic products for 20 years or more and disposes of them randomly or on rare occasions. The educational efforts associated with this handbook are intended to enhance awareness of the environmental and health consequences of inadequate disposal methods.

To remedy some of the consequences of disposing of household hazardous waste by the disposal routes discussed earlier, some more environmentally-sound alternatives have been developed in communities around the country. These alternative disposal methods can be used for a wide variety of household hazardous waste products and are briefly described below. Specific guidelines on which method to use for specific waste products are also included.

4-1 Basic Disposal Options to Consider

A. **Share/Donate** — Some organizations in your community (theater groups, for example) would gladly accept donations of paints

and other products. Consumers might also consider sharing these products with friends and neighbors.

B. **Recycle/Reprocess** — Some firms in Michigan can reprocess solvents, fuels and other wastes so that they can be used again. Used motor oil and car batteries can be taken to many gas stations, recycling centers and auto parts stores. (See list of firms in the Directory section.)

C. **Toxics Collection Days** — Collection operations are sponsored periodically in communities around the state. If possible, wastes should be saved and taken to these collection events. (See description of toxics collection days in Chapter One and the Bibliography.)

D. **Transfer/Dropoff Station** — It may be advantageous for a community to set up a permanent collection station staffed on a demand basis. Thus, wastes could be temporarily stored until enough is collected to make transportation to treatment or disposal facilties feasible. Such a transfer station could also be used for small quantity generators, such as gas stations, dry cleaners or research labs. Construction and operation of such a station might require a license or permit. Consult Michigan Department of Natural Resources (MDNR), Hazardous Waste Division for information and assistance.

E. **Hazardous Waste Landfill/Incinerator** — If a collection center or transfer station is not available, wastes can sometimes be taken directly to a licensed hazardous waste landfill or incinerator. (See references in the Directory section or call MDNR/Hazardous Waste Division for information.) Precautions should be taken in packaging the waste for transportation; consult the disposal company for advice. The only hazardous waste facility currently licensed and available to take household hazardous wastes in Michigan is Wayne Disposal (in Wayne County). Communities in western Michigan and in the Upper Peninsula might consider contacting facilities and the appropriate agencies in adjacent states.

F. **Solidify** — Less hazardous liquid wastes can also be solidified with an inert, absorbent material (kitty litter, charcoal, sawdust, sand, soil) and then double-wrapped in plastic before being discarded in the trash. This practice is not encouraged unless other alternatives do not exist because solidification is likely to slow down or delay contamination problems, not prevent them.

G. **Pour Down the Drain with Lots of Water** — A few toxic materials might be diluted safely. Consult with your local wastewater treatment plant operator and public health officials before recommen- ding this action. Many communities choose to not include this practice because it can encourage improper disposal methods.

4-2 Recommended Disposal Methods for Selected Household Products

The following section of the handbook will provide you with some carefully considered recommendations for disposal of specific hazardous products found in most households. (The Directory and Bibliography sections provide references for disposal of products not listed here.) The recommendations are divided into the following categories:

4-3 Automotive Products

A variety of toxic products are associated with the operation and maintenance of cars, trucks, motorcycles, etc., including: motor oil, gasoline, antifreeze, transmission fluid, brake fluid, batteries, degreasing fluids, oil treatments, etc. Most of these products are flammable and/or toxic, and therefore present a hazard if mishandled or disposed of improperly.

USED MOTOR OIL is an especially common waste product. Improperly discarded oil is a significant groundwater pollution problem in Michigan. The oil drained from your car contains contaminants that can be removed during reprocessing to allow reuse of the oil, thus conserving petroleum resources and preventing contamination of the environment. Used motor oil should be taken to an oil recycling center or to a gas station where it is collected and then taken to a reprocessing plant. The anticipated new EPA regulations on motor oil to classify it as a hazardous waste may reduce the number of oil collection sites. Contact your local Michigan Department of Natural Resources (MDNR) representative for the latest regulatory information.

TRANSMISSION FLUID, KEROSENE, DIESEL FUEL, and BRAKE FLUID are similar to motor oil and can be mixed with oil to be recycled/reprocessed. This is possible only if the treatment/disposal facility can handle each of these fluids. (See the list of companies in the Directory section.)

ANTIFREEZE (usually a formulation of ethylene glycol) is a poison to animals and birds. Its sweet taste and smell make it

attractive to children and pets. Antifreeze should be used according to directions or donated to others who could use it. Contact your local wastewater treatment plant to see if the plant can accept antifreeze. If it can't, take the antifreeze to a collection day or center or to a licensed hazardous waste disposal facility. Antifreeze should not be poured into a septic tank or storm sewer.

OLD CAR BATTERIES pose a hazard because of the toxicity and corrosiveness of the acid and metals in the battery. These batteries should be taken to a battery retailer (store or gas station) that can send them to a reprocessing facility. These companies are usually listed in the Yellow Pages of the telephone book under Batteries-Storage-Retail.

GASOLINE is both highly flammable and toxic. It also contains toxic additives. Gasoline should be used up whenever possible. Larger amounts (more than a gallon or two) and gasoline containing lead or other hazardous contaminants should be saved and taken to a hazardous waste collection center or licensed hazardous waste disposal facility. Gasoline drained from small moters (lawn mowers, snowmobiles, boats, etc.) can be strained through cloth or a paper coffee filter to remove impurities and stored for future use in a tightly closed, well-labeled container. "Dry gas" can be added to remove water. Consult your local fire station about storage precautions. *A few communities recommend evaporating gasoline in an open protected area, which is a very controversial suggestion according to the Environmental Protection Agency's Auto Emissions Lab in Ann Arbor, and is not recommended by the compilers of this handbook at this time.*

DEGREASING FLUIDS can contain trichlorethylene, methylene chloride and other chlorinated hydrocarbons. Some of these solvents are suspected or known carcinogens and as such pose a serious groundwater pollution threat. They should be saved in a secure container and taken to a toxics collection day or licensed hazardous waste disposal facility.

4-4 Pesticides

When faced with disposal of pesticide products already purchased, the following recommendations apply:

1) Do not use products now restricted or banned for household use by the Environmental Protection Agency. (This is not necessarily a comprehensive list of restricted or banned products. The EPA Hotline 800-621-8431 can provide the most current information.)

Aldrin
Arsenic trioxide
Bithionol
Chloranil
Chlordane (restricted use)
Chlorobenzilate
Copper arsenate
DBCP
DDD
DDT
Dieldrin
Endrin
Fluroacetamide
Heptachlor
Kepone
Lindane
Mercury
Mirex
Pentachlorophenol
Phenarzine
Safrole
Silvex
Sodium arsenite (in excess of 2%)
Sodium cyanide
Sodium fluoride (in excess of 40%)
Thallium sulfate
Toxaphene
2,4-D (restricted use)
2,4,5-T

2) If the products have not been banned, use them according to the directions on the container or give them to neighbors, friends or neighborhood nurseries.

3) Empty containers should be rinsed three times and the rinse water used as dilution water for the pesticide. The containers, properly rinsed, should be wrapped securely with plastic and disposed of with other household refuse.

4) Banned pesticides and those that can't be given away should be taken to a hazardous waste collection center or disposal facility.

5) Do not water a pesticide-treated area right after application unless directed to do so. The pesticide could run off with the excess water into a storm drain or a nearby stream. It is probably preferable to water the lawn or garden before application instead of after unless otherwise directed.

6) If spraying, follow label instructions and take the following safety precautions:

— wear a hat and rubber gloves
— wear long sleeves and non-canvass shoes
— change and wash clothes
— take a shower
— do not spray into the wind
— do not spray around children or pets
— if possible, post warning signs around the sprayed area for several days

7) Aerosol pesticides are not recommended (See 3-1 for explanation). Granulated products are considered safer than pump sprays.

4-5 Home Improvement Products

This category includes such materials as paints, varnishes, paint removers, furniture strippers, glues, wood preservatives, etc. Most of these substances contain toxic organic solvents and/or heavy metals and can be flammable.

USED SOLVENTS such as paint thinners and furniture strippers can be recycled. They can be filtered with a paper coffee filter or cheesecloth and reused in the home workshop or they can be taken to a reprocessing or treatment facility, a collection center or licensed disposal facility. (See list in the Directory section.) Allowing the solvents to evaporate outside is a very controversial recommendation and not currently endorsed by most state health agencies.

Uncontaminated PAINT THINNERS can be used by mixing them into remaining oil-based paint products or by giving them to neighbors, friends, or service and community organizations.

Manufacturers produce two types of PAINTS: oil-based and water-based. Oil-based paints contain organic solvents and thus pose similar problems as the solvents discussed above. Some oil-based and water-based paints contain toxic pigments. Some older paint products contain lead, a very toxic ingredient.

LEADED PAINTS should be saved and taken to a hazardous waste collection center or a disposal facility. Other paints should be used up or donated. Otherwise, OIL-BASED PAINTS should be taken to a hazardous waste collection center or licensed hazardous waste disposal facility. Unusable WATER-BASED PAINTS should be solidified, wrapped securely and put in regular garbage. Most paints remain useable for many years if correctly stored according to directions and kept from freezing temperatures.

WOOD PRESERVATIVES are very similar to pesticides and should be disposed of in a similar manner. Use them up or take them to a collection center or disposal facility.

ASBESTOS is a known human carcinogen and is harmful because the tiny asbestos fibers can be inhaled deep into the lungs. In general, asbestos products are much less likely to cause health risks if left undisturbed in the home than if the asbestos is improperly removed.

Asbestos is found in two forms: friable and non-friable. Non-friable appears as a solid mass (or is encased) and is not presently considered to pose health hazards if left undisturbed. Friable asbestos can be crushed or crumbled by hand pressure alone. Pipe insulation containing asbestos that has been damaged may be friable. Likewise

sprayed or blown-in insulation (commonly used until the 1970's but now banned by EPA), is also friable. Often resembling cotton candy, such friable material is hazardous because the asbestos fibers are easily released into the air.

If the material appears to be friable, the owner may decide to have the asbestos insulation wrapped with tape or removed by a licensed asbestos abatement contractor. Many county health departments maintain lists of laboratories that can test building materials for asbestos and of licensed asbestos abatement contractors.

4-6 Household Cleansers

This category includes a wide variety of cleaning and disinfecting products and correspondingly many different hazards and toxicants, including acids, bases and solvents. Within each type of product are a wide variety of formulations. Many of the products could be replaced with a smaller number of less-toxic or non-toxic alternative products. Conservative use of these products and/or consideration of alternative products is encouraged. If the products must be disposed of, donation to hospitals, schools or community service organizations could be considered.

Cleaning products should be used up or donated if possible. Small quantities (a cup or two) of less-toxic, water-soluble products like SOAPS and DETERGENTS can be poured down the drain with plenty of water. These products can also be wrapped securely and put in the trash (liquids should be solidified first). Solvent-containing products like FURNITURE POLISHES and WAXES should be used up, donated or taken to a collection site or licenced hazardous disposal facility. Highly toxic or corrosive products like DRAIN CLEANERS, TOILET BOWL CLEANERS, OVEN CLEANERS and MOTH BALLS should be used up or taken to a collection site or licensed hazardous waste disposal facility.

4-7 Personal Products and Pharmaceuticals

These products include medicines (prescription and over-the-counter), hair care products (hair spray, dyes, permanent wave solutions, etc.) and many other similar products.

Out-of-date MEDICINES should be wrapped in plastic and thrown out in the trash. Antibiotics and other medicines can kill the useful bacteria in sewage treatment plants or septic tanks if they are flushed down the toilet or sink. Ask your pharmacist about specific products.

Personal products in aerosol cans should be avoided. (See recommended disposal method for aerosol cans in the miscellaneous products section.) Pump bottle products, lotions and gels are recommended alternatives.

INSECT REPELLANTS should be disposed of like other pesticides. They should be taken to a collection center or to a licensed hazardous waste disposal facility.

4-8 Hobby Products

PHOTOGRAPHIC CHEMICALS should be recycled, if possible, in the individual darkrooms or by taking them to a cooperating local photo lab. If these labs generate large quantities, they usually send the used solvents, etc., to reprocessing/reclamation facilities. Photographic fixers contain silver, a valuable but toxic metal that can be reclaimed for reuse. Some of the older (5 to 10 years old and over) photochemicals contain cyanides and other toxic ingredients; these should be sent to a licenced hazardous waste facility. (See the bibliography for specific publications on appropriate disposal procedures for photochemicals.)

According to Kodak, photographic wastes can be flushed into a septic tank or sanitary sewer if the ratio of sanitary waste to photographic is at least 10 to 1. The average family of four produces enough effluent (200 gallons) to dilute about 13-20 gallons of photographic effluent a day. This dilution can still result in harmful water pollution and is not recommended unless other alternatives do not exist.

Photographic chemicals should not be discharged into the storm drains. Large amounts (a gallon or more) should not be discharged into the sanitary sewer at any one time. Holding tanks can be used to slowly release the effluent, if necessary.

Refer to other handbook sections for the disposal recommendations of OTHER HOBBY PRODUCTS such as paint and solvents.

4-9 Miscellaneous Products

SMOKE DETECTORS come in two varieties: photoelectric and ionizing (radioactive). The radioactive sensors contain a small amount of Americium-241 in a metallic foil container, supposedly leakproof during both normal use and in a fire situation. Though the useful life of the radioactive sensor is only about 15 years, Americium-241 has a radioactive half-life of 460 years.

Americium, which is water-soluble, accumulates in the environment where it can enter the human food chain in drinking water, plants, fish and animals. Once ingested by humans, Americium-241 moves readily from the gastrointestinal tract into the bloodstream where it can induce liver and bone cancer.

The alternative to the radioactive smoke detector is the photoelectric variety, which poses no health hazard. The National Bureau of Standards says the photoelectric units are almost as effective and has approved both types. The photoelectic type responds most quickly to a smoldering fire where the smoke particles are large, whereas the radioactive unit responds more readily to clean flames and smaller smoke particles. Either device will normally work for the home because of the wide variety of smoke particles usually found in a house fire.

Smoke detectors with an ionizing sensor should be returned to the manufacturer or to the Nuclear Regulatory Commission for long term disposal.

(From *The Progressive,* August 1977, "Caution: Smoke Detectors May Be Hazardous to Your Health," by McKinley C. Olsen.)

HEATING OIL is a significant causal factor in groundwater contamination from leaking underground storage tanks. Usable or left-over oil should be used up or taken to an oil reclamation facility.

AMMUNITION should not be thrown away in the trash. Contact your local fire or police department, sherrif or state police for assistance with disposal.

AEROSOL CANS can explode. Check with your local solid waste officials before recommending that empty aerosol cans be put into the trash. (Avoidance of the purchase of future pressurized aerosol cans is the best solution.)

SWIMMING POOL CHEMICALS should be used up or donated. Undiluted pool chemicals should be taken to a collection center or licensed hazardous waste disposal facility.

Chapter 5
Houshold Hazardous Substances Directory

5-1 Local Community Contacts

	PHONE	NAME
County Public Health Department		
Local Poison Control Center		
County Co-op Extension Agent		
Fire Department		
Toxicologist		
Other		
Reprocessing/recycling firms for oil, batteries		
Environmental and Consumer Organizations		
District MDNR Office		

District Dept. of Agriculture Office _____

Wastewater Treatment Operator(s) _____

Others _____

5-2 Michigan Government Agencies

Michigan Department of Natural Resources
P.O. Box 30038
Lansing, Michigan 48909

Hazardous Waste Division	517-373-2730
Groundwater Quality Division (regulates landfills, site cleanups)	517-373-1947
Community Assistance Division (technical assistance for local communities on recycling, wastewater treatment, etc.)	517-323-3710
Surface Water Quality	517-323-1949
Toxic Chemical Evaluation Section	517-373-2190
Hazardous Waste Division District Offices:	
Cadillac District	(see Roscommon)
Detroit Area District	313-459-0770
Grand Rapids District	616-456-5071
Jackson District	(see Roscommon)
Lansing District	517-322-1300
Marquette District	(see Roscommon)
Plainwell District	616-685-8996
Roscommon District	517-275-5151
Saginaw District	517-771-1731

Center for Environmental Toxicology 517-353-6469
C-231 Holden Hall
Michigan State University
East Lansing, MI 48824

Cooperative Extension Service
48 Agriculture Hall
East Lansing, MI 48824

Natural Resource Public Policy Program	517-373-1360
Pesticide Coordinator	517-355-0117

Michigan Department of Public Health 517-373-1360
3500 N. Logan
Lansing, MI 48909

Center for Environmental Health Sciences	517-335-9214
Michigan Occupational Safety and Health MIOSHA Occupational Health Services Div. (operates seven district offices)	517-335-8250
Toxics Hotline	800-MI-TOXICS

Michigan Department of Agriculture

Office of Toxic Substances and Emergency Services	517-373-0440

Toxic Substance Control Commission P.O. Box 30026 Lansing, MI 48909	517-373-1031
Pollution Emergency Alerting System (24-hour hotline to report spills, illegal spraying, other emergencies)	800-292-4706
Michigan Poison Information and Toxicology Center	313-764-5102
Regional Poison Control Centers	
Upper Peninsula	800-562-9781
Western Michigan (Grand Rapids)	800-632-2727
Detroit Metropolitan Area (Children's Hosp.)	313-494-5711
Area 313 calls (Detroit)	800-462-6642
Other Area Codes in Michigan (Detroit)	800-572-1655
Poison Information & Toxicology Ctr. (U-M)	313-764-5102

5-3 Federal Government Agencies

Toxic Substance Control Act Hotline 800-424-9065

Consumer Product Safety Commission 800-638-CPSC

Occupational Safety and Health Administration (OSHA)
U.S. Department of Labor
200 Constitution Ave., N.W.
Washington DC 20210

OSHA standards are available free upon request.

Environmental Protection Agency

Waste Management Division (Region V) 312-886-7579

Public Information Center (Washington, DC) 202-382-7550
Environmental Hotline (Washington, DC) 800-621-8431
(8:30 - 4:30 Central Time)

5-4 Selected Michigan Organizations

American Lung Association of Michigan
403 Seymore Ave.
Lansing, MI 48914 517-484-4541

Also has local chapters.

Citizens for Alternatives to Chemical Contamination
9646 School Street
Lake, MI 48632 517-544-3318

Citizens Organized Acting Together
701 E. Maple
Holly, MI 48442 313-634-5120

East Michigan Environmental Action Council
21220 West Fourteen Mile Road
Birmingham, MI 48010 313-258-5188

Ecology Center of Ann Arbor
417 Detroit St.
Ann Arbor, MI 48104 313-761-3186

Flint Environmental Action Team
939 Mott Foundation Bldg.
Flint, MI 48502 313-239-0341

League of Women Voters of Michigan
200 Museum Drive, Suite 202
Lansing, MI 48933-1997 517-484-5383

Also has local chapters

Michigan Environmental Council
115 Allegan St. #325
Lansing, MI 48933 517-487-9539

Michigan Environmental Education Association
Dave Chapman
4360 Hagadorn Rd.
Okemos, MI 48864 517-351-8888

Michigan Environmental Health Association
Environmental Toxics Advisory Committee
Robert Ceru
Ingham County Health Dept.
P.O. Box 30161
Lansing, MI 48909

Michigan Recycling Coalition
Grand Rapids — 616-846-8250

Michigan Right to Know Task Force
P.O. Box 24142
Lansing, MI 48909 — 517-355-5070

Michigan Toxic Dumpsite Conference
Northern Michigan Environmental Action Council
1308 Neahtawanta
Traverse City, MI 49684 — 616-946-6931

Michigan United Conservation Clubs
Box 30235
Lansing, MI 48909 — 517-371-1041

People's Action League
11836 Clark Road
Eagle, MI 48822 — 517-626-6393

Public Interest Research Group in Michigan (PIRGIM)
220 N. Chestnut
Lansing, MI 48933 — 517-487-6003

Science for Citizens Center
Western Michigan University
Kalamazoo, MI 49008 — 616-383-3983

Sierra Club of Michigan
115 W. Allegan
Suite 330
Lansing, Michigan 48933 — 517-484-2372

Also has local chapters

Southeast Michigan Coalition of Occupational Safety and Health (SEMCOSH)
1550 Howard St.
Detroit, MI 48216 — 313-961-3345

Provides resources for people working to improve job conditions. Offers workshops, fact sheets and technical assistance.

Upper Peninsula Environmental Coalition
P.O. Box 34
Houghton, MI 49931

Western Michigan Environmental Action Council
1324 Lake Dr.
Grand Rapids, MI 49506 616-451-3051

Waste Systems Institute
470 Market St, SW, Suite 100A
Grand Rapids, MI 49503 616-451-8992

Maintains a clearinghouse for toxic waste exchange within the Great Lakes region. Newsletters and workshops help businesses concerned with environmental protection and hazardous materials handling.

Home Chemical Awareness Council
116 W. Ottawa St., Suite 600
Lansing, MI 48933 517-372-8898

5-5 Selected National Organizations

Chemical Manufacturers Association
Chemical Referral Center 1-800-262-8200

Provides information on proper use and safety of household chemicals. Operates Monday-Friday, 8 a.m. to 9 p.m., Eastern Standard Time.

Environmental Action Foundation
1525 New Hampshire, NW
Washington, D.C. 20036 202-745-4879

National Campaign Against Toxic Hazards
1300 Connecticut Avenue, Rm. 301
Washington, D.C. 20036 312-886-7579

National Coalition Against Misuse of Pesticides 202-543-5450

National Health Info. Clearinghouse 800-336-4797

National Institute for Occupational Safety and Health (NIOSH)
4676 Columbia Parkway
Cincinnati, OH 45226

Conducts research and publishes information on workplace health and safety. Materials may apply to the "serious" home hobbyist.

National Pesticides Information Clearinghouse 800-531-7790

National Pesticide Telecommunications Network 800-858-7378

OSHA/Environmental Network
815 16th St, NW
Room 301
Washington, D.C. 20006

Coalition of labor unions, health and environmental groups

5-6 Organizations in Other States Working Directly With Household Hazardous Waste

Association of Bay Area Governments
Metro Center
Eighth and Oak Streets
Oakland, CA 94604

Florida Dept. of Environmental Regulation
2600 Blair Stone Road
Tallahassee, Florida 32301

Golden Empire Health Planning Center
2100 21st Street
Sacramento, CA 95818 (916) 731-5050

Massachusetts League of Women Voters
Box 233
Lexington, MA 02173 (617) 861-0123

Metropolitan Area Planning Council
110 Tremont St.
Boston, MA 02108

Minnesota Pollution Control Agency
Susan Ridgley (612) 297-1453

Municipality of Metropolitan Seattle
821 Second Avenue
Seattle, Washington

San Diego Environmental Health Coalition
P.O. Box 8426
San Diego, CA 92102 (619) 235-0281

Wisconsin Dept. of Natural Resources
Bureau of Solid Waste Management
Box 7921
Madison, Wisconsin 53707 (608) 266-7017

5-7 Michigan Treatment and Disposal Firms

DISCLAIMER: These firms are listed below as a service to people seeking further information on small quantity hazardous waste disposal and does not constitute an endorsement. This listing has not been evaluated by any criteria other than a willingness expressed by the owner to discuss handling household hazardous wastes. More current and comprehensive listings of treatment and disposal firms are compiled by Waste Systems Institute in Grand Rapids, at (616) 363-7367. Additional information may be available from the Michigan Department of Natural Resources, Hazardous Waste Division.

ABC Oil 313-775-0370

Will pick up over 50 gallons of oil. May charge for service in the future.

American Waste Oil
44141 Yost Rd.
Belleville, MI 48111 313-397-2300

Oil recycler. Will take hydraulic oil and machine oil. No charge for waste from households. Will take antifreeze.

Chemical Recovery Systems
36345 Van Born Rd.
Romulus, MI 48174

Solvents recycled. 55 gallon minimum. Organic solvents only.

Drug and Lab
331 Broad St.
Plainwell, MI 49080 616-685-9824

Is a waste transporter. Will take ny amount. Minimum charge is $75. Will take any waste except radioactive.

Michigan Disposal
(affiliated with Wayne Disposal)
49350 N. Service Dr.
Belleville, MI 48111 313-326-0204

Will take almost any type of waste, except explosives. Will accept small amounts from

Will take almost any type of waste, except explosives. Will accept small amounts from households (less than 5-10 gallons) but must be called ahead of time to clear. Reserves right to charge for disposal service.

Small Quantity Specialists
Westland 313-326-1523

Will accept wastes from non-household small quantity generators and from toxics collection programs. Will not accept explosives , radioactive or infectious wastes. Will pick up. Wastes are recycled, treated, incinerated or landfilled as appropriate.

Suburban Oil 313-941-5812

Will accept oils and antifreeze. Minimum charge of $100 plus disposal charge.

Michigan Department of Agriculture

The following are regional offices of the State Department of Agriculture. Call these offices with questions about safe commercial application of pesticides, to check if a pesticide is restricted in Michigan, or to register a complaint about misapplication of a pesticide.

Region 1
State Office Building
305 Ludington St.
Escanaba, MI 49829
(906) 786-5462

Region 2
701 S. Elmwood Suite 132
Traverse City, MI 49684
(616) 947-3171

Region 3
State Office Building Room 2C
350 Ottawa NW
Grand Rapids, MI 49503
(616) 456-6988

Region 4
State Office Building
411 F East Genesee
Saginaw, MI 48607
(517) 771-1778

Region 5
4032 M-139 Building 116
St. Joseph, MI 49085
(616) 428-2575

Region 6
1615 S. Harrison
East Lansing, MI 48823
(517) 373-8782

Region 7
1120 W. State Fairgrounds
Detroit, MI 48203
(313) 368-2230

5-8 Asbestos Resources
Standards Enforcement, Reference and Referral

Your County Health Department, Environmental Health Program

- receives questions regarding asbestos safety
- makes referrals for abatement (removal) for homeowners
- if determined necessary may inspect a home of public use building for asbestos (call for information)

EPA Region 5 - Chicago. . . . . . (312) 886-6003

- enforces Asbestos In Schools Rule
- receives calls and questions about the above rule
- call to inquire if a school district has been surveyed for asbestos

Michigan OSHA. . . . . . (517) 335-8250

Your Regional OSHA Office

- receives complaints regarding worker exposure and improper work practices on both large and small-scale jobs

Michigan Department of Natural Resources. . . . . . (517) 373-7023

Air Quality Division

- answers questions about disposal and work practices for NESHAPS size jobs (260 square feet or 160 linear feet)

Your Regional Office

- responsible for notification of demolition or removal (NESHAPS) and answers questions about the same

Ground Water Division, MDNR. . . . . (517) 373-1947

- receives complaints about improper waste disposal or locations of waste disposal facilities

Contractors

As a result of the 1986 Asbestos Abatement Contractors Licensing Act and the Asbestos Training Act anyone in the state of Michigan who provides asbestos abatement services must be licensed with the state.

For a list of licensed contractors who remove asbestos or for information regarding laboratories in your area that identify asbestos call the Michigan Department of Public Health, Occupational Health Program at (517) 373-1410.

Occupational Health Clinics

There are two hospital-based clinics that diagnose and treat asbestos-related disease:

University of Michigan, School of Public Health,
Occupational Health Program (313) 764-2594

Wayne State University
Dr. Ray Demers (313) 577-5074

Chapter 6
Bibliography

These references are suggested for background and ready reference information. If your office cannnot afford to purchase them, contact your public library or nearby university library to suggest their purchase.

6-1 Companion Guide

Municipality of Metro Seattle. *Toxicants in Consumer Products.* 1982. 180 pages. $4.50. Order from 821 Second Ave., Seattle, WA.

We recommend purchasing this book for much greater detail on the chemistry of common toxic substances in the environment. Although written for the layperson, the research will satisfy the professional as well.

6-2 Household Toxics Collection Days

Basic Sources

Golden Empire Health Planning Center. *Household Hazardous Waste: Solving the Disposal Problem.* 2100 21st Street, Sacramento, CA 95818. (916) 731-5050. 1984. ($13.50).

Excellent source on everything from planning and promoting through disposal and liability. Numerous case studies are included. Over 300 pages. Golden Empire is very active in the household toxic substances area and is planning publication of more titles.

Michigan Department of Natural Resources, Hazardous Substances Division. *"Guidelines for Establishing Household Hazardous Wastes Collection Days."* 1986. Available from MDNR, P.O. Box 30028, Lansing, MI. (free)

Additional materials are being developed through a Household Hazardous Waste Coalition, including a list of haulers in the state

to handle community household toxics collection day materials, and a less-toxic products list.

Maryland Environmental Service. *Feasibility Study of Special Collection of Household Hazardous Waste.* Prepared by MES, 2020 Industrial Drive, Annapolis, MD. 1986.

Case Studies

Florida Dept. of Environmental Regulation. *Amnesty Days—Workshop Report.* 2600 Blair Stone Road, Tallahassee, Florida 32301.

Folder of material, including liability agreements.

Natural Resources Committee. *Household Hazardous Wastes Collection Project: A How to Kit.* Lexington, Massachusetts League of Women Voters, Box 233, Lexington, MA 02173. (617) 861-0123. 1983. ($7.00).

A videotape and slideshow are also available for sale or rent.

Satyshur, K., J. Schmidt and S. Jones. *Clean Sweep: Household Hazardous Waste Program for Madison, Wisconsin.* Wisconsin Dept. of Natural Resources, Bureau of Solid Waste Management, Box 7921, Madison, Wisconsin 53707 (608) 266-7017). (Free).

Municipality of Metropolitan Seattle. *Summary Report.* Household Hazardous Waste Disposal Project. See address above. ($2.30).

The report provides a comprehensive overview of the project, including: origins and objectives, household hazardous waste problem, discussion of solutions, and conclusions and recommendations.

6-3 Alternatives

Wallace, Dan. *The Natural Formula Book for Home and Yard.* Rodale Press. Emmaus, Pennsylvania. 1982. ($17.98).

Describes formulas using natural, non-toxic ingredients for a wide variety of household products, including: general cleaners, kitchen, bathroom laundry, furniture, floors, hygiene/remedies, convenience foods, fertilizers, pesticides, garage.

Dadd, Debra Lynn. *Non-toxic and Natural: How to Avoid Dangerous Everyday Products and Buy or Make Safe Ones.* Non-toxic

Lifestyles, Inc. Box 210019, San Francisco, CA 94121.

Fritsch, Albert J. (ed.) *The Household Pollutants Guide.* Center for Science in the Public Interest. Anchor Press/Doubleday. 1978. ($3.50). Currently out of print.

6-4 Toxic Art Products

McCann, Michael. *Artist Beware.* Watson-Guptill Publications, New York. 1979. ($17.95).

"An excellent handbook for artists, craftsmen and home hobbyists. Explains the health risks associated with numerous chemical products, safety procedures, first aid and recognition of poisoning. Individual chapters on painting, printmaking, ceramics, glass-blowing, enameling, sculpture, metalworking, photography. crafts and children's art. Bibliography included."

Pembleton, Ron. *Not a pretty picture: Art Hazards in California Public Schools.* California Public Interest Research Group. 46 Shattuck Sq. #11, Berkeley, CA 94704 (415) 642-9952. ($4.50).

No art teacher, principal or parent should be witnout this booklet.

6-5 Technical Information

Basic Sources

Casarett and Doull's Toxicology. Second edition. Edited by J. Doull et al. Macmillan, 1980.

This is an standard toxicology textbook.

Gosselin, Robert E., et al. *Clinical Toxicology of Commerical Products.* Fifth Edition. 1984. Williams and Wilkins Co. ($94.00).

3000 chemical ingredients widely used in commercial products are included. Toxicity information is given for each. Also includes trade name index for 17,000 products and addresses of manufacturers.

Additional Sources

California Department of Health Services. *Health Effects of Toxic Substances: A Directory of References and Resources 1986.* Copies

available free of charge from the Community Toxicology Unit, 2151 Berkeley Way, Berkeley, CA 94704-9980 (415) 540-3963.

Corbett, Thomas H. *Cancer and Chemicals.* Nelson-Hall. 1977.

"Describes the carcinogenic chemical use in the home, at work and in medical practice. Includes information on decreasing risk."

Hamilton and Hardy's Industrial Toxicology. Fourth Ed. Revised by Asher J. Finkel. John Wright-PSG. 1983.

Kamrin, Michael and Alice E. Marczewski. 1985. *Toxicity and the Citizen.* Center for Environmental Toxicology, Michigan State University.

"Describes fourteen detailed treatment methods for 550 pesticides, treatment of small spills, disposal of empty containers."

Lewis, R.J. and R.L. Tatken. *Registry of Toxic Effects of Chemical Substances.* US Dept. of Health, Education and Welfare., 1978.

Metropolitan Area Planning Council. *The Safe Use, Storage and Disposal of Household Hazardous Chemicals.* 110 Tremont St. Boston, MA 02108

Michigan Office of Management and Information Systems (OMB), *"Citizen's Guide for Community Health Studies,"* prepared for Michigan Toxic Substance Control Commission. June 1985. (free).

National Fire Prevention Association. *Fire Protection Guide on Hazardous Materials.* 470 Atlantic Avenue, Boston, MA 02210, 1978.

Information on fire explosion, toxicity and reactivity ratings of thousands of chemicals. Listed by brand name. Indentifies manufacturer, flash point and principal uses. Information on safe storage methods.

National Research Council. *Prudent Practices for Disposal of Chemicals from Laboratories.* National Academy Press, 1983. ($15.00).

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NIOSH/OSHA Pocket Guide to Chemical Hazards. 1978. U.S.

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Acute hazard information on chemicals regulated by OSHA.

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Describes numerous houshold products and their role in producing allergic reactions.

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Describes toxic effects and common uses of 10,000 chemicals. Has poison control center list, first aid information and a cross index of chemical names and formulas.

Steere, Norman V. (ed.). *CRC Handbook of Laboratory Safety.* The Chemical Rubber Co. 1971.

"Gives procedures for disposal and hazards associated with several thousand chemcials. Laboratory safety procedures."

Zamm, Alfred V. *Why Your House May Endanger Your Health.* Simon and Shuster. 1980.

Described numerous household products and their role in producing allergic reactions. Describes safer alternatives including architectural design considerations.

6-6 Educational Materials

Purin, Gina. Golden Empire Health Planning Center. *Toxics in my Home? You Bet!* Four separate units (K-3, 4-6, 7-8, 9-12). ($8.00 each, bound, $4.00 unbound).

Addresses chemical hazards in the home including how to identify them, unsafe practices and safer, alternative products. It is activity oriented with master worksheets included. Background articles to orient teacher are included.

Municipality of Metropolitan Seattle. *Sleuth: Educational Activities on the Disposal of Household Hazardous Waste.* ($3.60). 160 pages.

For use by teachers in grades 4-12, Sleuth is a collection of classroom activities related to household hazardous waste, including problem solving exercises, a game, chemistry activites and worksheets.

East Michigan Environmental Action Council. *Groundwater Quality Protection in Oakland County: A Sourcebook for Teachers.* Feb. 1985. 21220 W. Fourteen Mile Road, Birmingham, MI 48010. ($10.00).

East Michigan Environmental Action Council. *"Teacher's Sourcebook on Household Hazardous Substances."* 1986. Address above. ($2 for postage).

Classroom and home projects for middle school students.

Hazardous Chemicals Education Project. *Hazardous Wastes and the Consumer Connection.* Michigan Environmental Education Association and Science for Citizens Center of Southwestern Michigan, Western Michigan University. Kalamazoo, MI. 49008 ($2.00).

Michigan Environmental Education Association. *Waste Away.* MEEA, c/o Dave Chapman, 4360 Hagadorn Road, Okemos, MI 48864. ($20.00 plus $2.40 postage and handling.)

A board game about the generation, shipment and disposal of hazardous waste. Each player in turn takes the role of consumer, industrialist, waste hauler and waste disposer. Game develops problem solving and decision making skills.

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For middle school or junior high age. Chapters on pesticides, industrial chemicals, household chemicals and heavy metals. Includes glossary and review questions.

Toxics Curicula for Middle Schools. Virginia Commonwealth Univ., College of Humanities and Sciences, 816 Park Ave., Richmond, VA 23284.

Also contact the Ecology Center of Ann Arbor for curricula adapted for Michigan schools. 417 Detroit St., Ann Arbor, MI 48104.

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Association of Bay Area Governments. *The Disposal of Hazardous Waste by Small Quantity Generators: Magnitude of the Problem.* Metro Center, Eighth and Oak Streets, Oakland, CA 94604. June 1985. ($15.00).

Includes survey of household hazardous waste generation and selected small quantity generators in the San Francisco Bay area. Statistical analysis and qualitative description included. Also includes: discussion of health and environmental consequences of inappropriate disposal, surveys of households and small businesses, case studies from other communities, and willingness to pay for disposal services.

Pollution Probe Foundation. *Breaking the Barriers: A Study of Legislative and Economic Barriers of Industrial Waste Reduction and Recycling.* 12 Madison Avenue, Toronto, Ontario, M5R 2S1

Waste Systems Institute. *Handbook on Small Quantity Generators of Hazardous Waste.* 1985. (616) 451-8992.

Has also published a bulletin series on the handling of specific chemicals and a directory of services for small quantity generators.

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Centaur Associates, Inc. *Siting of Hazardous Waste Management Facilities and Public Opposition.* Report (SW-809) prepared for EPA, Office of Solid Waste, 1979. Available from the nearest Government Printing Office.

"Thirty varied case histories intended to provide insights on how applicants can reduce public opposition to facility siting. 388 pages."

Clark-McGlennon Asociates. *An Introduction to Facilities for Hazardous Waste Management, Criteria for Evaluating Sites for Hazardous Waste Management, Negotiating to Protect Your Interests, A Decision Guide for Siting Acceptable Hazardous Waste Facilities.* A four volume set published for the New England Regional Commission, 1980. Available from the New

England Governors' Conference, 1546 State St., Boston, MA 02109.

"This is an excellent set of handbooks containing a wealth of practical advice, questions and answers, and technical information. The decision guide contains useful information on processes for risk assessment and conflict management."

Hazardous Waste Management Planning Committee. *Hazardous Waste Management Plan.* 1982. Available from the MDNR, P.O. Box 30038, Lansing, MI 48909.

"The officially adopted plan for Michigan containing the policies as well as the background discussion. 46 pages."

Hurley, Mike. *Social and Economic Issues in Siting a Hazardous Waste Facility.* Citizens for Citizens, Inc. 1982. Available from the Publisher at 264 Griggin St., Fall River, MA 02724.

"Brief descriptions of selected issues along with suggested responses, mainly addressing non-technical subjects. 70 pages."

Sobetzer, John G. and Lynn A. Corson. *Solid Waste Management in Michigan: A Guide for Local Government and Citizens.* Community Development Programs, Lifelong Education Programs, 27 Kellogg Center, Michigan State University, East Lansing, MI 48824. July 1982.

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Urban Systems Research and Engineering. *Using Compensation and Incentives When Siting Hazardous Waste Management Facilities.* A handbook (SW-942) prepared for the EPA, Office of Solid Waste, 1982. Available from the nearest Government Printing Office.

"One of the best short guides to the title subject, with specific examples and an annotated bibliography. 53 pages."

Wisconsin Center for Public Policy and the Institute for Environmental Mediation (Seattle). *Using Mediation When Siting Hazardous Waste Facilities.* A handbook (SW-944) prepared for the EPA, Office of Solid Waste, 1982.

"An excellent introduction for the subject of environmental mediation, listing many sources for assistance and including an

annotated bibliography. 43 pages."

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Environmental Protection Agency. *Guidance for Controlling Asbestos-Containing Materials in Buildings,* 1985. Available from the Office of Toxic Substance and Pesticides, U.S. EPA, Washington, DC 20460. Free.

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Available from the Conference on Alternative State and Local Policies. 200 Florida Avenue, NW. Room 404, Washington, D.C. 20009.

Purin, Gina and Susan Sherry. *Community Right to Know: A Handbook for Local Communities and Their Officials.* 1982. 144 pages. ($9.00). Available from Golden Empire Health, 2100 21st St., Sacramento, CA 95818.

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Eastman Kodak Company. *"Disposal of Small Quanitites of Photographic-processing Solutions."* (J-52). Dept. 412-1. Rochester, NY 14650. (Single copies are free.)

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The IPM Practitioner. Produced by the BioIntegral Resource Center, Rt.1, Box 28A, Winters, CA 95694.

State-of-the-art integrative pest management articles for small and large-scale applications are offered in this newsletter.

Lawless, E.W., T.L. Furguson and F.F. Meiners (Midwest Research Institute). *Guideline for the Disposal for Small Quantities of Unused Pesticides.* Publication No. EPA 670/2-75-057. June 1975.

O'Brian, Mary H. *On the Trail of a Pesticide: A Guide to Learning About the Chemistry, Effects, and Testing of Pesticides.* 1984. Northwest Coalition for Alternatives to Pesticides. P.O. Box 1393, Eugene, OR 97440 (503) 344-5044. ($15.00)

Project Pest: Alternative Approaches to Urban Pest Management. *Pest Management Manual.* Department of Resource Development, 323 Natural Resources Building, Michigan State University, East Lansing, MI 48224 (617) 383-6787. ($35.00)

This large, three-ring binder is an excellent resource for IPM pest control practices with special emphasis on Midwest plant and insect varieties.

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Wallace, Dan. *Encyclopedia of Natural Insect and Disease Control.* Rodale Press. Emmaus, Pennsylvania. 1984. ($21.95).

Comprehensive and detailed reference book appealing to all levels of gardening expertise. Published by Rodale's Organic Gardening magazine people.

Wasserman, Robert F. and Richard Wiles. *Field Duty: U.S. Farmworkers and Pesticide Safety.* Available from World Resources Institute, 1734 New York Ave., N.W., Washington, DC 20006.

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6-14 General

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Enterprize for Education. Hazardous Wastes from Homes. 1986. 1320-A Santa Monica Mall, Suite 205, santa Monica, CA 90401. Lists at $2.75 plus postage. Single copies may be free. 40-page magazine format. Discounts available on quantity orders.

Golden Empire Health Planning Center. "Pesticides, "Solvents," "Housefold Cleansers and Polishes." 2100 21st St., Sacramento, CA 95818. These brochures are available upon request with a self-addressed, two-stamp envelope.

Municipality of Metro Seattle. *Toward Hazardless Waste: A Guide for Safe Use and Disposal of Hazardous Household Products.* Order from 821 Second Ave., Seattle, WA.

Laderman, R., et.al., *Toward a Comprehensive Program for Management of Household Hazardous Wastes in Massachusetts.* The Environmental Institute, Blaisdell House, University of Massachusetts, Amherst, MA 01003. 1985. ($8.00)

San Diego Environmental Health Coalition. *The World is Full of Toxic Waste. Your Home Shouldn't Be.* Household Toxics Disposal Project. 1984. P.O. Box 8426, San Diego, CA 92102 (619) 235-0281.

Western Washington Toxics Coalition. *Home Safe Home: An Educational Open House.* Available from WWTC, 4512 University Way, N.E., Seattle, WA 98105.

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Bibliography Update

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An excellent, in-depth discussion of Integrated Pest Management for Carpenter Ants.

Environmental Hazards Management Institute. ***Household Hazardous Waste Wheel*****, 1986, Portsmouth, N.H.** To order send $3.75 to EHMI, P.O. Box 283, Portsmouth, NH 03801.

The "Household Hazardous Waste Wheel" is designed to help consumers identify commonly used products that may add to pollution in the community when improperly disposed of and to prescribe correct disposal methods. The wheel is turned to "dial" any of dozens of hazardous products and learn their chemical constituents, the dangers they pose to health, nontoxic products that may be used as substitutes, and preferred methods of disposal.

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Greenpeace. ***Stepping Lightly on the Earth: Everyone's Guide to Toxics in the Home.*** Available from: Greenpeace, 1611 Connecticut following Avenue, N.W. Washington, DC 20009. (202) 462-1177.

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Sterling, T.D., and Kobayaski, D. 1977. ***Exposure to Pollutants in Enclosed "Living Spaces,"*** **Envision. Res. 13:1-35.**

U.S. EPA. ***A Citizen's Guide to Radon: What it is and What to Do About It*****, August 1986.** Available from: Michigan Department of Public Health, Bureau of Environmental and Occupational Health, Divisior of Radiological Health, 3500 North Logan Street, Box 30035, Lansing, MI 48909 (517) 335-8193.

U.S. EPA. ***Radon Reduction Method, A Homeowner's Guide.*** **August 1986.** Available from Michigan Department of Public Health (see above).

Yocom, J. ***1982 Indoor-Outdoor Air Quality Relationships.*** **J. Air Poll. Control Assoc. 32(5): 500-520.**

Chapter 7
Appendices

This section provides information on the associated toxic substances issues of indoor air pollution, waste facility siting, small quantity generators and right-to-know regulations. In addition, the compilers have selected outstanding fact sheets from around the state and nation to assist you in developing your own programs on household hazardous substances. To encourage you to add to this section in an organized fashion, please list your additions below and insert in the binder.

A quick way to add to your sample files is to request free materials on household hazardous wastes from the organizations listed in the General Bibliography, section 6-14, and by writing to the organizatons in the Household Hazardous Substances Directory, Chapter Five.

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7-2 Asbestos in Homes
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7-4 Small Quantity Generators
7-5 Right to Know
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7-7 Integrated Pest Management
7-8 Lawn Care
7-9 Can Some of your Household Products Harm You?
7-10 First Aid for Poisioning
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7-12 Control Alternatives for Outdoor Insect Pests
7-A Figure 7-A: Recommended Control Measures for Some Common Indoor Pollutants
7-B Figure 7-B: *New York Times* article on Indoor Air Quality

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Making Your Handbook Easy To Use: Appendix

Indoor Air Pollution

- Introduction
- Asbestos in the Home (7-1)
- Recommended Control Measures For Some Indoor Pollutants (7-11)
- Indoor Air Quality, New York Times (7-B)
- *A Citizen's Guide To Radon*

Hazardous Waste

- Waste Facility Siting
- Small Quantity Generators
- *Waste Disposal Technologies*
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Pest Management

- Lawn Care
- Pesticide Toxicity Charts
- Integrated Pest Management
- Control Alternatives For Indoor Pests
- Control Alternatives For Outdoor Pests
- *Asking The Right Questions About Pesticides*
- *Milford Michigan Requires Notification Of Lawn Spraying*
- *Pressure Treated Wood*

Right To Know

- *Right To Know Laws In Michigan*

ECOLOGY CENTER FACT SHEET
RADON

A June, 1986, Federal General Accounting Office (GAO) report on the hazards of indoor radon was compiled at the request of the Pennsylvania Congressional Delegation after the following incident occurred:

"In late 1984, an eastern Pennsylvania nuclear power plant worker triggered radiation detectors in the plant. Investigation showed that he was radioactively contaminated, not by any source at the plant, but by high radon levels in his own home. The incident brought national attention to the issue of naturally-occurring indoor radon contamination."

by Rebecca Head

What is radon?

Radon is a colorless, tasteless, inert radioactive gas. It is formed from the decay of its radioactive parent, radium 226 Both radon and radium are intermediate decay products that derive from uranium 238, which occurs naturally in very small amounts throughout the earth's topsoil. A radioactive element is often unstable and decays to form other elements that may or may not be radioactive.

How does radon decay?

The time for an element such as radon to decay to one half its size or mass is its half-life, so the shorter the half-life the sooner the substance decays. Radon has a 3.8 day half-life and decays to form radioactive elements, known as progeny or daughters. It is the process of decay and the subsequent release of radioactive energy that causes damage.

The most toxic progeny are polonium 218, lead 214, bismuth 214 and polonium 214. They have very short half-lives and present the biggest threat of injury.

What kind of a health risk does radon pose?

The radon daughters attach to minute dust particles. Breathing in or inhalation of the radioactive particles can lead to their deposition in the lungs. There they rapidly decay, releasing injurious radioactive energy. The damage, in this case, is to the inner surface of the lungs, and can lead to lung cancer.

Radon Risk Evaluation Chart

pCi/l	WL	Estimated number of lung cancer deaths due to radon exposure (out of 1000)	Comparable exposure levels	Comparable risk
200	1	440—770	1000 times average outdoor level	More than 60 times non-smoker risk
				4 pack-a-day smoker
100	0.5	270—630	100 times average indoor level	
				20,000 chest x-rays per year
40	0.2	120—380		
				2 pack-a-day smoker
20	0.1	60—210	100 times average outdoor level	
				1 pack-a-day smoker
10	0.05	30—120	10 times average indoor level	
				5 times non-smoker risk
4	0.02	13—50		
				200 chest x-rays per year
2	0.01	7—30	10 times average outdoor level	
				Non-smoker risk of dying from lung cancer
1	0.005	3—13	Average indoor level	
0.2	0.001	1—3	Average outdoor level	20 chest x-rays per year

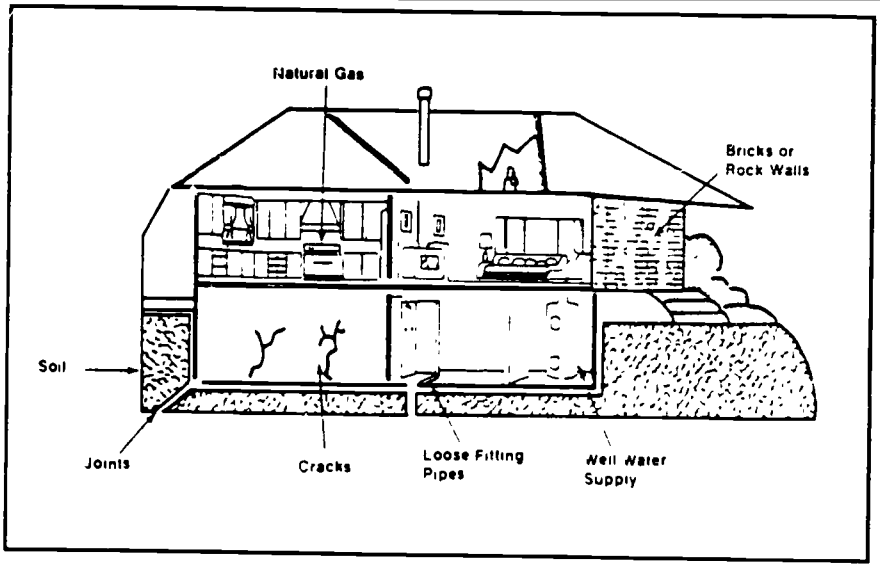
The probability or risk of developing lung cancer after radon exposure is based on estimating that risk from studies of individuals exposed to radon who then developed lung cancer. Studies of uranium mine workers who were exposed to radon provided evidence that exposure to radon can result in an increased risk of developing lung cancer. For example, the risk of developing lung cancer due to exposure to the average level of indoor radon is rated as less than a non-smoker's risk of dying from lung cancer.

Of course, the risks, as shown in the accompanying chart, do not take into account any other exposures to the lung that could increase an individual's chance of dying from lung cancer (for example, living with high radon levels and smoking).

How does radon get into buildings?

Radon is released from soil, rock, groundwater and natural gas. Some soils contain more radium (radon's parent) than do other soils. Radon enters buildings through cracks in the foundation floor, hollow-block walls, floor drains, sumps, joints, and the water supply if the supply is well water.

(over)



poses little risk. However, the radon released from contaminated water increases the indoor air concentration of radon. The figure above illustrates these potential pathways.

Radon tends to accumulate in the basement, because that is the closest area to the source of the radon. Basements that are living spaces; cement slab houses; buildings with underground crawl spaces; and houses with "Michigan basements," where soil forms the basement floor, are more likely to have high radon levels.

What kind of standards exist for radon?

There are two different units used for measuring radon. The unit picocuries/liter (pCi/l) measures radioactivity per volume of air. However, one is not exposed to all of the radon in the air -- only to that which reaches your lungs. The cumulative level of **exposure** to radon decay products is defined as the Working Level (WL). The Environmental Protection Agency (EPA) recommends that if annual average levels of .02 WL (4 pCi/l)or above exist, steps should be taken to reduce the indoor air concentration of radon. (See the chart.)

Although the EPA believes that no absolutely safe level of radon exists, it notes that reduction of radon to a level below .02 WL may not be technically feasible. The higher the level, the sooner corrective actions should be taken.

How do I know if radon is in my home?

The presence of radon can be detected most easily via a charcoal canister or an alpha track detector test. Both are commercially available and must be sent to a laboratory for analysis. Contact the local health department or the Ecology Center for more information on radon measurement or kits. Screening for radon should be done first in the basement. If high levels exist in the basement, then other parts of the house should be tested.

How can I reduce the radon level in my home?

These are some methods suggested for reducing indoor levels of radon. Depending on the circumstances, certain methods may be more appropriate than others. Don't rush into deciding on a method.

Sealing off radon entry routes. By placing barriers between the source material (i.e., the bedrock) and the living space, less radon gas will enter the home. This method can involve covering exposed soil inside a structure with concrete, sealing cracks in floors and walls, carpeting the basement, and filling concrete block walls. Sealing may be used in conjuction with other reduction methods. However, as a house settles, new cracks may appear.

Air filtration. Air passes through high efficiency filters or electronic devices which collect dust and other airborne particles. The devices decrease the concentration of airborne particles and radon products attached to these particles, but they may not decrease the concentration of smaller, unattached radon daughters, which are more hazardous.

Home ventilation. This method involves increasing a home's air exchange rate - the rate at which fresh air completely replaces existing air. This can be done with the aid of fans or just by opening windows. It has limited applicability.

Soil ventilation. This method prevents radon from entering the home by drawing the gas away before it can enter. Soil ventilation normally requires installation and testing by competent, experienced professionals. Depending on the home, it may be difficult and expensive to install.

Air-To-Air Heat Exchanger. An air-to-air heat exchanger is a ventilation device that is designed to retain indoor heat as it exchanges indoor air and accompanying pollutants for fresh, outdoor air. Generally, air-to-air heat exchangers are oesigned to ventilate an entire home, and like any central system, it is easiest to install them at the time the house is being built.

Radon References

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3. U S. General Accounting Office, **Air Pollution: Hazards of Indoor Radon Could Pose a National Health Problem**, Report to the Pennsylvania Congressional Delegation House of Representatives, GAO/RCED-86-170, Resources, Community and Economic Development Division, Washington, DC 20548. Published June 1986.

7-1 Indoor Air Pollution

Air pollution from industry and vehicle exhaust has been significantly reduced in the past 15 to 20 years. Air quality research is now turning to non-point sources and sources inside houses and other buildings.

As monitoring equipment has become more sophisticated and sensitive and as air circulation/exchange has been decreased in many buildings due to weatherization, indoor air pollution has become more apparent and may have actually increased.

According to Hugh Kaufmann, an EPA hazardous waste consultant, "We're just beginning to identify the problem of indoor air pollution. But everywhere we look, its worse than we expected."

Originally, researchers thought indoor air quality would correspond to outdoor air quality in the same location. Recent studies however have indicated that this assumption may be false. These studies show that indoor air pollutant concentrations are two to five times higher than outside levels. In some of the samples, levels were over 100 times higher.

In a study at the Lawrence Berkeley Laboratory in Berkeley, California, scientists found that lack of ventilation was not the primary cause of higher indoor concentrations. The evidence shows that the buildings themselves are generating pollution. Some of the pollutant sources include:

- Combustion products: unvented gas appliances, stoves, furnaces, smoking, automobiles
- Micro-organisms: air conditioners, cooling systems (found to be responsible for Legionnaires disease)
- Radon gas: concrete, bricks, rock, soil
- Volatile solvents: household products
- Formaldehyde: manufactured wood products (particleboard, plywood), insulation
- Asbestos: insulation

A few of these substances are carcinogenic (formaldehyde, asbestos, radon decay products, cigarette smoke). All of them can cause health problems, especially lung irritation or damage, if present

in significant concentrations.

One recent EPA study (see enclosed *New York Times* article) showed that these air pollutants pose a greater health hazard in an average home than they do around chemical plants where they are also produced. Indoor and outdoor air quality were sampled in a heavy industrial area with many chemical plants, a light industrial area without chemical plants, and a rural, agricultural area. People tested in the latter two areas were exposed to approximately the same concentrations of pollutants as the area with many chemical plants.

"Perhaps the most significant finding," according to an EPA summary report, "has been the discovery that the indoor levels of all the target chemicals are much greater than outdoor levels." This is especially important since average urban residents spend up to 90 percent of their time indoors.

To find out more about indoor air pollution, contact your local office of the American Lung Association or the Environmental Protection Agency.

7-2 Asbestos in Homes

Asbestos has been used in over 3,000 building products since 1930. These products have sheltered us from the rain and insulated the hot water pipes in our homes. They have helped cook our meals, wash our dishes, dry our clothes and protected us from the dangers of fire.

Unfortunately, for decades asbestos has been creeping up on us like a silent unseen killer. If products containing asbestos deteriorate, minute fibers can float through the air and invade our bodies as we breathe, eventually lodging in the tissue of our lungs. You cannot see these tiny fibers and they are so small that they pass through the filters of normal vacuum cleaners and get back into the air. After many years, cancer or mesothelioma can develop.

In order to be a health risk, asbestos fibers must be released from the material and be present in the air for us to breathe. Soft, easily crumbled asbestos-containing material has the greatest potential for asbestos release and therefore presents the greatest health risk.

HOW DANGEROUS IS ASBESTOS?

Asbestos is one of 19 substances that are known to cause cancer. There is no safe level of exposure that experts can assure is completely safe. Diseases such as asbestosis, lung cancer and mesothelioma can result from the inhalation of airborne asbestos. Symptoms of asbestos respiratory disease generally do not appear for 20 years or more after the initial exposure to airborne asbestos. The earlier in life that one begins inhaling asbestos, the higher the likelihood of developing disease later in life. Thus, there is concern over exposure of school children to asbestos. Early detection is possible by a medical examination that includes your work and medical history, breathing capacity tests and a chest x-ray. Finally, exposure to asbestos fibers and cigarette smoking combine to create a much greater risk of developing lung cancer.

WHERE DANGERS MAY LURK IN YOUR HOME

Asbestos has been used in a wide variety of household products such as appliances, ceilings wall and pipe coverings, floor tiles and some roofing materials. **In most cases, it is best to leave asbestos-containing products alone.** If you must work with these materials, reduce your exposure to the fibers by following the guidelines below. If you determine that material with asbestos must be removed, it is best to have it done by a state-certified contractor. Many home repair contractors are not experienced in the proper procedures for handling and removing asbestos from a home.

Asbestos may be found in the following household products:

***Vinyl Floor Tiles and Sheet Flooring:** Asbestos has been added to these to strengthen them. Fibers can be released if the tiles are sanded or seriously damaged, if they are severely worn or cut to fit, or if the backing on sheet flooring is dry-scraped or sanded.

***Patching Compounds and Textured Paints:** Some wall and ceiling joints patched with material made before 1977 and some textured paint sold before 1978 may contain asbestos. If the material is in good condition, it is best to leave it alone. Sanding and scraping will release fibers into the air.

***Ceilings:** Some buildings remodeled between 1945 and 1978 may contain a crumbly, asbestos-containing material sprayed or troweled onto ceilings or walls. If it appears damaged, it should be removed or repaired.

***Stoves and Furnaces:** Asbestos-containing cement sheets, millboard and paper have been used when wood-burning stoves and oil, coal or wood furnaces were installed. Avoid scraping, sanding, drilling or sawing these materials.

***Door Gaskets:** Some door gaskets in furnaces, ovens and wood and coal stoves may contain asbestos. Handle this material as little as possible.

***Walls and Pipes:** Hot water and steam pipes in some older homes may be covered with asbestos-containing insulation material. Homes constructed between 1930 and 1950 may contain insulation made with asbestos. It is best to leave these alone. Protective covering is recomended for damaged pipe or boiler insulation.

***Appliances:** Asbestos has been in parts of toasters, popcorn poppers, broilers, slow cookers, dishwashers, refrigerators, ovens, ranges, clothes dryers and electric blankets. It is unlikely that these pose a potential risk. Hair dryers with asbestos-containing heat shields were voluntarily recalled in 1979.

***Roofing, Shingles and Siding:** Asbestos was used as a binding agent in some roofing shingles, siding shingles and sheets. Since these are already in place and outdoors, there is little human risk. However, if the siding is worn or damaged, spray painting can help seal in the fibers. It is best to avoid disturbing these products.

WHAT CAN I DO ABOUT ASBESTOS IN MY HOME?

Asbestos in the home is a serious problem, but it can be managed and you can continue to live in your home without fear. **There are three basic steps in approaching the problem:**

1) **Identification** - You should first determine whether the material contains asbestos. If you are uncertain, you may want to call someone who works frequently (such as plumbers, heating contractors or a licensed asbestos removal contractor) with asbestos. They are often able to make a reasonable judgement based on a visual inspection.

2) **Sampling** - In some cases, you may want to have the material analyzed by a laboratory. An analysis might be useful if you are preparing a major renovation which will expose materials contained behind a wall or other barrier. Before attempting to take a sample yourself, remember not to disturb the material and create a bigger problem. In some cases, several samples are necessary for an accurate determination of asbestos content Laboratory costs usually range from $30 to $50 per sample.

3) **Determining the Risk** - You must make a judgement based upon what you can afford for sampling and removal of asbestos. In many cases, the application of a sealer to contain asbestos provides the best protection from health risks at the most reasonable cost. For example, Taping and painting rotting insulation around your steam heating pipes will end the potential for air contamination in many cases. In other instances where the asbestos-containing material shows no signs of deterioration, the best solution is to do nothing and avoid cutting or sanding the material. Make your own judgement based upon the information supplied by an experienced contractor or laboratory results.

HOW TO HANDLE ASBESTOS SAFELY

The following general guidelines for handling products containing asbestos are provided by the U.S. Consumer Product Safety Commission and the U.S. Environmental Protection Agency.

If you think that a material contains asbestos and you have to disturb it, handle it very carefully. If possible, find a State-certified contractor trained in safe procedures for handling asbestos (such as a contractor familar with removal of asbestos from schools or commercial buildings). Watch out for home contractors who offer "cheap and easy" asbestos-removal work.

Always keep in mind the following: Never dust, sweep or vacuum particles suspected of containing asbestos. This will disturb tiny asbestos fibers and make them airborne. The dust should be removed by a wet-mopping procedure or by a specially-designed vacuum cleaners used by trained contractors.

Follow these basic precautions for working with asbestos:

* Do not disturb any material you think may contain asbestos unless you have to as a last alternative.
* Seal off the work area from the rest of your home. Plastic sheeting and duct tape may be used. Take great care not to track asbestos dust into other rooms of your home.
* Always wear an approved respirator. Wear protective gloves and other protective clothing. If possible, dispose of all this equipment immediately after using it. If you cannot dispose of your clothing, wash it separately from the family wash.
* When working with asbestos-containing material, wet it with

a hand sprayer. The sprayer should provide a fine mist, and material should be throughly dampened, but not dripping wet. Wet fibers do not float in the air as readily as dry fibers and will be easier to clean up. Adding a small amount of a low-sudsing dish or laundry soap will improve the penetration of the water into the material and reduce the amount of water needed.

* If you must drill or cut an asbestos-containing material, do it outside, if possible. Wet the material first.
* If you must remove the material, avoid breaking it into small pieces. While it is easier to remove and handle small pieces you are more likely to release asbestos if you break the material into small pieces. Pipe insulation was usually installed in preformed blocks; remove these in complete pieces.
* Place any material you remove and any debris from the work in heavy plastic trash bags and dispose of it in a proper landfill. Call the Air Quality Division of the Michigan Dept. of Nat. Resources for instructions about how to dispose of asbestos. Do not throw these bags out with the trash. They will break open and may expose more people.
* After you are finished removing the material, throughly clean the area with wet mops, wet rags or sponges. Repeat the cleaning procedure. Wetting will help to reduce the chance that the fibers will be spread around the home. If possible dispose of the mop, rag or sponge in the trash bag with the asbestos materials. Otherwise, vigoursly flush the mop, rag or sponge in running water in a sink or basin. Make sure to completely rinse the utensil and basin.
* If you are going to have the work don by a contractor, discuss these guidelines and other steps to minimize exposure.

FOR MORE INFORMATION, CALL OR WRITE:

U.S. Consumer Product Safety Commission/1-800-638-CPSC or write CPSC, Washington, D.C. 20207. They have a 12-page booklet on handling asbsetos.

The National Cancer Institute/1-800-638-6694. For information on health concerns.

Michigan Department of Natural Resources/517-373-7023. For information on safe work practices and disposal of asbestos materials.

COUNCIL ON HAZARDOUS MATERIALS
4115 Bridge Avenue, Room 104 • Cleveland, OH 44113 • (216) 961-4646

Figure 7-A
Recommended Control Measures for Some Common Indoor Air Pollutants

Pollutant	Control Measure
Radon and byproducts Combustion products Tobacco smoke Bacteria/biological agents	Ventilation Enhanced air exchange
Organic substances Asbestos Tobacco smoke	Source removal and substitution of less-hazardous materials
Radon Organic substances Asbestos Combustion products	Containment and design modification
Particulates Combustion products Biological agents	Purification Adsorbers, filters, precipitators
Organic Substances Combustion byproducts Tobacco smoke	Behavior modification: education product labelling building design warning devices legal liability

From: Spengler, J.D. and K. Sexton. "Indoor Air Pollution: A Public Health Perspective." *Science.* July 1983. p.13

Figure 7-B
New York Times Article

U.S. Calls 11 Toxic Air Pollutants Bigger Threat Indoors Than Out

NYT PAGE 1 By PHILIP SHABECOFF 6/11/85

Special to The New York Times

WASHINGTON, June 10 — Eleven common toxic air pollutants pose a greater hazard in an average home than they do in the air around the plants where they are produced, a new study by the Environmental Protection Agency has reported.

The researchers measured levels of 11 chemicals chosen because they are found in household products such as cleaning agents, building materials and gasoline, or in cigarette smoke. Agency officials said the study showed that indoor air pollution is a more serious problem than it had been thought to be.

Dr. Bernard D. Goldstein, the agency's assistant administrator for research and development, said the study did not take in pollution from other chemicals produced by the plants, or the wide array of other air pollutants But in the case of the 11 chemicals, he said, it showed that exposure outdoors was relatively insignificant compared to indoor air pollution and other "life style exposures."

Higher Pollution Levels Indoors

In some cases, the indoor exposures were 70 times the outdoor exposures, even for people living close to the chemical factories, the study found

Although there was no evidence of imminent threats to the health of the people exposed to the chemicals, scientists both in and out of the agency said the results could alter the focus of efforts to combat air pollution. Until now, the environmental agency has concentrated on outdoor pollution from major sources such as chemical plants and refineries.

Volunteers in the study, which took five years to complete, wore monitoring devices throughout the day to measure their exposure to the 11 chemicals. At the end of the day, the volunteers took a breath test to determine the quantity of the chemicals in their blood. They also filled-out a questionaire on their activities during the day.

The main study was conducted in Elizabeth and Bayonne, N.J., because of their proximity to petrochemical plants and refineries discharging the 11 chemicals into the air. Identical experiments were conducted on a smaller scale in Greensboro, N.C., which contains light industry but no chemical plants, and Devils Lake, N.D., a rural, agricultural area.

The chemicals studied were chloroform, 111 trichloroethane, trichloroethylene, benzene, carbon tetrachloride, perchloroethylene, meta-para-di-

Continued on Page 18, Column 1

U.S. Calls 11 Toxic Air Pollutants Bigger Threat Indoors Than Out

Continued From Page 1

chlorobenzene, meta-para-xylene, styrene, ethylebenze, and orthoxylene.

The original purpose of the study was to develop ways to measure individuals' exposure to toxic substances in the air, something agency officials said they had accomplished But they described the results of the study as surprising, even startling

The people living in Greensboro and Devils Lake, the study found, recorded no less exposure to the chemicals than the people living next to the chemical, paint and plastics factories and refineries in the Bayonne-Elizabeth area. And they had equivalent amounts of the chemicals in their blood.

Paint, Solvents and Cigarettes

The study found a "significant correlation" between the levels of the chemicals in participants' bodies and their use of paint or solvents at home or at work, cigarette smoking, and visits to gas stations or dry-cleaners' stores It found a similar correlation with the presence of these chemicals in building materials, cleaning agents and other substances in participants' homes

"Perhaps the most significant finding," a summary of the report said, "has been the discovery that the indoor levels of all the target chemicals are much greater than outdoor levels "

The study did not attempt to deal with many of the known indoor air pollutants, such as radon, a radioactive gas that can cause lung cancer, or formaldehyde, a ubiquitous element of home furnishings and building materials.

Dr Goldstein said future studies using similar techniques would test exposures to these chemicals

The study said "it seems probable" that consumer products such as paints, cleansers, propellants, plastics, cosmetics and others, and building materials such as adhesives, fixers, resins, insulation and other products are the major sources

Dr Paul J Lioy of the New York University Medical Center's Institute of Environmental Medicine, who has reviewed the study, said it "brought some good science to bear" on the extent and source of human exposure to volatile chemical pollutants

He said the levels of chemical air pollution indoors "suggest significant risks" to health but emphasized that there are not enough data yet to determine if "the problem is a health risk that needs addressing "

David D Doniger, an expert on toxic air pollution and a lawyer with the Natural Resources Defense Fund, an environmental group, said he was concerned that the Reagan Administration would use the results to ignore the problem of toxic chemicals in the outdoor air He said the agency's own figures showed that 1,500 to 2,000 people die each year in this country because of toxic air pollution

"I don't like the suggestion that one problem is small because another may be bigger," Mr. Doniger said.

7-3 Waste Facility Siting

As we become more aware of the volume of solid and hazardous waste generated in this state and the magnitude of the public health threat posed by inadequate disposal, it becomes more obvious that well-designed and environmentally sound facilities must be constructed and then operated under close scrutiny. If these facilities are not constructed, we will remain unprepared to deal with our growing waste disposal problem. Reliance on existing facilities will delay access to urgently needed long-term disposal capacity. Our continued reliance on out-of-state facilities increases the possibility of contamination incidents when the material is in transit.

Before these facilties can be built, though, we must decide on the best locations considering economic, social and environmental factors. Traditionally, communities have been reluctant to accept these facilities in their areas because reports of poor design and operation at a few sites have tarnished the reputation of them all. But without new sites, waste will continue to go to older and inadequate sites, and the well-operated sites will fill up and no longer be available.

Although in the past hazardous waste was often dumped in solid waste landfills and most household hazardous continues to be dumped there, siting procedures for solid waste and hazardous waste treatment/disposal facilities are separate and are regulated under different laws.

Since passage of Michigan's Hazardous Waste Management Act of 1979 (Act 64), a new procedure has been developed for regulating the siting of hazardous waste facilities. (Contact MDNR Hazardous Waste Division for more information.)

The siting, construction and operation of all solid waste "disposal areas" are regulated under Act 641, the Michigan Solid Waste Management Act. Disposal areas are defined as sanitary landfills, processing plants (including incinerators) or other solid waste transfer, handling or disposal facilities. (Contact MDNR Solid Waste for more information.)

7-4 Small Quantity Commercial Generators

As of November 1984, reauthorization and amendment of the Resource Conservation and Recovery Act (RCRA) and under previously existing Michigan law (Act 64), small quantity commercial generators are defined as those businesses and industries that generate between 100 and 1000 kilograms (1 kilogram = 2.2 pounds) of hazardous waste per month. Waste Systems Institute, a non-profit research organization, estimates 15,000-18,000 Michigan businesses may fall into this category. Together, these small quantity generators generate about 50,000 tons of hazardous waste per year.

New regulations will require a manifest system (a written log) to be used for tracking the waste, will limit on-site storage to 180 days unless a permit is approved, will restrict disposal to licensed hazardous waste landfills and will define recordkeeping requirements.

Waste Systems Institute, along with subcontractor Resource Policy Services, received a major grant from EPA, Region V, in March 1985. In a cooperative effort with MDNR, they will conduct a notification, education and training program for small quantity generators in Michigan. This project emphasizes an `assistance first' approach thought to be more effective than a `hardline' regulatory approach. The program will include:

1) an overview booklet on RCRA

2) a "how to" guidebook for small quantity generators, which includes information on low cost methods of compliance

3) identification of and contact with trade associations for assistance in notification, education and information disemmination.

4) management practice bulletins explaining cost-saving management techniques and more detailed compliance instructions.

5) a training manual and workshop for trade associations, business groups and leaders, and state and local government personnel.

For more information on small quantity generator regulation, contact MDNR/Hazardous Waste Division or EPA/Region V (Small Business Ombudsman or the RCRA hotline).

For more information on the WSI project, contact William Stough, Project Mgr., at Waste Systems Institute, (616) 451-8992.

Waste Disposal Technologies

"I wonder what happens to this stuff after it's collected?" mused one woman at a recent household hazardous waste collection in Washtenaw County.

When communities planning household hazardous waste collections purchase the waste transport, treatment and disposal services, organizers are told where specific categories of waste will end up. But what about current waste technologies and costs? This information is available from the waste service provider and should be considered of interest to participating community members. Attaching a pricetag to the proper disposal of one aerosol can ($8 in 1987) may convince more people to think twice before tossing them out with the trash, "If it costs that much it must be pretty bad stuff. . . ."

The following is a summary of a five page issue of Waste Alert published by the Great Lakes Regional Waste Exchange in 1981. Many changes have occurred in these methods since 1981. However, to our knowledge, the basic principles remain the same and no comparable updated article has been published.

> The MDNR states, "The existing Michigan Hazardous Waste Management Plan recognizes that waste cannot all be treated the same way and established the following priority of preferred treatment: a. reduction b. recycling c. treatment d. destruction (generally suitable for organic wastes) e. fixation (inorganic wastes) f. storage, including landfilling". (MDNR, 1984)

Chemicals present in consumer products are smaller quantities of the same chemicals generated by chemical manufacturing and formulation. When this household waste is collected the treatment employed is often similar to that used by industry.

REDUCTION

The most logical (and the most cost effective) method of getting rid of hazardous waste is, of course, reduction. For industry, this means changing the manufacturing process to reduce up front the quantity and toxicity of hazardous waste. Consumers can borrow products instead of buying them; buy less hazardous alternatives and reuse or use up materials they already have. (See the Waste Disposal section of the Michigan Household Hazardous Substance Handbook for more information).

SOLVENT RECOVERY

Solvent recovery is the cleaning and removal of solvents from waste streams containing used solvents for their reuse in industrial processes. Solvent recovery is a longstanding and proven technology that uses distillation.

Household solvents that are suitable for solvent recovery include: paint sludges, paint thinner, dry cleaning fluid.

CHEMICAL TREATMENT

Chemical treatment is a way of detoxifying liquid hazardous wastes by using a variety of chemical reactions. These treatments include oxidation-reduction, neutralization, fixation, precipitation, and ion exchange. These processes are most often used for wastes that have ignitable or corrosive properties. Chemical treatment may be used in combination with other methods such as landfilling.

INCINERATION

Incineration is considered the most effective technology currently available to dispose of organic liquid and solid hazardous wastes. Basically, incineration is the controlled burning of waste at extremely high temperatures for a specific length of time. It breaks the material down into its basic chemical elements and may result in as much as 99% destruction of the hazardous substance in the waste. Gas emissions resulting from incineration even after proper cooling and chemical scrubbing may still be toxic. In addition, the resulting ash waste, although substantially reduced in volume, must still be landfilled at a hazardous waste facility.

Wastes considered suitable for incineration include: organic chemical wastes such as PCBs (which do turn up from time to time at household collections), pesticides and herbicides, biological sludge, paint and solvent sludge.

CHEMICAL LANDFILLS

Although previously landfills were just pits in the ground into which drums of waste were placed and then covered with dirt (and many of these still exist, waiting for cleanup), under new regulations landfills for hazardous waste are designed to be "secure." Even the waste disposal industry admits all landfills do now or will eventually leak. However, good landfilling minimizes those leaks. Good landfilling requires appropriate location of the landfill in a place where leaked material will disperse without harming the environment. Management of these facilities requires continual monitoring of wells uphill and downhill from the site.

Materials that are typically landfilled include: pretreated chemical waste, stable waste (no ignitable, corrosive or reactive materials), wastes which cannot be recovered, reused, incinerated or otherwise disposed of.

OIL REREFINING AND REPROCESSING

In Michigan for the last five years used motor oil has been collected at many gas stations and retail stores across the state. However, fluctuations in the number of businesses participating in this used motor oil "recycling" occur as a result of fluctuating crude oil prices. When oil prices go down fewer businesses offer the service and people resort to inappropriate disposal in ditches and fields, possibly contaminating ground water.

How does re-refining and reprocessing work? One way oil is re-refined is by mixing the waste oil with sulfuric acid and clay to get rid of impurities and odors resulting from use in engines. Another method, distillation/hydrotreatment, is similar but does not result in waste clay sludge. Reprocessing uses clay treatment and produces a fuel oil rather like lube oil.

For more information on waste processes and technologies contact: Waste Systems Institute at (616) 451-8992 or the MDNR, Waste Management Division (517) 373-0540.

Photoelectric Smoke Detectors Phased Out

A recent survey of Ann Arbor retail stores revealed that the smoke detector market has been taken over by the radioactive variety and that photoelectric smoke detectors are no longer carried by local stores. Disposal of radioactive smoke detectors concerns some environmentalists and health experts (see 4-9). Consumers should be encouraged to request photoelectric smoke detectors from local stores.

In January 1981, the Nuclear Regulatory Commission (NRC) deleted a requirement (10 CFR Part 32, 1/81) that spent smoke detectors be returned to the NRC for disposal. However, many companies continue to consider environmentally sound disposal important. The following companies will accept spent detectors mailed to their offices:

"First Alert" smoke detector send to:

BRK Electronics
Attn: Customer Service
780 McClure Road
Aurora, IL 60504
(312) 851-7330

"Professional" smoke detector send to:

Black & Decker
200 Crompton St.
P.O. Box 7025
Charlotte, NC 28217
(704) 374-1779

"Life Saver" smoke detector send to:

Fyrnetics, Inc.
1021 Davis Road
Elgin, IL 60123
(312) 742-0282

"Wake & Warn" smoke detector send to:

Wake & Warn
Box 68
Aurora, IL 60507-0068

"Sears" smoke detector call:

(312) 875-2500

Consumers who are interested in encouraging the NRC to regulate smoke detector disposal practices or who would like to send in their detector to the NRC may contact the agency at the regional offices whose listings follow:

Nuclear Regulatory Commission Offices

Region I
631 Park Ave.
Prussia, PA 19406
(215) 337-5000

Region II
Suite 3100
101 Marietta
Atlanta, GA 30323
(404) 331-4503

Region III
799 Roosevelt Road
Glen Ellyn, IL 60137
(312) 790-5500

Region IV
Parkway Central Plaza Building
Suite 1000
611 Ryan Plaza Drive
Arlington, TX 76011
(817) 860-8100

Region V
Suite 210
1450 Maria Lane
Walnut Creek, CA 94596
(415) 943-3700

Disposing Of Paint Products

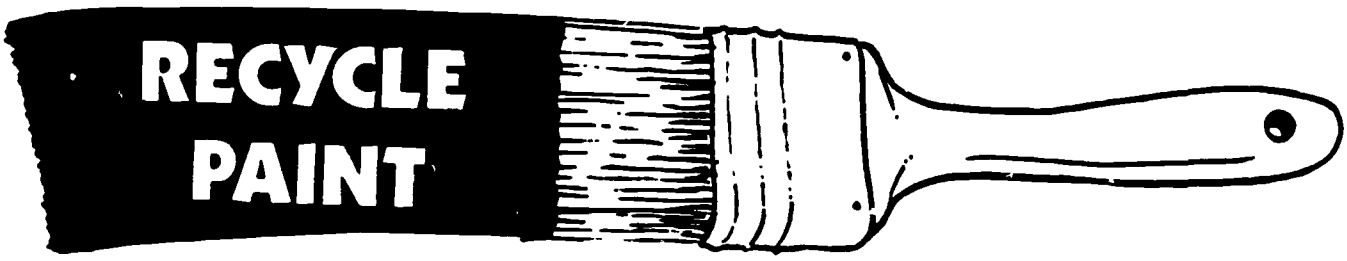
In the last few years a number of Michigan communities have organized household hazardous substance collections in an effort to keep products containing harmful chemicals from being dumped into local landfills. One of the drawbacks of these collections is the high cost involved. In some cases the cost is as high as $48 per household. In large part this expense results from the quantity of paint products that community members bring to the collections.

While the good intentions of those who do bring paint products to these collections should be acknowledged, there is an equally sound disposal option. Both money and effort could be saved if all of us tried a few simple measures at home.

Measures that have been shown to help reduce the cost of collecting household waste include: recycling and sharing paint products with organizations and individuals such as local housing agencies, art councils and schools; evaporating less toxic water-based latex paints and solidifying solvent-based paint products.

It takes education and media coverage to inform people that these options exist. The extra advantage of such an information campaign is that you reach those who wouldn't participate in the collection in the first place.

The following flyer, developed by the Huron Valley River Watershed Council may be useful in educating the public in your area about the hazards of unsafe disposal and the effectiveness of recycling and home "treatment" of leftover paint products.



IMPROPER DISPOSAL TECHNIQUES

Everyone enjoys a well kept home and work environment. Unfortunately, improper disposal of the products (paints, both oil and water based, stains, thinners, strippers) necessary to create the well kept environment, can contaminate the air, soil and water. Oil-based paints and solvents (thinners, strippers, turpentine) create disposal problems because of the toxicity of the chemicals they contain. While water-based paints are lower in toxicity than oil-based paints, they are more mobile in the environment, causing different disposal problems. Solvents also tend to travel readily through soils. Some improper disposal techniques include the following:

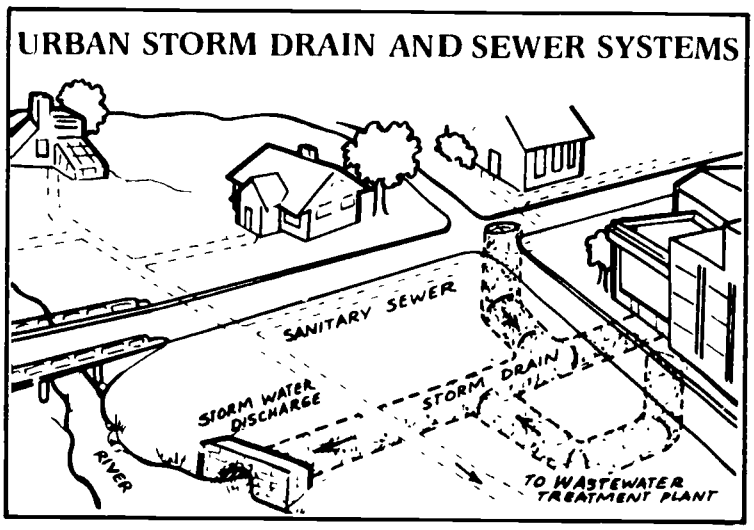
Evaporation of solvents does not get rid of them. It just changes them from a liquid waste to a gaseous one and causes air pollution. Unfortunately, evaporation may be the only alternative for a flammable liquid which cannot be used completely or given away. Sanitary landfills **will not** accept flammable liquids. Thus, evaporation should only be done if absolutely necessary and only in very well ventilated areas.

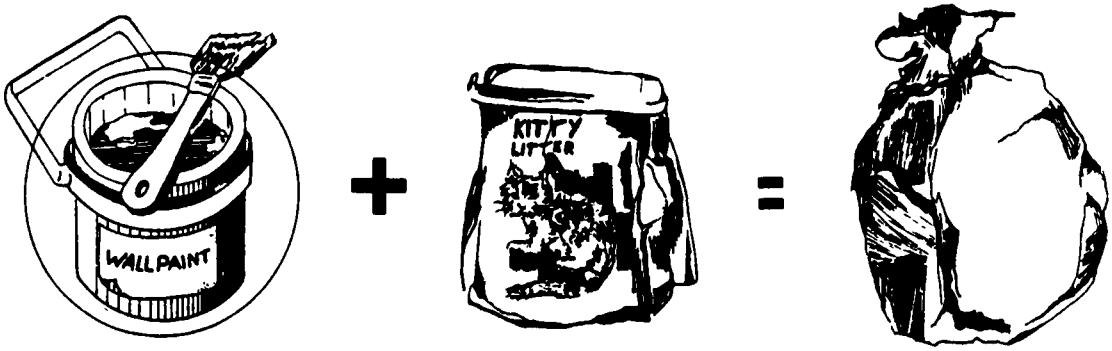
Tossing out liquid leftovers with the garbage creates the potential for soil and water pollution. Sanitary landfills were not designed to handle hazardous wastes. You may think "it is only a half gallon of solvent, it will not hurt anything." However, when you add up all the half gallons that are being disposed of by others, a lot of hazardous wastes are going into landfills which may not be able to contain them. If the landfill leaks, it can carry the liquid solvents with it, polluting the surrounding groundwater.

Dumping paints and solvents on the ground may lead to surface and/or groundwater contamination by run-off reaching a nearby stream, pond or other body of water or by the chemicals traveling through the soils to the groundwater.

Rivers and other surface waters can become contaminated when paints and solvents are **dumped into storm drains.** Storm drains lead directly to the river, the water in them is **NOT** treated (see Figure 1). Thus, dumping paints and solvents into storm drains can cause fish kills and can pollute the river. It is also illegal!!! Most cities have laws prohibiting placement of anything but storm water into storm drains.

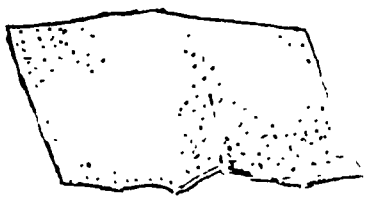
While no perfect solution exists for disposal of these products, a number of alternative and more environmentally safe disposal techniques are available.



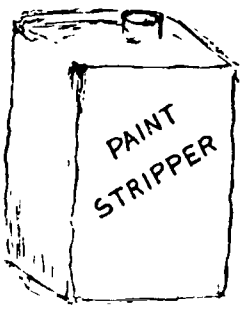


GENERAL ALTERNATIVES

- Use water based-latex paints. These have a number of advantages
  - Easy to apply
  - Low in odor
  - Easy to cleanup
  - Dries fast
  - Excellent durability
- Sand off old paint, stain and/or varnish rather than using chemical strippers.



YES



NO

RECOMMENDATIONS FOR HOUSEHOLD HANDYPERSONS

- The best thing to do with paints and solvents is to use them up. Solvents can be filtered and reused, or allow the solids to settle and pour off the solvents for reuse.
- Share paints and solvents with neighbors, friends and/or relatives.
- Donate leftover paint to churches, schools or other community groups who can use them.
- Take leftover solvents and oil-based paints to the next Household Hazardous Waste Collection Day
- If you must get rid of these products immediately, solidify the paint or solvent with kitty litter or sawdust, then double wrap the container and dispose of it with the household refuse. Solidification can best be achieved by pouring 2 cups of liquid hazardous waste into a gallon container filled with kitty litter. In this way, you are able to dispose of the hazardous waste in a form less likely to escape from the landfill.

Commonly Used Pesticides

PESTICIDE	COMMON USES	PERSISTENCE	ACUTE TOXICITY	CHRONIC EFFECTS	ADVERSE EFFECTS ON NON-TARGET SPECIES
Dichlorvos (Vapona®, DDVP)	No-pest strips, fumigants	Rapidly hydrolyzed in pure water. No toxic residues.	Organophosphates are absorbed via ingestion, inhalation & dermal contact. They are degraded in the liver & other tissues within hours. Degradation products excreted in urine & feces -- do not accumulate. Found to cause increased airway resistance.	Found mutagenic in bacterial cultures. Found teratogenic in rats but not several other mammals.	Toxic to fish and bees.
Pyrethrins (Resmethrin & Tetramethrin are synthetic pyrethroids).	Plant sprays, indoor ant and flea killers	Highly unstable in light, moisture & air. Insecticidal activity easily destroyed.	Acute effects-contact dermatitis, occasionally severe phylactic reactions.	No information available	Toxic to fish. Relatively non-hazardous to bees.
Chlordane	Termite control, now restricted (No longer available for general use)	Persistent	Oral, dermal & inhalation toxicity-high	Cumulative; affects enzymes and hormones; toxic to embryos in rats & dogs; kidney & liver damage. Carcinogen. Adrenal, nervous system damage.	Acute toxicity; to birds - medium to high; mammals, fish, earthworms - high.
Carbaryl (Sevin®)	Flea killers, rose dust, slug bait	Moderately persistent	Slightly toxic. Carbamates absorbed via ingestion, inhalation & dermal contact. Actively metabolized by liver	Teratogenic in dogs and mice. Carcinogenic in rats.	Highly toxic to bees. Will increase mite populations. Moderately toxic to fish.

PESTICIDE	COMMON USES	PERSISTENCE	ACUTE TOXICITY	CHRONIC EFFECTS	ADVERSE EFFECTS ON NON-TARGET SPECIES
2,4,5-T-Silvex	Weed killer, now restricted (generally replaced by 2,4-D)	Moderate	Oral: medium	Liver and kidney damage; muscular disturbances; teratogen, carcinogen, fetotoxin.	Acute toxicity: birds, low; fish, medium, but affects reproduction. Toxic to some pond insects, shrimp, phytoplankton. Can accumulate.
2,4-D (phenoxy) (Hedonal®, Herbical®, Weed-B-Gon®, Weedar®, Verton-D®, etc.)	Weed killer	Non-persistent to moderate	Oral, dermal, inhalation: high	Suspected carcinogen, mutagen and teratogen.	Relatively harmless to bees. Toxic to trout and bluegill. Toxic to Carabid & Coccinellid (beetle) predators. Secondary effect of increasing some insect pest problems.
Diazinon® (Spectracide®)	Home and garden pest killers	Non-persistent to moderate	Oral, dermal, inhalation: high	Teratogenic in rat fetuses & chick embryos. Breakdown products of diazinon® - mutagenic in bacterial cultures.	Highly toxic to ducks, geese, fish, bees, other wildlife and to beneficial insects.
Propoxur (Baygon®)	Ant, roach, wasp killers	Forms nitrosopoxur in contact with nitrite in environment. Long residual activity.	Acute effects: typical carbamate. (see carbaryl)	Mutagenic in bacterial systems. In presence of nitrite in environment, propoxur forms nitrosopropoxur, which is mutagenic in bacteria, carcinogenic in rats, & causes single strand breaks in DNA of human skin cells.	Harmful to bees and fatal to birds feeding in treated areas.

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PESTICIDE	COMMON USES	PERSISTENCE	ACUTE TOXICITY	CHRONIC EFFECTS	ADVERSE EFFECTS ON NON-TARGET SPECIES
Malathion (Cythron®)	Plant sprays & dusts	Non-persistent	Slightly toxic - acute symptoms include headache, dizziness, twitching, nausea & vomiting, constriction of the bronchial tube & abnormal slowness of the heartbeat.	Found to be carcinogenic in rats. Also found to be teratogenic in chick embryos.	Highly toxic to fish and beneficial insects. Toxic to bees. Moderately toxic to birds.
Metaldehyde (Metason®), (Halizan®)	Slug bait	No information	No information	No information	Toxic to fish and fresh water snails. Toxic to wildlife, especially birds. Attracts and poisons dogs.
Methoxychlor (Marlate®, DMDT)	Fruit & vegetable sprays & dusts	Persistent	Relatively non-toxic	No information	Toxic to fish. Relatively non-hazardous to bees. Greatly concentrated in algae & bacteria in the water. Rapidly broken down in warm-blooded animals.
Rotonone	Plant sprays & dusts	Non-persistent	Highly toxic. Acute effects: dermatitis, gastrointestinal irritation, respiratory depression.	No information	Highly toxic to fish. Relatively non-toxic to bees.
Captan (Orthocide®)	Fungicide. Plant sprays & dusts.	Moderately persistent in soil	Relatively non-toxic	Some studies indicate teratogenic, carcinogenic and mutagenic effects.	Moderately toxic to fish. Toxic to some beneficial soil fungi. Low toxicity to game birds.

PESTICIDE	COMMON USES	PERSISTENCE	ACUTE TOXICITY	CHRONIC EFFECTS	ADVERSE EFFECTS ON NON-TARGET SPECIES
Acephate (Orthene®)	Plant sprays	Moderately persistent	Acute effects- typical organophosphate (see Malathion).	No information	Toxic to bees. Toxic to birds.
Folpet (Phaltan®, Thiopal®)	Fungicide. Plant sprays & dusts	No information	Relatively non-toxic	Possibly teratogenic	Low toxicity to game birds.
Chloropynfos (Dursban®, Lorsban®)	Lawn insect sprays	Moderately persistent in soil	Moderately toxic. Acute effects- typical organophosphate (see Malathion)	No information	Toxic to fish & other wildlife. Relatively toxic to birds. Toxic to beneficial insects.
Lindane (Kwell®)	Plant sprays.	Persistent in soil	Moderate to highly toxic.	Teratogenic, carcinogenic & central nervous system effects in rats.	Toxic to fish & other wildlife. Toxic to bees. Toxic to beneficial insects.
Bacillus Thuringiensis (Biotrol®, Thuracide®, Dipel®)	Plant leaf sprays	Non-persistent	Non-toxic (disease specific to insect larvae, no effect on mammals).	No known effects on health	Affects only leaf-eating insects, so harmless to beneficial insect predators & parasites, birds, bees, fish & mammals.

Categories of persistence are:
non-persistent - several days to about 12 weeks
moderate - 1-18 months
persistent - many years, at least 20
permanent

A CARCINOGEN causes cancer.
A TERATOGEN causes birth defects.
A MUTAGEN causes mutations.

Prepared by the Ecology Center of Ann Arbor, 1983

7-7 Integrated Pest Management

URBAN ECOSYSTEM MANAGEMENT

This column, developed by the staff of the Center for the Integration of the Applied Sciences, a division of the John Muir Institute, under a Cooperative Agreement with the U S Environmental Protection Agency (EPA), is a regular feature of the *IPM Practitioner* Information contained in this column was not reviewed in advance by the EPA, and the authors are solely responsible for its contents

WHAT IS IPM?

Integrated pest management (IPM) is the selection, integration, and implementation of pest control based on predicted economic, ecological, and sociological consequences

IPM seeks maximum use of naturally occurring pest controls, including weather, disease agents, predators, and parasites In addition, IPM utilizes various biological, physical, and chemical control and habitat modification techniques. Artificial controls are imposed only as required to keep a pest from surpassing intolerable population levels predetermined from accurate assessments of the pest damage potential and the ecological, sociological, and economic costs of the control measures.

[Since IPM was originally developed in agricultural settings], major emphasis has been placed on cotton, citrus, deciduous fruits, soybeans, and alfalfa, which account for approximately 70 percent of the insecticides applied annually to cropland. For nearly every crop included in [Cooperative Extension Service] demonstrations in over 30 states, pesticide use has dropped significantly without a sacrifice in yield or quality and **with increased profit to the farmer.**

Equally encouraging results have been achieved in IPM programs directed against pests affecting urban areas, public health, and forests (Dale Bottrell, Council on Environmental Quality, *Integrated Pest Management* 1979 Emphasis added)

Applying the IPM Concept

From the perspective of the IPM practitioner/manager, IPM is a process for deciding **if** pest suppression treatments are needed, **when** they should be initiated, **where** they should be applied, and **what** strategy and mix of tactics to use The major components of an IPM program remain the same, no matter what the target pest the first and most important of these is the development and operation of a monitoring program A monitoring program is essential in order to determine injury and action levels, select, time, and place treatments that are least disruptive to the natural controls operating to suppress the pest organisms and least hazardous to human health and the environment, and evaluate the pest management program as it proceeds Monitoring is an on-going activity throughout any IPM program.

The trained pest manager or academic researcher has a variety of statistical methods to use in developing a monitoring and sampling procedure, as well as an acquaintance with a growing number of specific IPM program examples to use as models But there is also a demand to understand and apply IPM concepts and techniques coming from the lay public and professionals whose work requires incorporation of or cooperation with pest management activities or policies The following discussion is written with these readers in mind, so that they may become familiar with the steps requisite to development of an IPM program, can adapt the process to the management of pest problems they encounter at home or work, and will discern when the expertise of an IPM specialist may be needed

Monitoring

Monitoring is the regular observation of specific animal, plant, or microbial populations, human behaviors, the weather, or any combination of these Each monitoring program needs to be tailored to the particular problem situation requiring management Not only must the population size of key pests and their natural enemies be recorded, but potential pest populations within the same system and their natural enemies may also need to be observed regularly Horticultural practices such as fertilizing, watering, pruning, and mulching can affect pest populations Management of garbage and domestic animals as well as other human behaviors affecting household pests may need to be monitored Heat, humidity, and such weather phenomena as rain, wind, and flooding can influence pest population size Any of these factors may need to be recorded, the choice will depend on the purpose for which the monitoring is undertaken

Developing a Monitoring Program

(1) Determine the **purpose** for the monitoring For example, one might establish a monitoring program to determine injury levels, time pesticide treatments, release predatory insects or mites, relate pest population size to weather, learn something specific about the biology or ecology of the pest or its

What is IPM?

A SUMMARY

Integrated Pest Management is a process for determining IF you need pest suppression treatments, WHEN you need treatment action (timing), WHERE you need treatment application (spot treatment), and WHAT strategy and mix of tactics to use Strategies used may involve physical, cultural, biological, or chemical controls

In selecting treatment tactics, choose those that are:

1 Least disruptive to naturally occurring controls upon the target pest populations and other potential pest populations ("When you kill off the natural enemies of the pests, you inherit their work "—Carl Huffaker)
2 Most in harmony with both short- and long-term human and environmental health
3 Most likely to be relatively permanent
4 Easiest to carry out effectively
5 Most conserving of nonrenewable energy fuels
6 Most cost-effective in the short- and long-term ("Use of a pesticide is no substitute for prevention." —Mike Dover)

An integrated pest management program contains the following components

1 A MONITORING SYSTEM for regular sampling of the pest population and its natural enemies, potential pests in the same environment and their natural enemies, management decisions and practices that could affect the pest or potential pest populations, and weather
2 A determination of economic or aesthetic INJURY LEVEL—that size of the pest population which can be correlated with an injury sufficient to warrant treatment of the problem
3 A determination of ACTION LEVEL—the pest population size, along with other variables such as weather, from which it can be predicted that injury levels will be reached within a certain time if no treatments are undertaken
4 TREATMENTS—application of selected strategies and mixes of tactics that are least disruptive to the natural controls operating to suppress the pest organisms and least hazardous to human health and the environment
5 An EVALUATION SYSTEM to determine outcome of treatment actions

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MONITORING: WHAT IS RECORDED?

1. Pest population size
2. Population sizes of the pest s natural enemies
3. Presence of potential pest populations in the same system
4. Presence of natural enemies of the potential pests
5. Horticultural maintenance activities and other human behaviors
6 Weather

natural enemies, or some combination of these.

(2) Determine **which populations** are to be sampled. For example, although there are many predators and parasites which could be monitored with respect to the management of most animal pests, since it would be too time-consuming to check them all, some basis for sampling must be chosen. Some parasites and predators, for instance, may be more important, more easily damaged by treatments, or easier to sample than others.

(3) Decide on the **frequency** of the visits. While once-a-week observation is a common choice, this may need to be varied to suit the season and the weather or the size of the pest population. Initially a frequency can be selected based on memory or records of previous years' experience with the pest population. This can then be refined, as written data is collected on a regular basis.

(4) Decide **which sites** should be inspected. High priority areas or those offering examples of characteristic variation in the system may be visited more frequently than those less affected or visible. The latter should be visited just often enough to compare with the others.

(5) Determine the **number** of plants or locations to be sampled at each site. With pest problems which are affected by weather, it usually takes two or three seasons to determine the minimal number that can be checked and still provide reliable information on which to base decisions.

(6) Decide upon a **precise sampling procedure.** More than one technique or sample size may have to be tried to determine this. This is where the expertise of an IPM specialist may be needed, depending partially on the purpose for which the sampling is being undertaken and the nature of the organisms being counted.

(7) Devise a **recording** system that is easy to use in the field.

(8) Develop a system of **displaying** the field data for ease in decision-making.

(9) **Evaluate** the sampling and decision-making system. For example, one might ask if the treatment actions taken had the desired effect upon the pest

DETERMINING INJURY LEVELS

1 How much aesthetic or economic damage can be tolerated?
2 How large a population of pests, at what time in the season and/or life stage of the pest or host, is correlated with intolerable damage?

populations without triggering other problems such as secondary pests or having undesirable effects upon the environment.

(10) **Make corrections** in the overall process as the evaluation may show to be appropriate.

Pest Suppression: Objectives and Tactics

In an IPM program the object of treatment action is to suppress the pest population below the injury level, not to attempt to eradicate the pest. Generally, it is considered desirable to allow the pest to survive at some low level in order to maintain the presence of its natural enemies.

Many treatment tactic options become apparent by taking an ecosystem view of the pest problem, that is, recognizing the interactions between the pest and its natural enemies such as predators, parasites, and diseases, other natural controls such as weather, and human behaviors such as maintenance activities.

Finally, it is important to remember that in large measure pest problems have been designed into our human-managed systems. The most energy- and cost-effective pest management strategy is to design the pests out of the system. Through the selection and mix of plant species, the design or remodeling of structures and interiors, the contouring of sites, and the design of organic waste and other resource management processes, the extent to which we provide the preferred harborage, food, water, and other requirements of the life cycle of the pest can be reduced.

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MANY TREATMENT OPTIONS TO REDUCE PEST PROBLEMS ARE AVAILABLE

1. **Selection of plants or structural materials** that are:
   - Resistant to pests
   - Supportive of natural controls
   - Enhancing of ecosystem diversity and processes
2. **Habitat modification** for purposes of:
   - Reduction of pest harborage, food, or other requirements
   - Enhancement of the environment required by the pest's predators, parasites, and diseases
3 **Human behavior changes,** including:
   - Modification of horticultural or other resource management practices such as watering, fertilizing, pruning, mulching, cultivating, waste management, and human food storage
   - Modification of aesthetic judgments regarding cosmetic damage to food, manicuring of landscapes, and visual presence of certain animal species (such as insects)
4 **Physical controls,** such as:
   - Manual picking, weeding, etc.
   - Barriers
   - Traps
   - Mechanical action
5. **Biological controls,** including:
   - Conservation of the pest's natural enemies through proper selection of materials and timing and placing of treatments
   - Augmentation through the introduction of additional numbers of the pest's natural enemies or commercially available pathogens
   - Inoculation by the repeated reintroduction of effective natural enemies that will not survive over winter or from crop to crop
   - Importation of host-specific natural enemies of exotic invaded pests
6. **Chemical controls,** including:
   - Pheromones and other attractants to lure and/or confuse the pest
   - Juvenile hormones that arrest pest development
   - Sterilants or contraceptives to reduce breeding of future generations
   - Contact, stomach, and other poisons

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7- 8 Lawn Care

Maintaining Your Lawn Naturally
(nature sets a great example!)

Written by David Stead, Issues Coordinator

The maintenance of a lawn is dependent on a delicate species of plant, one that must be carefully mananged because it requires high fertility, and is susceptible to drought, insects, and various types of mold or fungus disease. If we have a variety of grass species in our yard, plus the soil organisms to decompose organic matter, our lawns should be able to combat disease and drought. When a multi-species lawn is stressed by drought or attacked by insect or disease, only some of the grass species will be affected, while the resistant grasses will continue to provide a healthy cover. As organic matter falls to the ground, beneficial insects, bateria, fungus, and algae decompose the matter and recycle the nutrients back to the soil. This is nature's system for maintaining productivity in soil By practicing good backyard ecology, we will find that lawns can be easily maintained by following the tried and true example set by nature. Addressed below are some of the lawn problems that occasionally crop up and how they can be dealt with.

SOILS

The most important step to a healthy lawn is to determine and respond to the nutritional needs of your particular soil type. Soil tests done every few years will indicate nutrient and mineral deficiencies of nitrogen, phosphorus, and potash, to name a few. These tests can be performed by the Cooperative Extension Service for a nominal fee. Once recognized, inadequate levels of nutrients can be supplemented by the correct mix of organic fertilizers. Soil that has been enriched with well-rotted manure, peat or muck will encourage lawn grasses to grow vigorously, thereby crowding out weeds. Missing minerals can be replaced by applying natural soil improvers such as mineral rocks.

Timing of the application of fertilizers is perhaps the most important step in producing a healthy lawn. Fertilizer should be applied in the early spring or late fall to stimulate the growth of desireable grasses while preventing the growth of weeds and crabgrass. Once undesireable grasses start to grow, they are difficult to get rid of.

It is important to have well-drained and aerated soils to allow water and oxygen to move down into the root zone. Without this, weak root systems will develop and the plant will be more susceptible to disease. Good soil structure can be achieved with organic fertilizers as they help to prevent compacted soil and leaching of nutrients while increasing the ability to retain water. All in all, poor soil structure encourages the growth of weeds.

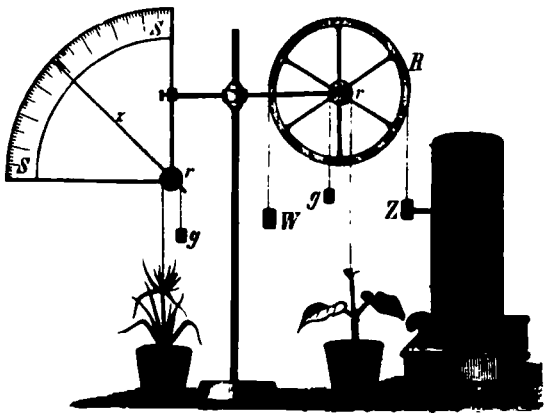
SEED SELECTION

Because diversity is the key to a healthy and resilient lawn, seed selections should include several species of grasses or other mixtures of native grasses and wildflowers. When choosing a seed, attention should be paid to the weed seed content. Cheaper varieties of mixes tend to have a high weed-seed content - it would be better to opt for a higher quality mix as a preventative measure. A good combination for the Ann Arbor area contains Kentucky Bluegrass, perennial rye, Clark Kentucky Bluegrass, and creeping red fescue Organic fertilizers should be applied several weeks before seeding takes place.

WATERING

Lawn grasses are often damaged due to improper watering. Frequent light applications of water saturates the upper soil layers while encouraging shallow rooting and weak root structure. Applying water to turf at a rapid rate prevents movement down into the soil, leaving an overly-moist soil which will encourage the development of fungus and molds. Water should be applied deeply and infrequently and the soil should be well-drained. Watering in the early morning or late afternoon will avoid excessive evaporation.

After seeding, a light mulch is useful to retard water loss and to prevent heavy rainfall from washing out seeds. Light watering is good until seeding is established. Thereafter, water only when necessary so that roots grow deep, thereby strengthening the plant



MOWING

Grass is a crop which grows at different rates throughout the year depending on climate, rainfall, and fertilization The health of your lawn, once it is established, depends a great deal on how it is mowed. Consequently, mowing technique should be customized to meet the needs of your lawn.

Mowing at any height damages the root system of grasses by reducing the leaf area used to provide food through photosynthesis. Frequent, light mowings cause less stress than infrequent heavy mowings. Mowing should never remove more than one-third of the leaf area at a time. A medium height of one to two inches is best for buffalo grasses, red fescue, carpet grass, bluegrass, perennial ryegrass, and meadow fescue.

Mow higher and less often in the mid-summer heat. Letting the grass grow up allows the roots to grow down, providing your grass with more staying power during times of drought Taller grasses also help to shade the soil, preventing it from drying out. In shaded areas, mow one-half to one inch higher to allow more leaf area for photosynthesis, making up for possible light shortages.

GROUP I COOL SEASON GRASSES	Relative Maintenance Requirements	Top Disease Insect	Life of Grass	Appearance of Grass	Traffic Resistance	Shade Tolerance	Mowing Height	Time required for Seeds to come up (1)
(Creeping and Creeping) Red Fescues	Medium	Grubs, Sod Web worms, Leafhoppers	Permanent	Fair	Medium	Good	1 2	2 to 4 weeks
Merion Bluegrass	High			Medium	Good	Fair	1 2	3 to 5 weeks
Kentucky Bluegrass	Medium			Fair	Medium	Fair	1 2	2 to 4 weeks
Bent Grass	Very High	Grubs, Sod Web worms, Leafhoppers, Chinch Bugs		Medium Fair	Medium	Fair	1 3 4	2 to 4 weeks
Rough Bluegrass	Low	Grubs, Sod Web worms, Leafhoppers	Short Permanent	Fair	Poor	Very Good	1 2	2 to 4 weeks
Redtop	Low		Temporary	Fair	Medium	Fair	1 2	1 to 2 weeks
Ryegrass	Low			Medium				
Tall Fescue (Alta & Ky 31)	Low		Permanent	Medium Coarse	Medium Very Good	Fair Fair to Good	1½ 2 2 3	1 to 2 weeks 1 to 2 weeks

THE THREE BIG LAWN PROBLEMS

Mismanagement in any of the areas mentioned above will result in a variety of short- and long-term lawn problems.These might include an overabundance of weeds, harmful insects, and/or development of lawn diseases and fungus. It is important to realize that these problems can be resolved without the use of herbicides and chemical fertilizers. Described below are some common problems and alternative treatments that will result in a naturally healthy lawn.

Weeds. A weed is nothing more than a plant in the wrong place. The right choice of a grass for your area and conditions and proper watering and use of fertilizers will do a lot to prevent weeds. The most important step is good soil and lots of organic matter. Weeds become a problem because they are better adapted to conditions under which turf grasses perform poorly. Many types of weeds thrive in soils that are low in some nutrients and minerals, while high in others.

Many undesireable plants such as crabgrass are susceptible to shading and can be crowded out by healthy grasses. Another technique for controlling undesireable plants like dandelions is to defoliate them in the spring when the root reserves are the lowest. Using organic fertilizers high in nitrogen just before or after broad leaf plants bloom will serve to essentially "fertilize" them to death. This should not be done, however, if you also have a crabgrass problem. Defoliating a plant by shearing off the leaves several times a season has been shown to kill off the majority of those plants.

Insects. Some grasses are more susceptible to attack by certain insects than others and should simply be avoided where the insect is a problem. There are also several beneficial insects and organisms which help to maintain a healthy lawn which are natural enemies of many damage-causing insects. Earthworms and ant mounds may be an annoyance, especially in lawns that are kept short, but a lawn could not do better than to contain large numbers of these natural aerators. Again, the composition of the soil is a major determinant of the ability of insects to cause damage to a lawn. Identification of the cause of the problem is the first step.

Disease and Fungus. Lawn diseases are caused by fungi which are spread by wind, water, and equipment. Fortunately, only a small number can actually damage a lawn. Most disease and fungus problems are the result of over/under-watering, poor nutrient levels, improperly aerated and drained soil, monoculture lawns, and improper mowing height. Homeowners should remember the following facts when attempting to deal with lawn diseases:

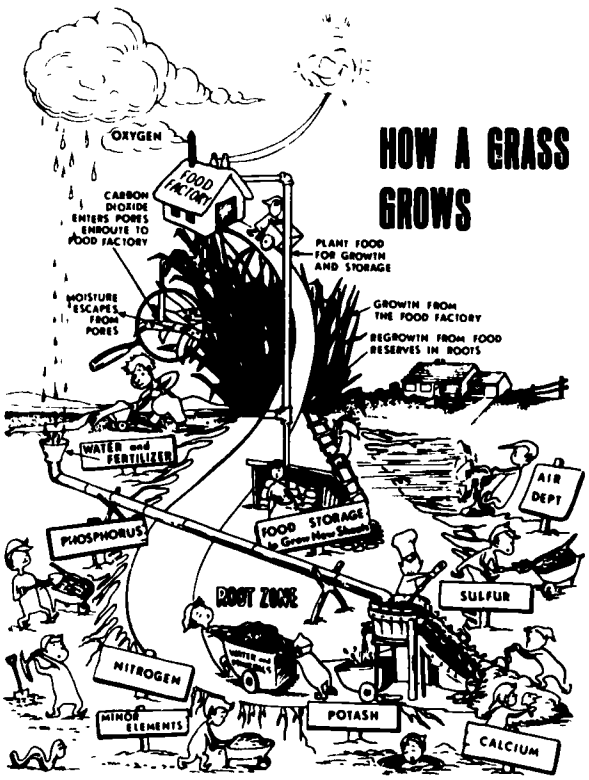
1) Because fungi thrive in soil with a high moisture content, over-watering should be avoided. Aerate the lawn periodically.

2) Most fungi live on grass clippings as well as on living plants. If there is a problem, clippings should be collected and disposed of.

3) Mow the infected area of the lawn last. Clean the mower blades after mowing an infected area to prevent the spread of the disease to other parts of the lawn.

4) Mixed grasses will always be less susceptible to any one fungus or disease.

When practicing the lawn maintenance techniques described above, homeowners should keep one thought in mind: naturally-healthy lawns take time. Good soil structure results from several seasons of care and will provide the conditions necessary for a beautiful lawn that is compatible with nature. Toward that end, **Happy Gardening!**



7- 9 Can Some of your Household Products Harm You?

	TOXICITY RATING	LETHAL DOSE FOR 150 lb. HUMAN	HOUSEHOLD PRODUCTS.....
1	Practically Non-Toxic	More than 1 Quart	foods, candies, 'lead' pencils, eye makeup
2	Slightly Toxic	1 Pint to 1 Quart	dry cell batteries, glass cleaner, deodorants and anti-perspirants, hand soap
3	Moderately Toxic	1 Ounce to 1 Pint	antifreeze, automotive cleaners, household bleaches, many detergents, dry cleaners, most floor cleaners, metal cleaners, most oven cleaners, many general cleaners, most fuels, lubricating oils, most stain and spot removers, many disinfectants, floor polish, shoe polish, most paints.
4	Very Toxic "CAUTION"	1 Teaspoon to 1 Ounce	most toilet bowl cleaners, some deodorizers, engine motor cleaners, some fertilizers, some paint brush cleaners, some paint and varnish removers, fireworks, some mildew proofing, air sanitizers, some paints, lacquer thinners, many pesticides: DDT, chlordane, heptachlor, lindane, mirex, diazinon, malathion, diquatdibromide, endothall, 2,4D.
5	Extremely Toxic "WARNING"	7 drops to 1 Teaspoon	some of the insecticides, fungicides, rodenticides, herbicides: aldrin, eldrin, bidrin, methyl parathion, paraquat, some fertilizers, mercury cell battery
6	Super Toxic "DANGER"	a taste (less than 7 drops)	a few pesticides like: paroxon, phosdrin, parathion, isobenzan, pyrazoyan

Gosselin et al. (1976) Clinical Toxicology of Commercial Products.

7-10 First Aid for Poisioning

TYPE OF POISONING	WHAT TO DO
Swallowed poisons	If the person is awake and able to swallow, give milk or water only Then call the poison center or doctor *Caution* Antidote labels on products and antidote charts may be out of date and incorrect *DO NOT* give salt, vinegar or citrus fruit juices
Poisons on the skin	Remove any affected clothing Flood involved parts with water, wash with soap and water, and rinse Then call the poison center or doctor
Poisons in the eye	Flood the eye with lukewarm (never hot) water, poured from a pitcher held 3-4 inches from the eye for 15 minutes Then call the poison center or doctor.
Inhaled poisons	Immediately, carry or drag the person to fresh air and give mouth-to-mouth resuscitation if necessary Ventilate the area Then call the poison center or doctor

Always keep on hand syrup of ipecac which induces vomiting, and epsom salts which acts as a laxative Do not use either one unless instructed to do so by the poison center or your doctor, and *follow their directions for use*

SOME COMMON SUBSTANCES & POSSIBLE SYMPTOMS OF OVERDOSE

The following is a list of some of the potentially toxic substances in the environment Always call for assistance immediately after a poison exposure NEVER wait until symptoms appear

MEDICINES

Amphetamines—hyperactivity, agitation, convulsions
Antibiotics—allergic reaction, such as swelling, skin eruptions, breathing difficulty, shock
Anticonvulsants—coma
Antidepressants—coma, convulsions, hallucinations, heart irregularities
Antidiarrheals (prescription)—coma
Antihistamines—hallucinations, agitation, convulsions, coma, fever, depression
Aspirin—fast breathing, ringing in ears shock, sweating, fever, convulsions
Camphor—convulsions, excitement, coma, feeling of warmth
Cold preparations—hyperactivity, convulsions, coma
Iron, vitamins with iron—bloody vomiting and diarrhea shock, coma
Oil of wintergreen—fast breathing, ringing in ears, shock, sweating, fever convulsions
Sleeping pills—coma, convulsions, respiratory depression
Tranquilizers—coma, convulsions, respiratory depression

CLEANING PRODUCTS

Ammonia, bleach, dishwasher soap, disinfectants, drain cleaners, toilet bowl cleaners—irritation or chemical burns in mouth and esophagus
Furniture polish, bleach mixed with other cleansers—burning irritation, coughing
Laundry detergents, soaps—vomiting and, or diarrhea

GARAGE & GARDEN PRODUCTS

Acids, adhesives—chemical burns
Antifreeze—coma, blindness, convulsions, drunkenness
Fertilizers—vomiting and/or diarrhea
Gasoline, kerosene, turpentine, paint thinners, solvents, thinners, degreasers, charcoal lighter fluid—coughing, coma, burning irritation
Insecticides—headache, increased body secretions, vomiting, diarrhea, convulsions
Strychnine—convulsions

PERSONAL PRODUCTS

Nail polish remover—irritation and dryness inside mouth and esophagus
Perfume, after shaves, mouthwashes, rubbing alcohol—incoordination, depression, coma
Shampoo, soap, lotions—vomiting and or diarrhea

PLANTS

There are thousands of poisonous plants The poison control center should always be called if any plant is ingested
Mushrooms—Symptoms vary, and may be delayed Always call the poison center if it is thought a poisonous mushroom may have been eaten

Prepared by the:
Regional Poison Center, University of California, Davis Medical Center

D4858 (5 80)

Unknown poisons. Call the poison center or doctor immediately.

POISON INFORMATION

University of Michigan Medical Center
Emergency Services
764-5102

INGESTED POISONS

In case of actual or suspected poisoning, call Poison Information Center.

- Give them the following information:
  a) Name, age & weight of victim
  b) Name of product taken
  c) Estimate of how much was taken
  d) Description of the incident
  e) Description of symptoms
- Induce vomiting only if instructed by the poison center.
- Use SYRUP OF IPECAC to cause vomiting as directed by poison center.
- Obtain one ounce of SYRUP OF IPECAC from a pharmacy and keep it in your home.

If victim is unconscious, having difficulty breathing or having convulsions, call rescue squad for an ambulance.

- Begin artificial respiration if necessary.
- Transport victim to an emergency facility.
- Do Not induce vomiting. If vomiting has occurred, bring vomitus to the emergency room with victim.

DO NOT induce vomiting if:

- The substance swallowed was a strong alkali/acid (lye, ammonia, drain cleaner, oven cleaner).
- The substance swallowed was a petroleum product (kerosene, chest rubs, gasoline, turpentine, lighter fluid, insecticide or furniture polish).

Remember:

- Always call your doctor or poison information to find the correct treatment for a poisoning.
- Have the poison container available when talking with the poison center.
- Bring the poison container, if you take the victim to an emergency room.

INHALED POISONS

- Move the victim to fresh air immediately.
- Begin artificial respiration, if necessary, until help arrives.
- Call for poison information.

SKIN OR EYE CONTACT WITH POISONS

- Flush immediately with large amounts of water for at least 15 minutes.
- Remove contaminated clothing.
- Call for poison information.

POLICE OR RESCUE SQUAD

Ann Arbor 911
Ypsilanti 483-2311

POISON INFORMATION
UNIVERSITY HOSPITAL
4TH LEVEL OUTPATIENT DEPARTMENT
24-HOUR EMERGENCY SERVICE
(313) 764-5102

7-11 CONTROL ALTERNATIVES FOR INDOOR PESTS

Ants Take appropriate measures to eliminate outdoor food and nesting sites, and to trap ants outdoors when possible. (See control alternatives for outdoor pests). Make sure firewood or tree branches are not in contact with the house.

Caulk or otherwise seal common ant entry points such as window sills, thresholds, baseboards, etc. A pyrethrum-silica gel dust, (available at hardware stores) blown into cracks before sealing will provide an additional barrier.

Keep all foods tightly covered. Be meticulous about kitchen cleanup and sanitation. Thoroughly scrub the kitchen, including areas behind and under major appliances with a degreasing type of cleanser.

A bait made of equal parts borax and powdered sugar can be sprinkled or placed in shallow open containers under baseboards, in corners, etc. In homes with small children or pets bait the trails and nest areas as follows. Mix together 3 cups of water, 1 cup of sugar and 2 tablespoons borax. Gather a number of small jars. Loosely pack cotton to half the depth of the jars. Saturate the cotton with the bait solution, then secure the lids tightly on the jars. Punch 2 to 3 small holes (less than 1/8" diameter) near the center of each lid and set out the traps. The addition of small quantities of bacon drippings to either the borax-powdered sugar bait or the liquid formulation will help to lure grease eating ants.

Two herbs, green sage and tansy, either growing near entrances or dried and placed in cupboards will help to discourage red ants. Steamed bone meal sprinkled near the foundation serves as a barrier to some species.

Boxelder Bugs and Elm Leaf Beetles These casual invaders congregate on the warm, sunny side of buildings on autumn days. Thorough caulking and screening of attic vents is necessary to exclude them. One foot wide collars made of cardboard and coated with Tanglefoot or other sticky material can be used to trap them as they migrate down tree trunks beginning in mid-August.

Sprinkle borax or a pyrethrum-silica gel mixture in attics, or into cracks before caulking to provide a further barrier. Similarly treat and caulk the interior sills and baseboards. Screen return air ducts to keep them from entering the living areas of buildings when walls warm up in the spring.

Carpet Beetles Carpet beetles are very closely related to the larder beetles, common pests of stored food products. Many of the common carpet beetles are as likely to be found in stored food products as in carpeting, and will usually be found in both places unless control measures are implemented when they are first discovered. Control in the kitchen will be covered with larder beetles.

All the carpet beetles which enter homes have a similar life cycle. In the spring the adults are attracted to flowers where they feed on pollen, congregate and mate. After mating, the female searches for a suitable place to lay her eggs. Out doors, this is often

a birds nest, where the larvae can feed on feathers. They become pests when the females enter the house and the larvae develop on stored woolens, wool rugs or rugs with jute backings, furniture, items containing hair, bristles, silk, feathers or other products of animal origin, or in such varied food products as flour, cayenne pepper, seeds of any type and dryed bulk pet foods. Depending on the species of beetle, the temperature, humidity and abundance of food, carpet beetles may complete their life cycles in anywhere from six months to three years. The characteristic bristle-tailed larvae molt many times during this period. Large numbers of shed larval skins are often found, even though the population is still small or confined to a limited area.

In the spring, when early blooming shrubs are in bloom, many adults will be found feeding on the flowers. At this time, do not leave windows open unless they are covered with tight fitting screens. These beetles are very small and can enter the home through cracks in the siding or eaves, unscreened attic vents, etc. so careful caulking is essential.

If long term problems with carpet beetles have indicated the need for some chemical control, it is better to spray the adults outdoors when they are all congregating in one place than to attempt to use an insecticide indoors. They feed early enough in the spring that the weather is generally too cool for the bees to be active, so the adults can be safely targeted with rotenone or other garden sprays. These chemicals are toxic to honey bees and should not be used when temperatures are above 62 degrees F. when the bees are likely to be active.

Cedar chests or tightly sealed closets made of at least 70% heartwood of red cedar can be used to store seasonal clothing and woolens. Cedar surfaces should be treated with 100% cedar oil every 3 years to insure good protection. The cedar oil may kill smaller larvae, and will deter older larvae and adults from entering, but clothes must be dry cleaned or cleaned with hot water and detergent before being placed in storage.
Finally, the best preventive measure is good housekeeping. Regular use of a vacuum cleaner will remove lint and pet hair, as well as eggs and larvae of carpet beetles. The use of a carpet shampoo or professional steam cleaning is helpful for existing infestations. Seal all cracks along interior moldings and the openings around pipes and heating vents to prevent beetles from moving from room to room within the house. Finally, store dried foods in tightly sealed containers and keep cupboards clean of flour dusts, spilled grains, etc.

Clothes Moths If they fly towards the light at night they may be meal moths or casual invaders, but they are not clothes moths. Clothes moths like darkness and generally only attack clothing which has been stored for some time in a dark place. Clothes moths are small, with a wingspan of less than 1/2", and fly about aimlessly when disturbed or exposed to light.

The larvae of clothes moths, which are no more than 1/3" long when fully grown, feed on wool, hair, feathers, furs, dead insects, natural bristles, leather and milk powder. The adults do not feed. The life cycle can take anywhere from six weeks to four years, but the most rapid development, and the most damage, occurs at average room temperature and 75% relative humidity. There will be no feeding damage at temperatures below 45 degrees F.

Feeding damage can easily be distinguished from that caused by carpet beetle larvae because the moths always have silken thread, like that used for their cocoons,

associated with them. Fine silken threads or silken cases will be found over the surface of materials they have damaged.

As with carpet beetles, excluding them from the home and careful sanitation are the best deterrents. Clothing should be carefully cleaned before long periods of storage, either by dry cleaning, washing in hot (135 dedgree F.) water or by washing normally and hanging in bright sunlight for 4 to 6 hours. As with carpet beetles, storage in an oiled cedar closet or chest is a good deterrent, but only the young larvae will be killed if infested articles are placed in cedar storage without cleaning.

The life cycle of clothes moths is slowed and damage is reduced if articles are stored at cool temperatures and low humidity. At temperatures below 45 degrees F. the larvae do not feed. This is why furriers use cold storage for valuable garments. Invasion can also be prevented by wrapping susceptible fabrics in cotton batting. The larvae will not eat through cotton. Furniture upholstered with natural materials has layers of cotton batting installed underneath the cover, to prevent clothes moths from attacking from the inside.

A herb sachet made from two parts each of rosemary and mint, and one part each of thyme and cloves is said to serve as a repellent in tightly closed closets, boxes or other closed storage containers.

Cluster Flies Exclude them from wall spaces and home living areas in the same manner as boxelder bugs (above). Because their larvae are parasitic on earth worms, measures to reduce the amount of wet, organic mulch and moist soil near buildings may be helpful.

Cockroaches Habitat modification is the key element in the long term management of a roach problem. Top priority should be placed on practices which reduce drinking water and humidity. Water for roaches is available in sink traps and drain pipes, wash basins, tubs, toilet bowls, flush tanks, pet dishes, aquaria, vases, drainage pans beneath refrigerators, from condensation on cold pipes and windows, and in various foods. Eliminate as many of these sources as practically possible through repairs and barriers.

When cockroach harborages are found, accessible areas can be vacuumed and washed to eliminate egg cases, fecal material and bits of food waste that may have accumulated. Dispose of vacuumings by burning, placing in tightly closed containers for disposal or composting (after disinfection with household ammonia).

Caulk or otherwise plug all small cracks around baseboards, wall shelves or cupboards, pipes, sinks and bathroom fixtures. Roaches prefer to have both the upper and lower surfaces of their body touching some part of the microenvironment (the small spaces in which they live). An adult German cockroach can hide in cracks as small as 1.6 mm. wide. A young nymph can fit through a gap as small as 1.0 mm.

A variety of commercial and homemade traps can be used for roaches. They are useful in eliminating some of the insects and as a monitoring tool to judge the magnitude of the roach population and the effectiveness of habitat modification efforts. Commercial traps usually consist of a small cardboard box with bands of a sticky substance. They must be placed along the periphery of walls and other objects

where roaches prefer to travel. They will not seek out traps placed outside of their normal runs.

Homemade food-lure traps can be used effectively in cupboards, under sinks and in other feeding areas. Use one quart mayonaise jars or similar large glass jars. Place a small amount of peanut butter or apple slices in the bottom of the jar. Spread a one to two inch ring of petroleum jelly around the inner rim of the jar, and place it upright in suspected feeding areas at night. The roaches will be able to climb in but won't be able to climb out and can be destroyed in the morning.

For large roach populations, something with insecticidal properties will be needed. Boric acid has been used for years for roach control and roaches have not developed resistance to it. They are not particularly repelled by it, as they are by other insecticides which they can detect and avoid. To be effective for roach control, boric acid must contain an anticaking agent. The boric acid often sold by pharmacies does not contain the anticaking agent. It will be available at hardware stores and garden centers. Boric acid is most effective as a very light dust applied along their runways, in difficult to seal cracks, under refrigerators, etc. It can also be blown into wall voids. Roaches walk through the dust, then injest the material while cleaning themselves. It kills them in one to two weeks.

Insect growth regulators containing methoprene are known to prevent nymphs from maturing to reproductive adults. While methoprene will not kill or eliminate the population, it can buy time for effective habitat modification by preventing increases in the adult population.

Cricket Field crickets often invade homes in the fall when their natural food supply is depleted. While a temporary nusiance, they are unable to adapt to indoor conditions and generally die off by mid-winter. Field crickets are prevalent near refuse piles, wet organic mulch, etc. Elimination of outdoor habitat and thorough caulking and screening should keep them from becoming a nusiance.

House crickets are able to complete their life cycle indoors and are often active year round, once established. They are nocturnal and will migrate to lights. Their food consists primarily of soft plant materials and certain stored products, especially soiled rags or fabrics. Cotton, rayon, linen, wool, silk and furs are particularly susceptible. They like warmth and are often associated with fireplaces or basement storage areas near furnaces.

Sanitation is of paramount importance in cricket control. All areas in and around buildings must be kept free of debris and moisture. Make sure all screens, windows and doors close tightly. Caulk or otherwise seal all cracks and crevices, especially those near ground level.

Fleas The important factor in flea control is to attack on three fronts simultaneously. 1) Larval stages of fleas are found in grass and on other low growing vegetation outdoors in areas frequented by pets and wildlife. 2) Larval stages and eggs are present in carpeting, floor areas and any furniture with which infested pets come in contact. 3) Pets themselves are usually infested with the adult fleas which need a blood meal before they can reproduce.

Fleas must be eliminated from the pet by frequent bathing and possibly the use of a flea powder containing rotenone. Feeding the animal a small quantity of yeast daily is said to help repel fleas. Feed 1 to 2 tablespoons for a dog, less for cats and smaller animals. Rub mint or tansy leaves into the pet's coat as a repellent, or tie a small sachet of these herbs to the pet's collar.

Pet houses, sleeping areas and all indoor areas visited by an infested pet must be thoroughly cleaned and vacuumed. Destroy the contents of the vacuum cleaner bag daily. Larval fleas can exist on very small bits of lint and debris that accumulate in the corners of rooms, doghouses, cracks under molding, etc. Vacuum daily. For a heavy indoor infestation it will help to use a carpet shampoo or have carpets steam cleaned.

Salt crevices in the floor and corners of the dog house. Place fresh mint in the dog house or in sachets under the pets bed. If possible, grow some mint or tansy around the doghouse.

The insect growth regulator methoprene, currently sold as Precor, is registered for both indoor and outdoor use to prevent maturation of larval fleas. Outdoors it is most effective if used early in the summer before any larvae begin to mature. Once they mature to the adult stage Precor is not effective. Indoors, Precor can be used any time, and in the case of a breeding indoor population will probably have to be applied several times at 3 or 4 week intervals to catch new larvae that hatch from eggs after the first application. Outdoors it is helpful to keep the lawn and other vegetaion or nearby fields mowed short to reduce the contact of both wild and domestic animals with vegetation on which fleas rest.

Grain and Flour Beetles There are three common beetles that infest stored grain and flour products in Michigan and the midwest. These are the saw-toothed grain beetle, the red flour beetle and the confused flour beetle. All three will infest such products as stored grains, flour, cake mixes, spaghetti, macaroni and cereal. In addition to these, the saw-toothed grain beetle often infests dried fruits and nuts, including roasted and salted nuts, and a variety of other products.

The first step in controlling grain and flour beetles is to check all stored foodstuffs and discard any that are infested. They are often brought home with unfumigated flours or grains from bulk food bins in organic food stores. Herbal teas, dried chili peppers and bulk pet foods are other common sources. In the pantry, they are likely to develop in any packaged flour product which has been stored for a long time. During the cleanup, the "source product" will usually be obvious, with much higher numbers of pests than most of the other infested products. In a pantry, do not limit the cleanup effort to stored foods. Beetles will hide in boxes of straws, coffee filters and just about any other package they can chew their way into.

Once all infested foods have been discarded, remove shelf paper and vacuum all shelves, concentrating on cracks behind shelves and corners. After vacuuming, wash cupboards thoroughly with a strong household cleanser. Allow to air dry. Place all food to be returned to the cupboard in tightly sealed containers, including air-tight plastic, ground glass or rubber sealed canisters or tightly closing tins. Paper or plastic bags will not prevent infestation by missed beetles; nor will they confine missed beetles to a single product. It is advisable to purchase dried flour and grain products in small quantities for the next six to eight weeks, or until you are certain that

the infestation has been completely eliminated. A reoccurence of the beetles does not indicate the need for an insecticide. It just means some were not detected the first time and another cleanup is in order.

Traps now available (1986) from the Zoecon Corporation utilize synthetic pheromones (insect sex attractants) and oil based food attractants for the monitoring and partial control of these pests.

Pheromones are available to use in combination with a sticky trap or a grain probe trap for the red and the confused flour beetle. A pheromone for the sawtoothed grain beetle is currently under development. These traps could play an important role for the individual homeowner after a thorough clean up has largely eliminated a beetle population. They will trap any adult beetles missed in the clean up operation; and can provide a good warning system so a reinfestation is detected before it gets out of control again. These traps are especially recommended for health food stores, warehouses and bakeries where large quantities of flour and grain products are handled.

Another grain beetle, the foreign grain beetle is also found in Michigan homes, though not in stored food products. It is more commonly found feeding on mold growing on moist grain, bird seed or pet food. It is also found in new houses on new cabinets made of particle board. The particle board, when new, may still be damp and mold may grow on the plant materials used in its construction. This is all the foreign grain beetle needs to live on, so they are quite common around kitchen cupboards and bathroom vanities. Cleanup, and efforts to control humidity are helpful in dealing with these.

Houseflies Sanitation is the key to fly control. Dispose of garbage and clean garbage pails regularly. Sprinkle the inside of garbage pails with dry soap.

Keep food tightly covered. Clean out and dispose of moist, uneaten pet food an hour after it is offered. Check fruit in room temperature fruit bowls daily and remove any fruit that is beginning to soften or get overripe.

Sticky traps such as flypaper are reasonably effective. Their effectiveness outdoors can be increased by providing a lure. A small pill bottle filled with household ammonia, with a piece of wick (sold for kerosene lamps, etc.) out a small hole in the cap is an effective lure. Place lure and sticky traps close together, but away from doors, patios or other outdoor living areas. Homemade traps can be made by boiling sugar, water and corn syrup, or by mixing molasses and Tanglefoot and spreading on heavy paper or cardboard.

Fly predators are the preying mantis and toads.

Herbs sweet basil and tansy are said to repel flies. Plant them near doorways, near patios or picnic areas, or grow sweet basil in containers in the kitchen.

Larder Beetles The larder beetle is a type of carpet beetle, but can be distinguished from other carpet beetles by a wide olive to brown band across the middle of its black body. There are six black spots within the brown band. The adult beetles can live indoors for up to one year. Eventually they will mate and lay eggs after they have fed on a protein rich food. The eggs are laid directly on the food source. At room

temperature the hairy, worm-like larvae will emerge and feed on that food for about two months before leaving the food in search of a crack or other sheltered place to pupate.

Larder beetles require animal matter to develop to maturity. The most common source of infestation in the midwest is dried dog food. Although mostly cereal, it has enough meat, bone meal and animal fat to allow development of the larder beetle. Other sources are hams, bacon, cheese and home cured meats. After eliminating all infested foods, follow the cleaning instructions given under flour and grain beetles. Remember, the larvae leave the food to pupate and may be hiding in any crack or crevice near the infested area. Thorough cleanup is very important.

Larder beetle infestations will often follow rodent infestations, especially where poison baits rather than traps were used to control the rodents. Poisoned rodents are often trapped in wall voids where they die and become an excellent source of protein for larder beetles. Such sources of carrion, including dead insects, may need to be removed before satisfactory larder beetle control can be achieved.

Meal Moths An infestation of meal moths should be suspected when the small adults, with about a 1/2" wingspan, are seen flying to lights in the kitchen or pantry. It is the larvae, or caterpillar stage of meal moths that infest stored products such as cornmeal and other ground grains, dried fruit, nuts, chocolate, dog food, bird seed, spices and a variety of other stored products, especially those high in protein. The larvae are usually found within webbing over the surface of the food they are infesting. In full packages, such as flour, the webbing may not be visible itself, but it will hold the flour in small clumps, giving it the appearance of flour with a small amount of shortening cut in until it reached the slightly crumbly stage.

As with the grain and flour beetles, disposal of infested foods, vacuuming and finally scrubbing with a strong cleaner are the primary steps for the control of meal moths. However control is often a little more difficult because the larvae often migrate away form the food source and seek a small crack or corner in which to spin a small silken cocoon to pupate. Use a soft scrub brush to reach into cracks at the back of shelves and underneath cupboards. It is usually necessary to thoroughly clean an area much larger than just the cupboard in which infested food was found.

Pheromone traps are now available to detect and help control meal moth populations. These traps use a sex attractant to lure the male moths to a sticky trap, and will trap males of both the Indian and Mediterranean meal moths as well as the almond moth, rasin moth and the tobacco moth. They are typically sold in kits with enough materials for six weeks of trapping. Because of the difficulty in finding and controlling the pupae of these moths, 6 to 12 weeks of monitoring with a pheromone trap is recommended to trap any emerging adults before they can reinfest food supplies. Establishments such as health food stores, bakeries and food warehouses would be well advised to utilize pheromone monitoring traps as an early warning system for developing infestations. Pheromone attractants can also be used in specially designed grain probes that can be inserted in bulk storage containers and checked regularly for early signs of moth infestation.

Silverfish Silverfish are able to feed on the starch of wall paper paste or book bindings in high humidity situations. Measures to increase ventillation and reduce humidity

in bathrooms or basements are important. Replace old, peeling wallpaper. Store books in a dry location. Sprinkle a mixture of boric acid and flour or powdered sugar in infested areas. The boric acid that is premixed with an anticaking agent will give longer term control in damp areas.

Silverfish traps can be made by placing strips of masking tape on the outside of glass jars, from the rim to the base, to create a surface rough enough for the silverfish to climb. A bait of wheat flour, sugar and chipped beef inside the jar will attract them, but once inside the jar they will be unable to climb out. Place the traps in areas where silverfish are found. Clean and re-bait them each day.

Sowbugs, Millipedes and Centipedes These arthropods are often found in gardens and foundation plantings where the soil is constantly moist and rich in organic matter. They hide under ornamental wood chips, bark mulches, compost heaps, under stones and under the loose bark in firewood stacks. They often enter basements and garages from these areas. Sowbugs and millipedes feed on both living and dead plant material. Sowbugs prefer tender roots and stems of living plants; millipedes prefer decaying plant materials. Centipedes are efficient predators. feeding on house flies, clothes moths and small cockroaches and should not be killed unless they become numerous.

All foundations and foundation sills should be tightly caulked to prevent entry of these arthropods. Keep manure, compost, wood chips, etc. away from buildings. Plant shrubs and flowers far enough away from the foundation to permit good air circulation along the house.

Sowbugs and millipedes can be trapped near wood piles, foundations, etc. Punch 1/8 inch holes in the sides and bottom of empty cans. Fill the cans with potato and/or carrot peelings and sink them so their rim is about even with the soil surface. Empty them every 3 to 4 days.

Sprinkle lime or diatomaceous earth in a 4 to 6 inch wide band arounds foundations, under outdoor wood piles and around landscape plantings before applying mulches.

Spiders For the most part spiders are beneficial to man because they are exclusively predaceous, feeding on a variety of live prey including insects, centipedes and even other spiders.

The danger of spider bites is greatly exaggerated. Most spiders are not dangerous to man under normal conditions and only a few species are of public health significance. Spiders are not aggressive and most will not bite unless provoked. Even then, only the larger species are capable of piercing human skin with their fangs.

The first consideration in spider control is to determine whether or not the spiders are living indoors. If large numbers of spiders are seen indoors they could be more than a nuisance problem. The cobweb spiders and the yellow house spiders are capable of living indoors. They are usually small, uniformly colored (pale yellow, grey or tan) and are not hairy. Those spiders which are casual invaders, but which would normally live outdoors, are usually large (1/2" or longer), hairy, distinctly patterned and/or brightly colored and usually jump or run quickly.

General sanitation, both indoors and outdoors is very important in spider control. Clean up all woodpiles, rocks, trash, compost piles, old boards and other debris. All garages, cellars and crawl spaces must be kept clean and uncluttered. Control of excess moisture is also helpful. Plant trees and shrubs far enough away from buildings to allow sunlight and wind to penetrate.

Weevils Weevils are among the easiest of the kitchen pests to eliminate because they infest a limited variety of products. Two true weevils, looking like little beetles with long snouts, infest only whole grain products such as rice, corn, wheat, dried beans and other legumes. A third insect, the bean weevil, is not a true weevil and does not have a protruding snout. It infests only legumes, leaving perfectly round holes in dried beans. When any of these pests are detected a cleanup of the area and disposal of infested products is usually all that is required to eliminate them. Where these pests have been a common problem, especially in home grown and stored grains or dried legumes, a number of good protective methods are available.

Very often, beans are harvested from the garden which look perfectly good, but there can already be bean weevil larvae inside. These will continue to develop in storage and adults will begin to emerge over the winter. Heating the beans to 175 degrees F. for 1/2 hour before storage will kill any eggs or larvae present.

Certain vegetable oils, including cottonseed, soybean, maize and peanut oils will surpress the development of weevils in whole grains. Use between 5 and 10 mg. of oil per kilogram of stored grain, thoroughly mixing to coat the grain very lightly.

Another useful technique for the home storage of any type of whole seed, grain, herbal tea or dried herbs, nuts, etc. involves the use of carbon dioxide to kill stored product pests. Place a 1/2 inch layer of the product to be stored in the bottom of a clean glass storage jar. Wearing gloves, place one cubic inch of dry ice (solid carbon dioxide) per quart of volume on top of the bottom layer, then quickly fill the jar with the remaining product. Tighten the lid, then loosen it 1/2 turn to allow the carbon dioxide to escape slowly. After several hours, tighten the lid all the way and the product will be safely stored. Always wear gloves when handling dry ice. If the dry ice is allowed to touch the sides or bottom of the jar the glass is likely to crack.

7-12 CONTROL ALTERNATIVES FOR OUTDOOR PESTS

Biting Midges The midges are a group of tiny, biting insects that are also called punkies, sand flies and no-see-ums. They are active in the early morning and evening. Their bites cause an intense burning and irritation. The adults are weak fliers and become serious pests near their breeding sites, which include standing water and wet, decaying organic matter. Efforts to eliminate any standing water, discussed with mosquito control below, are appropriate. In addition, it is important to clean up wet organic matter, especially in the early spring. Leaves and other organic materials that mat down, especially alongside buildings or in shaded areas are prime breeding sites.

Efforts to increase sunlight penetration and air circulation outdoors will help significantly. Thin dense vegetation; keep grasses mowed. Plant shrubs far enough away from fences or buildings to allow good air ciruclation around them and to facilitate raking of accumulated organic debris. Midges are weak fliers so even a light breeze will inhibit them. Midges are attracted to lights and enter homes through screens. Prevent their entrance by using tight fitting, fine mesh screens. Most insect repellents do not prevent these insects from biting.

Black Flies, Horseflies and Deerflies Black flies, also called buffalo gnats, are small black or gray flies. They are capable of flying several miles from their breeding sites in streams and rivers. Horseflies and deerflies are very strong fliers and are most abundant in swampy, forested areas begining in late May. Elimination of the breeding habvitat around homesites and cabins my be of some help, but because they are strong fliers, there are areas where such efforts will be of little value in the control of horsefleis and deerflies.

The bacterial insecticide *Bacillus Thuringiensis* var. *Israelensis,* currently sold as Bactimos, Teknar and B.M.C. offers promise in the control of black fly larvae. It must be applied to streams when the insect is in the larval stage, not the pupal stage, so timing is difficult and critical. Furthermore, the concentration of bacteria is diluted rapidly in a flowing stream, so the product must be applied upstream of the infestation and with accurate knowledge of the flow of the stream in order to determine the correct application rate.

Insect repellent applied to exposed skin, combined with wearing long sleeved clothing is probably the most effective protection from biting flies. Many of the commercial insect repellents dissolve plastic and my damage plastic glass frames, watch crystals and some synthetic fabrics.

Mosquitoes Because the adults of some mosquitoes will fly a mile or more to obtain a blood mean (needed to complete the reproductive cycle of the femaile), a formally organized community mosquito control program is undoubtedly the most effective way to manage these pests. In the absence of such a program, there are many things an individual can do to reduce the mosquito population to a tolerable level.

All mosquitoes require water for the development of immature stages. Eggs of early season mosquitoes are deposited on the ground in low-lying wooded areas throughout the summer and hatch early in the spring when these areas are flooded by melting snow and spring rain. There is only one generation per year. Eggs of floodwater mosquitoes are deposited on the ground in low-lying, sunny areas subject to periodic flooding. These mosquitoes may have several generations each year, depending on the available moisture. Their numbers can continue to build until the first killing frost in the fall.

The elimination of breeding habitat is the most important management tool that individuals can use to control a mosquito problem. Eliminate all trash items in the yard that hold water. Items such as plastic wading pools, birdbaths, etc. should be emptied and scrubbed at least once a week. Water containers for pets and domestic stock should be emptied and cleaned daily.

Low areas of the yard should be filled or graded to prevent ponding or puddling. Rain gutters should be kept clean. Hollows of old trees or stumps should be filled with sand or concrete. Thin out or mow dense vegetation, especially in low and/or shaded areas where the vegetation remains wet for long periods. Any efforts to improve sunlight penetration and air circulation will help, since some mosquito larvae can complete their development on wet vegetation.

There are now three types of products that can safely be used for mosquito larvae control in areas with standing water - growth regulators, bacterial agents and surface films. The insect growth regulator methoprene is sold as Altocid SR-10 for mosquito control. This product does not kill the mosquito larvae. It disrupts their normal development to the biting, egg laying, adult stage. It is effective only when applied to the mosquito larvae, not the pupae or adults.

The bacterial agent *Bacillus thuringiensis* var. *israeliensis* is sold under several trade names including Vectobac, Bactimos, Teknar and B.M.C. This material is also effective only against feeding larvae, not larvae which have ceased to feed prior to pupation, pupae or adults, so the timing of applications is very important. Both the growth regulator and the bacterial insecticides are most effective if applications are started early in the spring, before a diverse, breeding population of adults has developed.

Mosquito larvae and pupae breathe through tiny tubes at the surface of the water. Materials which form a very thin film over the surface of standing water can suffocate these larvae. Years ago people used to pour oil on standing water, devastating as this was to other forms of wildlife. Today certain surfactants or monomolecular surface films are available which will kill larvae, pupae, emerging adults, resting males and even the egg rafts of certain species, yet will not harm birds, frogs, and other aquatic or wetland species. Films such as Arosurf, (produced by Sherex Chemical Co.) are only effective when the surface of the water is not disrupted by wind, waves or boats. Field tests have shown that combined use of a surface film plus a bacterial insecticide give much better control than either type product alone.

Most literature on mosquito control recommends directing efforts at the adults in the area at any one time, since larval control in a small area will not impact the number of adults flying in from other breeding sites. Such efforts usually involve the use of malathion, pyrethrum or allethrin, applied to dense vegetation, protected areas where vegetation is close to buildings and other adult resting places. If the decision is made

to use a chemical insecticide for adult control, application with a mister or thermal fogger will enable much better distribution of a small amount of chemical and better penetration of dense vegetation than a conventional pressurized or hose-end type of sprayer. Mists or fogs should be applied in the very early morning or at dusk when an atmospheric inversion will help the mist remain near the ground. Their effectiveness is greatly reduced if applied during the hot part of the day. Do not attempt to mist or fog if the wind speed is over 3 to 5 miles per hour. In attempting to control those species of flood water mosquitoes with several generations per year, it is important to target the early generations of biting, egg laying adults.

Wasps (Yellowjackets) Only about five of the twenty plus species of yellowjackets, *Vespula vulgaris,* are significant pests of urban areas. These generally become pests in the late summer when they change their feeding patterns and begin to seek sugars instead of the protein they have scavenged all summer. General sanitation is important in keeping them out of areas of the yard where they might interfere with activities. Keep garbage cans washed out, and use tight fitting lids at all times. They are attracted to the sugars of ripe fruit and vegetables, so daily clean up of dropped, damaged or overripe fruit and vegetables is important in home gardens. Food should be kept indoors and tightly covered until it is time to eat, and picnic tables washed off after each meal. Avoid the use of hair sprays or sweet smelling perfumes or cosmetics when attending outdoor events or just working outdoors in the late summer and early fall.

Some species of wasps tend to build their nests around urban structures, such as under garage eaves, in wall voids of uninsulated buildings, etc. Others build their nests underground. If their nests can be detected early in the season, before the wasps become a nusiance, and before their population builds significantly, then this is the time to begin trapping methods near the nest or to take direct action against the nest.

If the decision is made to approach the nest, do so on a cool evening when the workers have returned to the nest and are relatively inactive. Wear protective clothing. For ground nests, a simple approach is to quickly dump one to two gallons of boiling water into the hole. Nests located in wall voids should be targeted with a dust formulation of a pyrethrin or borax with an anti-caking agent. Use a duster to force distribution of the dust all around the nest so workers will pick it up and carry it in to the larvae.

Another strategy involves the use of a bait mixed with the insect growth regulator methoprene. This must be presented early in the season while the workers are still seeking protein and before the larvae pupate. Methoprene baits will be carried back to the nest and fed to the larvae, inhibiting their further development. Two very attractive carriers for the methoprene are canned dogfood or boiled, chopped ham. The difficulties are that the baits tend to dry out quickly and must be changed frequently and that they tend to attract other insects such as flies. Various types of inverted funnel or other "one-way" traps can also be baited with a protein source, but the same two problems still exist. Traps must be emptied and cleaned at least every other day.

Commercially produced wasp traps are now available for late season control. These traps use a sweet, floral type lure, and should be placed in a sunny location several yards away from outdoor activity areas. Homemade traps using a sweet substance such as watermelon juice, honey, etc. are also worth trying. A simple trap can be made by placing the bait in the bottom of a 1 qt. or larger jar and taping a funnel into the mouth of the jar. Another form of trap can be constructed from a piece of cardboard

5 to 8 inches wide and 18 to 24 inches long. Bend it to form a triangular tent, staple the top to secure its shape and coat the inside with Tanglefoot or other sticky substance. A cotton ball soaked in a sweet substance and stuck to the inside of the trap will serve as the lure. Use a twist tie or wire to hang the trap. Research has shown that different species of wasps will respond differently to various traps and baits. Don't be discouraged if one doesn't work. Try something else.

Remember that most of the workers will be killed by the first killing frost and only those fertilized females which will be next year's queens will overwinter. They spend the winter hiding under bark, in small cracks and various outdoor hiding places. They will not return to the old nest.

Compiled by Roberta Lawrence of the Washtenaw County Cooperative Extension Service for the Ecology Center of Ann Arbor, *Michigan Household Hazardous Substances Handbook,* 1986.

Asking The Right Questions About Pesticides

The following are questions you may want to ask, should you decide to contract for landscape maintenance services.

1. Do you offer services without spraying insecticides or herbicides (i.e., a flexible program)?

2. What specific chemicals (chemical names of the insecticides, herbicides, or fertilizers) will be used on my property?

3. What potential toxicities are associated with these products?

4. On what basis do you decide what to spray and when to spray it?

5. What specific pests are you spraying for and when are you spraying for them?

6. Will I be told exactly when my lawn or trees will be sprayed?

7. What guidelines do you use about wind conditions?

8. Do I have options for what chemical is used? Are there differences in terms of toxicity, odor, length of time to stay off the lawn?

Questions to ask if you decide to spray:

1. What precautions should be taken to limit exposure?

2. How long should pets, children stay off the lawn?

3. How long should I wait before watering the lawn?

4. How long will it take for the chemicals to break down into non-toxic components?

If you don't get the information you want:

If a contracted pesticide applicator refuses to answer these questions or to provide you with all the specific information you request, seriously consider using another company. To learn what information an applicator must supply you with, call the Michigan Department of Agriculture at **(517) 373-1087**.

Milford Michigan Requires Notification Of Lawn Spraying

Milford's council is threatening to step on some toes in the state department of agriculture, and perhaps even wound a few bureaucratic egos, all for the sake of a new ordinance aimed at protecting the health of some pesticide-sensitive village residents. And the department of agriculture isn't about to put up with it.

The village council, fortunately, recently told the department of agriculture to bug off.

The issue has arisen out of a concern expressed over a year ago by several village residents who complained that bug spraying near their homes caused them respiratory problems.

After a year of consideration, the council adopted an ordinance for this summer which would require commerical pesticide applicators to notify village residents of their intent to spray ahead of time.

That brought a reaction from the state department of agriculture's director, Paul Kindinger, who contended in a letter to the village council that it would have to repeal its new ordinance because the department of agriculture has sole responsibility and authority to regulate pesticides.

Never mind that Milford's ordinance in no way restricts the use of any kind of pesticide, nor does it seek to control the method of its application. Never mind that Milford's only requirement on commercial pesticide firms would be registration with village hall, so that when there is to be spraying, those on a pre-compiled list of pesticide-sensitive residents could be notified.

And never mind that, according to one state-level environmental activist, the state has done nothing to enforce its 10-year-old pesticide control act or that there is nothing in state law to conflict with Milford's notification procedure.

Milford Village council, in considering the department of agriculture's objections last week, voted unanimously to reject a resolution which would even temporarily set the rule aside.

The question now becomes whether the department of agriculture will carry the argument any further; whether it will seek some form of court action to get Milford Village to back off from its ordinance. If it does, we'd recommend the village council stand tough.

Milford's ordinance counts as a model for possible similar regulation in other communities. The ordinance has won praise from environmentalists, both locally and across the state, as a well-drafted and highly workable initiative. The ordinance has also won praise from state-level lawmakers.

But more important, the ordinance is a reasonable law born of a legitmate concern for the health and well-being of local residents.

One has to wonder where the department of agriculture's priorities are.

A copy of the ordinance is available by calling the East Michigan Environmental Action Council. See directory.

Treat Pressure Treated Wood With Caution

Pressure treated wood products are often the material of choice for decks, fences, outdoor furniture and playground equipment, as well as for a wide variety of farm, industrial and commercial uses. This wood is desirable because it is attractive and resists insect attacks and decay. Unfortunately, consumers have not been informed that the preservatives used to treat the wood -- usually arsenic compounds, creosote or pentachlorophenol (penta) -- have been shown to cause cancer in laboratory animals.

More than a year ago, the Environmental Protection Agency (EPA) concluded a six-year study and imposed restrictions designed to protect workers who are certified to use these pesticides. The agency also planned to begin a "consumer awareness program" to instruct consumers about handling procedures, such as the use of protective coveralls and face masks when sawing treated wood products. To date, however, this consumer education program has not been put into effect. Consumers should know that these products cause chronic effects and that they should not apply wood preservatives themselves without taking precautions.

In July of 1984, an EPA press release stated that when used without restrictions, the risk to public health would outweigh the pesticides' benefits. The agency based this determination on evidence showing that:

1) Creosote causes cancer in laboratory animals and has been associated with skin cancer in some workers occupationally exposed to it;
2) A dioxin contaminant (HxCDD) in pentachlorophenol has been shown to cause cancer in laboratory animals, and
3) Arsenic has been shown in epidemiology studies to be associated with cancer in humans who either drank water contaminated with arsenic or breathed air containing arsenic.

In addition, EPA said that pentachlorophenol and inorganic arsenicals cause defects to the offspring of laboratory animals and that creosote and inorganic arsenicals also cause mutagenic effects (gene defects) in bacteria and laboratory animals.

Based on these findings, consumers should be warned to:

* Not use wood treated with these chemicals where it can come into contact with food;
* Wear a face mask when sawing such wood;
* Avoid skin contact by wearing tightly-woven coveralls and gloves made of impervious materials;
* Wash the above garments separately;
* Wash any exposed skin thoroughly after handling the wood, and
* Refrain from burning treated wood in open fires or fireplaces because toxic chemicals may be released.

For further information, write to CPSN for a complete copy of the EPA press release.

Consumer Federation of America • 1424 16th Street, N.W., Suite 604 • Washington, D.C. 20036 • (202) 387-6121

7-5 Right to Know

Another important issue in building awareness of toxic and hazardous substances in the community is access to information on hazardous substances. Often, workers are not told or are denied access to information about the substances they use in the workplace. Residents in the community are usually not told about what substances are discharged from or stored in neighboring factories or transported over city streets. Without this information, workers and their neighbors can be unknowingly exposed to highly toxic substances. Workers can be exposed to toxic fumes, dusts and liquids. Worker's families can be exposed to materials brought home on the clothing of the worker. Neighbors can be exposed to substances when they are spilled onto the soil or discharged into the air or water.

The consequences of exposure to these substances can range from reduced productivity due to chronic illness to serious disease to genetic damage to death. Because disease caused by exposure to hazardous substances is often thought to be linked to long-term, low-level exposures, it is especially difficult to link causes with effects. Physicians are often unable to definitively diagnose the cause of the diseases by the symptoms alone, which makes preventative measures almost impossible. These difficulties are aggravated when information about exposures and potential exposures are not available.

In response to this significant and complicated health issue, unions, health professionals and environmental groups have been working for several years to attain a legally-affirmed "Right to Know". Legislation protecting and facilitating the workers' and communities' right to know about hazardous substance exposure has been enacted in many states and municipalities around the country, including Macomb and Washtenaw counties in Michigan. These laws usually include provisions for labelling hazardous substances with accurate, scientific names (rather than trade names), safety precautions and health effect information; requiring education and training of workers in safe handling and emergency response; and recordkeeping of exposure information.

In 1984, an OSHA regulation was promulgated to address some worker right to know concerns. Affected businesses are required to develop and implement information and training programs by May 25, 1986. Labelling as required in the law must be in place by November 25, 1985. Businesses are supportive of the OSHA regulation and opposed to the state and local laws because they say the regulation includes stronger protection of trade secrets, covers a smaller number of workers and is consistent for all states. Proponents of broader right to know legislation are critical because they say only 25% of the workforce is covered, trade/marketing secrets are being protected at the expense of

worker health, and no provisions are available for informing community members since OSHA only regulates the workplace. The OSHA regulation and some of the state and local right to know laws are currently facing challenges in the courts.

For more information, contact the National Campaign Against Toxic Hazards, the OSHA/Environmental Network, OSHA or the Michigan Right to Know Coalition. (See the Directory section.)

Right-To-Know Laws In Michigan

April 1987

I. EMPLOYEE RIGHT-TO-KNOW

MIOSHA Amendments Act 80 of 1986 (H.B. 4111);
OSHA Hazard Communication Standard, 29 CFR 1910.20

The Michigan Employee Right-To-Know (RTK) Law includes the adoption of the Federal OSHA Hazard Communication Standard. It is enforceable through MIOSHA. The Michigan law adds several requirements that go beyond the federal standard. The law will be enforced by both the Michigan Department of Labor and the Department of Public Health.

Scope Of Coverage

(MIOSHA-14a)

The employee RTK law applies to any employer that stores, uses, or produces hazardous chemicals within the state. While the federal OSHA standard applies only to manufacturers, the Michigan law expanded the RTK regulations to non-manufacturers and the public sector.

Compliance Dates: All employers were to be in compliance by Febrary 25, 1987.

Exemptions: The Michigan RTK law does not apply to: chemicals in sealed packages and in transit by a "common carrier," as long as the seal remains intact (MIOSHA-14g); and chemicals in use by agricultural operations which are regulated under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) or the Michigan Pesticide Control Act (Act 171 of 1976) (MIOSHA-14f).

What Chemicals Are Covered Under The Law?

(OSHA Sec. d, MIOSHA 14a[1])

The RTK law covers hazardous chemicals from four different lists. Chemical suppliers will also have to evaluate all other chemicals and provide hazard information on any chemical for which there is at least one human or animal study which indicates a health hazard.

Written Hazard Communication Program

(OSHA Sec. e)

Each employer must prepare and implement a written plan which explains how that employer will meet the requirements of the new law regarding labels, MSDS's, and training. In addition, the written plan must contain the following:

1. A list of hazardous chemicals which are known to be present in the workplace;

2. The methods the employer will use to inform workers about the hazards of non-routine tasks and the hazards of chemicals in unlabelled pipes;

3. The methods the employer will use for sharing hazard information with on-site contractors.

The written plan must be made available upon request to workers and union representatives.

Labels And Other Forms Of Warning
(OSHA Sec. f; MIOSHA-14c)

Each container (bags, barrels, boxes, cans, cylinders, drums, tank trucks, and other vessels) of hazardous chemicals must carry a label. All new containers will have to carry a label, as well as containers currently in stock.

The label will provide three different types of information. First, it will have the IDENTITY of the product, which may be the chemical name, brand name, trade name, code name, or code number. The same identity used on the label must also be used on the MSDS to permit cross-referencing. Second, the label must carry an APPROPRIATE HAZARD WARNING. This includes information on:

- Health effects, including short-term and long-term illnesses and effects on specific organs of the body;
- Physical hazards, such as fires and explosions and how to avoid harm;
- First aid procedures.

Some labels communicate hazard information by means of a numerical rating system. These systems are acceptable only when additional health effect warnings are added to the label. Third, the label must carry the NAME AND ADDRESS OF THE SUPPLIER. Contact the Michigan Department of Public Health regarding these labelling exemptions.

Material Safety Data Sheets
(OSHA-Sec. g; MIOSHA-14j-1)

The MSDS is the second way in which hazard information will be provided. An MSDS must be provided for each hazardous substance in the workplace. Non-manufacturers must acquire the MSDS from the chemical suppliers (as required by the OSHA standard). However, when mixing hazardous chemicals, they must provide an MSDS for each hazardous ingredient and maintain a system that identifies the appropriate MSDS for each component of a mixture.

A complete MSDS will include the following information:

- Identity of the hazardous chemical ingredients
- Chemical characteristics (flash point, boiling point)
- Physical hazards, such as fires and explosions
- Health effects, including signs of exposure, acute and chronic effects, and primary routes of entry
- Exposure limits
- Ingredients which are known or suspected of causing cancer
- Precautions for safe handling
- Measures to control exposures, such as ventilation and personal protective equipment
- Emergency and first aid procedures
- Name, address, and phone number of the supplier

No blank spaces are permitted on an MSDS; however, the chemical supplier may indicate that information is unknown or not applicable.

To ensure that employees have access to the MSDS's, the employer must comply with the following requirements:

1. The MSDS's must be readily accessible.

2. The MSDS's must be organized in a systematic and consistent manner, and employers must train workers in how to find a particular MSDS. (MIOSHA-14k[1])

3. The MSDS's must be organized in a systematic and consistent manner, and employers must train workers in how to find a particular MSDS. (MIOSHA-14k[1])

4. Employers must post signs throughout the workplace advising workers about their rights in regard to hazardous chemicals in the workplace. (MIOSHA-14j)

Failure to provide the most recent MSDS to a worker is considered either a "serious" or "non-serious" violation of the law. (MIOSHA-14i) In other words, penalties will be more severe.

Employee Information And Training
(OSHA Sec. h, MIOSHA-14a)

Employers must provide training to all exposed and potentially exposed employees. Additional training will be necessary when: 1) a new employee is hired, 2) an employee is

given a new assignment where new hazards exist, or 3) a new hazard is brought onto the job site.

Regardless, training must be completed before employees are assigned to handle hazardous chemicals. For specific information on training, call the Michigan Department of Public Health at 517-335-8250. Giving a worker an MSDS to read does not meet the training requirements of the law.

Red Tagging Of Unknown Chemicals

(MIOSHA Sec. 5[3]; Sec. 31)

A container of an unknown and unlabelled chemical or a container of hazardous chemicals which is not labelled or for which an MSDS is not available must be considered an imminent danger. In order to refuse to handle such a container an employee will have to file an imminent danger complaint with the Michigan Department of Labor or Public Health.

Trade Secrets

(OSHA-Sec. i; MIOSHA-14b and 14d)

A chemical supplier may claim a trade secret for chemical ingredients of a particular product, but there are several restrictions, including the following.

1. If the hazardous ingredients can be easily discovered by chemical analysis, they cannot be claimed as trade secrets.

2. Moreover ical emergencies, the chemical supplier must provide specific chemical names t ing physician or nurse.

3. In non-emergencies, chemical manufacturers and suppliers must disclose hazardous ingredients claimed as trade secrets to health professionals, occupational health nurses, exposed employees and union representatives of exposed employees.

II. SUPERFUND/EMERGENCY PLANNING AND COMMUNITY RIGHT-TO-KNOW

Superfund Amendments (SARA), Title III (Sec. 300), 1986

Although Superfund's RTK provisions are quite comprehensive, the new federal legislation primarily adds to the state RTK requirements in two ways.

1. It establishes a range of new authorities and responsibilities of state and local governments in emergency planning.

2. It requires mandatory reporting of chemical information by facility owners to local emergency response committees and local fire departments.

Superfund also creates enforcement mechanisms such as the right of fire departments to conduct on-site inspections (to verify information) and the right of any citizen (or state or local government) to bring suit against a facility owner or government agency that fails to meet its responsibilities.

Enforcement
(MIOSHA Sec. 14a)

The most effective enforcement of the RTK law will occur in those workplaces where unions and their members are familiar with the requirements of the law and are aggressive in demanding employer compliance. The union must educate the membership about the importance of protecting people from hazardous chemicals.

Any worker, union or citizen can file a complaint with MIOSHA when violations of the law occur. However, individual non-union workers are more vulnerable to reprisal by their employer. In general, the employer should be approached first with a request for compliance. Contact the Michigan Department of Labor or the Michigan Department of Public Health (MDPH) to file a complaint. The addresses and phone numbers are listed below:

RTK Enforcement

Michigan Department of Labor
Bureau of Safety and Regulation
P.O. Box 30015
Lansing, MI 48909

Director	(517)322-1814
Gen. Industry	322-1831
Construction	322-1856
Standards	322-1845
Consultations	322-1809
Appeals	322-1297
Detroit Office	(313)256-3620
Discrimination	256-3620

Michigan Department of Public Health
Division of Occupational Health
P.O. Box 30035
Lansing, MI 48909

Division Chief	(517)335-8250
Education/Training	335-8250
Standards	335-8250
Consultations	335-8250
Appeals	335-8250

Although both of these departments are responsible for enforcing right-to-know provisions, complaints involving a trade secret claim or an incomplete MSDS should be directed to the Department of Public Health.

For more information regarding the Michigan RTK law, call:

Scott Tobey, MSU Labor Program Service (517)355-5070
or the
Southeast Michigan Committee on Occupational Safety and Health (SEMCOSH)
(313)961-3345

RECOMMENDATIONS OF THE TOXIC CONSUMER PRODUCTS AND INDOOR AIR QUALITY CONFERENCE , MAY 27, 1987

Compiled by the Ecology Center of Ann Arbor
Ann Arbor, Michigan

The following ideas for changing household chemical product labeling and packaging and "Consumer Right To Know" were collected from participants at the Toxic Consumer Products and Indoor Air Quality Conference May 27, 1987, sponsored by the Ecology Center of Ann Arbor with funding from the Charles Stewart Mott Foundation. Public health educators, environmental health professionals, artists, researchers and business representatives contributed to this list.

Although there was discussion on specific points there was general agreement that more informative labeling is crucial to the prevention of unnecessary exposure to hazardous household chemicals and to preventing environmentally unsound disposal.

CHRONIC TOXICITY

1. In order for consumers to obtain more information on chemical products, all containers should provide the company's name, address and phone number and indicate the availability of a Material Safety Data Sheet for the product.

2. All chemical hazard information for school products should be available to school and local community medical service providers.

3. Chronic toxicity testing should be required for all chemicals in household products. At a minimum, Ames tests should be performed for currently available and all new products. (An Ames test is a standard toxicological method for measuring the potential for certain materials to cause mutations in bacterial DNA).

INERT INGREDIENTS

4. To improve the current lack of information regarding inert ingredients, labels should provide a complete listing of active and inert ingredients, related acute and chronic toxicity warnings and precautionary statements.

SAFE USE INFORMATION

5. Specific storage instructions should be featured on all containers of hazardous household chemicals.

6. Safe use explanations should include examples such as "keep more than six feet away from heat source or open flame such as range, wood stove or furnace."

7. Directions should include specific protective equipment, ie. "wear impermeable gloves approved for use with solvents"

8. Proper use directions should be featured that may help protect the environment, such as "using more than a cup of this detergent as recommended will not improve the laundering ability of this product".

10. Labels should include color coded international symbols to assist illiterate and non-English speaking consumers. Public Service Announcements and product advertising should highlight these symbols.

11. Labels should always be brightly colored with a light backround and dark lettering.

DISPOSAL

12. Companies could help to deter the unsafe disposal of toxic pesticides by sponsoring state by state pesticide waste exchanges. A toll free number could be displayed on all containers of home use pesticides.

13. Hazardous household products like oven cleaners and herbicides should only be available in single use packages.

14. Labels should carry safe use information and warnings regarding the pesticidal quality of pesticide container rinse water.

15. Directions on how to recycle, evaporate or solidify paint products should be featured prominently on the container to reduce improper disposal of paint products in landfills and city streets.

16. The message "Buy only what you need" should be carried on all household "project" products such as paint stripper and pesticides.

17. All containers of household chemicals should carry as standard information: "improper disposal may damage the environment, consult your local health agency for further information."

Michigan Household Hazardous Substances Handbook User Response form

Please rank the usefulness of the handbook chapters:

		Very useful		Good		Not useful
1.	Binder format	1	2	3	4	5
2.	How to use the handbook	1	2	3	4	5
3.	Overview	1	2	3	4	5
4.	Routes of disposal	1	2	3	4	5
5.	Toxicity & Alternatives	1	2	3	4	5
6.	Product disposal	1	2	3	4	5
7.	Directory	1	2	3	4	5
8.	Bibliography	1	2	3	4	5
9.	Appendices	1	2	3	4	5

10. Specific comments on handbook:

11. Have you used any handouts or forms from the handbook? Please specify.

12. Has your community developed disposal recommendations that are different from those listed in the handbook? Please advise us.

13. Are there hazardous household substances you would like to see included in future revisions?

14. The authors of this handbook feel that encouraging people to use less toxic substances is the best long-term solution to household hazardous wastes. Do you have any comments on this strategy?

Please send us any material you have developed on household hazardous substances. We will keep these on file for others to use.

Thank you very much, The authors.

place
stamp
here

Ecology Center of Ann Arbor
417 Detroit St.
Ann Arbor, MI 48104

Household Hazardous Substances
Handbook User Response Form

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