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ABSTRACT

This teaching guide provides an interactive introduction to hazardous waste, with particular emphasis on personal responsibility and action. Nine lessons engage advanced grade 10 and grade 11-12 science students in group discussions and actions that help them develop awareness of hazardous waste, understanding of the hazardous waste situation in Ontario, Canada, and opportunities for taking personal action. Students are encouraged to develop skills in classifying, recording information, and classroom discussion. Lessons contain goals, activities, and suggested teaching strategies. Students conduct surveys, research projects, presentations, games, and action plans. A resource section contains reproducible worksheets, survey forms, and fact sheets. Two appendices provide annotated references for 54 books, and 49 audio-visual aids. The teaching guide is accompanied by a guide to hazardous waste terminology, and a booklet and "Enviro-Dial" that suggest alternatives to the use of common household hazardous wastes. (LZ)

HAZARDOUS WASTE AND YOU

A Teacher's Guide

Ontario Waste Management Corporation
Société Ontarienne de Gestion des Déchets

PREFACE:

The Ontario Waste Management Corporation (OWMC) is a provincial Crown agency created in 1981 to design, develop and manage a liquid industrial and hazardous waste management system for the province. To fulfil its mandate, the Corporation is proposing to build and operate a modern industrial waste treatment and disposal facility in the Township of West Lincoln in the Regional Municipality of Niagara. Public hearings to examine OWMC's site selection process and environmental assessment of the proposed site are currently being held before a Joint Board under the Consolidated Hearings Act.

OWMC does not regulate any aspect of industrial waste management practices. The Ontario Ministry of Transportation is responsible for monitoring the transportation of industrial wastes, while the enforcement of treatment and disposal standards is the responsibility of the Ministry of the Environment.

This Teachers' Guide has been prepared by OWMC to fulfil a need for educational materials on hazardous waste management and the impact of hazardous wastes on the natural environment in the Province of Ontario.

The guide is designed to lead teachers and students through a series of steps which will help make them aware of hazardous waste and related issues, provide them with a basic understanding of the hazardous waste situation in Ontario, develop in them some sense of responsibility for their contribution to hazardous waste, and provide opportunities for taking personal action based on what they've learned. They will discover that you can't throw something "away" any more. There is no such place.

Although OWMC has attempted to ensure the accuracy of the information provided, the Corporation does not assume any liabilities with respect to the use of, or damages resulting from the use of any information, apparatus, method or process described in this document.

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HAZARDOUS WASTES AND YOU

TEACHER'S GUIDE

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INTRODUCTION

SCOPE:

This lesson material is an interactive introduction to hazardous waste, with particular emphasis on personal responsibility and action. It does not deal in depth with the problems and management of industrial wastes in Ontario. Nor does it provide you, the teacher, with an extensive background in those areas. The material does provide you with an opportunity to learn along with your students. You may provide some guidance and control, but not necessarily "the answers". Students should be made aware of this.

This lesson material is recommended for: Grade 10 Advanced Science, Optional Unit 2, Waste Management

The structure of this lesson material meets the following objectives selected from the Grade 10 Advanced Level Science Curriculum Guidelines (1987):

Attitudes

Students will be encouraged to develop:

a) a concern about the influence of our lifestyle on the quality of the environment;

b) a respect for the effort and expense required to maintain a clean environment;

c) a commitment to the reduction of hazardous wastes.

Skills

Students will have an opportunity to develop skills in:

a) classifying household hazardous wastes;

b) classifying products according to their packaging;

c) recording information obtained in a survey;

d) taking part in classroom discussions

Knowledge

Students will be expected to:

a) name some common household hazardous wastes and describe their effects on the environment;

b) outline methods of disposal for household hazardous wastes.

c) describe methods of reducing household hazardous wastes.

d) name some common industrial hazardous wastes and describe how they enter the environment and their effects on the environment.

INTRODUCTION

e) outline methods of managing and reducing industrial wastes;

f) list the benefits of proper waste management.

This lesson material can also be taught in the following lesson units with little or no modification:

Grade 10 General Science, Core Unit 3, Environmental Chemistry and Core Unit 5, the Wise Use of Resources

Grade 11 General Applied Biology, Core Unit 6, Waste Management

Grade 12 General Environmental Science, Core Unit 2, Air Quality and Waste Management

Key process elements:

The following processes are emphasized:

Identification with situations in the real world.

Focus on local practices and options.

Focus on personal responsibility and action.

Flexibility in unit length and depth.

Flexibility in matching learning and teaching styles.

Emphasis on problem finding and solving.

The key concepts to be covered include:

- Consumer responsibility for understanding the processes involved and for dealing with hazardous wastes through one or more of the following:

  1) minimizing hazards through correct use and disposal;

  2) reducing hazardous wastes through:
  — moderating use
  — researching and using non-hazardous alternatives,

  3) bearing the economic and social costs of proper reduction, reuse, recycling, recovery and disposal,

  4) understanding, as a citizen/voter, the larger issues related to industrial wastes and their regulation;

5) monitoring, and acting on if required, actual or potential problem situations involving hazardous wastes

- Key features that make hazardous wastes different from non-hazardous wastes.
- Key hazardous wastes in Ontario and the effects of their improper use and disposal.
- Proper use and disposal of hazardous materials at the consumer level.
- The 3-R strategy and its application to hazardous waste at both the producer and consumer levels, including opportunities for application.
- Ultimate disposal problems, prospects and costs.

Time frame:

To do all steps requires 6-7 hours of class time. By omitting designated sections, class time can be reduced to 3 hours. Similarly, time spent out of class is variable, depending on the options chosen and the desire of the students to dig deeper.

If time is tight, we suggest the following changes:

Step 2	Delete complete step
Step 3	Delete Activity 3.2
Step 4	Delete Activity 4.2
Step 5 & 6	Skip game activities and do 5.1.2 only (testing of alternate products)
Step 7 & 8	As outlined in guide
Step 9	Reduce sharing/discussion to 30 min.

The unit would then require approximately 3 1/2 hours of class time

RESOURCES:

This unit can be taught independent of additional resources. However, if you wish students to investigate some areas on their own, it is strongly recommended that you obtain the **Hazardous Waste Educational Resource Kit** developed by the Federation of Ontario Naturalists (FON).* Specific sections are cited at the appropriate places within this unit.

Two other useful Canadian references have been produced by The National Survival Institute, Suite 406, 1 Nicholas St., Ottawa, K1N 7B7:

Hazardous Waste Environmental Questions for Educators 1 (3), The National Survival Institute, Ottawa 1984 $10.00

Environmental Citizenship: Focus on Toxic Chemicals, The National Survival Institute, Ottawa 1988 $10.00

In addition, particularly useful text references are:

Science 10: An Introductory Study, W.A. Andrews, ed., Prentice-Hall, 1988 Chapter 25: "Hazardous and Radioactive Wastes"

Heath Science Connections 10, J.L. Candido et al, D.C. Heath Canada Ltd., 1988. Section 20.2 "The Problems of Hazardous Wastes" and Section 20.3 "Managing Hazardous Wastes"

A list of other books recommended in the Federation of Ontario Naturalists' Hazardous Waste Educational Resource Kit can be found in Appendix A. Appendix B contains the FON's recommended Audio-Visual Aids.

We wish you success with this unit and hope that you and your students not only learn from, but enjoy our joint efforts.

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CREATE AN EXPERIENCE

STEP 1

GOALS: To involve the student personally in the topic, and to answer the question, "Why study hazardous wastes in the first place?"

This exercise will relate the use and disposal of hazardous wastes to the students themselves, so that they can begin to understand that it is not an "us versus them" situation.

Activity 1.1: The unfinished letter.

Rationale: The intent of this activity is to involve each student at a feelings level. They must put themselves in the shoes of those directly affected in a significant way by uncontrolled hazardous waste, and try to feel the impact on themselves and their families. Finishing the letter will help students to express those feelings. Discussing it allows them to process the experience.

Preparation: Copy **Resource #1, The unfinished letter...** (1 copy/student).

Time: 30 minutes in class

Action:

Introduction: The letter was designed as an interactive introduction to this lesson unit. Put the letter into context *briefly* by asking for their sense of what "hazardous wastes" are, and whether anyone has had direct experience with them. Clarify, but don't dwell on their understanding (see **Resource #2, What are hazardous wastes ...**). Indicate that, while most people are vaguely aware of terms like "PCBs" or "dioxin", a much more intense awareness and concern about hazardous wastes is generated through an experience such as the one described in the letter.

The unfinished letter: Distribute copies of the letter. Ask students to read it as if it was *their* letter to a good friend, and they were rereading it just before adding the last paragraph. They may need to read it again to let the situation sink in. Emphasize that they need to put themselves *into* the circumstances as much as they can, and to focus on how they would feel as they wrote the letter. At that point, they should finish the letter, adding the things they would feel like doing if they were actually in that situation. Comments should be brief — 1 to 2 paragraphs at the most.

Group discussion: Have several students read their responses. Sample their feelings about the situation. Once feelings are aired, you could guide the discussion by asking, "Is this what you feel like doing? Is it practical? Is it possible? Could it get useful results? What could you do in such a situation? Could you do anything?"

Note. This is primarily a chance to vent feelings. Don't evaluate or criticize suggested options—students will evaluate this initial reaction themselves in Step 9. The discussion can then shift to the students' actual lives. Could this happen to them? Do they know of any other situations where dangerous or hazardous materials threatened or affected people? Use this discussion as a transition to:

Going further Here, or in conjunction with an English, history or geography class, students could read about and evaluate environmental "disasters" involving hazardous materials, eg. the St. Basile fire, the toxic gas incident in Bhopal, India, or the Exxon Valdez oil spill. What is the full range of impacts? How did the people affected respond? The people at fault? The governments? Were the media responsible in their reporting practices? Balanced? Did they help or hinder? Was there, or will there be, any long-term resolution?

Activity 1.2: Household Hazardous Materials Survey.

Rationale: The survey brings the concept of hazardous materials closer to home—in fact, into the home. Students will begin to understand that they use hazardous substances on a regular basis and may contribute to the problem themselves through poor use, storage and/or disposal.

Preparation: Have copies of the following ready for distribution:

Resource #2 What are Hazardous Wastes

Resource #3 Hazardous Substances in the Household

Resource #4 Toxicity Ratings of Household Products

Resource #5 Household Hazardous Materials Survey

Time: 10 min. intro.; 30-60 min. at home; 20 min. discussion

CREATE AN EXPERIENCE

Action:

Challenge your students: "Chances are, you have hazardous wastes in your basement or under your sink, or in your garage. We're going to find out. Are you part of the problem? Can you be part of the solution?"

The Household Hazardous Materials Survey is designed to provide most of the information necessary for its own completion. Highlight the sections which help students locate likely areas of materials concentration, likely items to check for, and the warning designations. Review the specific directions on page 1, and relate them to the column heads on the survey form. Stress that they should determine what is happening *now* with these materials, not what the labels may say should happen.

Students should bring the completed surveys with them to the next class. Resources #3, #4 and #5 can be used to fill in the remaining columns.

Group discussion

Have students compare the "management" of hazardous materials in their homes with correct use and disposal as presented in the brochure.

Have hazardous materials ever been a concern or consideration in their family?

Do they think that their families are or might be willing to change how they use, store and dispose of these materials?

The key here is the understanding and acceptance by the students that they are directly involved with hazardous wastes, and that they are probably some small part of the problem. As Pogo said in the cartoon strip of the same name, "We have met the enemy, and he is us."

ANALYZE THE EXPERIENCE

STEP 2

GOALS: To give students an opportunity to examine their actions and feelings from the "outside" to analyze what they know now.

ACTIVITY: **Group discussion**

Rationale: This discussion provides an opportunity to:

1) encourage an initial examination of each student's relationship to hazardous wastes;

2) assess their feelings of responsibility and their ability to influence the situation;

3) encourage feelings of "not knowing", and to establish what they feel they still need to find out.

Note: this discussion may flow out of the earlier Survey discussion.

Preparation: Copy Resource #6 Consumer Links to Hazardous Waste for distribution.

Time: 30 min. (or less if incorporated with Survey discussion)

Action: Summarize activities to date, and try to get an assessment of where people feel they are in relation to hazardous waste problems & issues.

One way to present this visually is to scribe a large circle on a large piece of newsprint taped to the blackboard. Ask each student to:

1) mark an x where they see themselves as *influenced* by solid waste: right smack in the middle of the problem, out near the edge but influenced some, near but still outside the influence of the problem, or far removed from it.

2) They could then place an o where they see themselves in their ability *to influence* the problem, from the centre (high degree of influence) to the edge (marginal influence) to just outside (maybe) to far away (no influence)

3) Finally, they could place themselves on a line or continuum that represents how *responsible* they feel at this time about hazardous waste

ANALYZE THE EXPERIENCE

If there appears to be a sense of powerlessness, use Resource #7 to show how individual family action can add up to a significant impact on overall waste quantities. In fact, if they are recycling, they are already reducing some of the 86,000 tonnes of hazardous household wastes generated every year in Ontario.

Transition: Ask: "Do you feel you know enough to deal with hazardous wastes in your home? With other hazardous waste situations?" Indicate that they will look next at the problems of hazardous waste across Ontario.

INTEGRATE REFLECTIONS INTO CONCEPTS

STEP 3

GOALS:

To illustrate how students can relate personally to the problems of hazardous wastes and to encourage them to see the links between their behaviour as consumers and environmental problems.

To create in them a desire to know more (which should have started in Steps 1 & 2), and to be motivated to act in some way to help alleviate the situation.

ACTIVITY 3.1: How am I involved?

Rationale: To link the students' lifestyle to the generation, use and disposal of hazardous waste.

Preparation: Copy **Resource #6 Consumer Links to Hazardous Waste,** if required, for distribution.

Time: 5 minute introduction; variable time outside class; 15 minute discussion

Action: Post the following numbers:

Total hazardous waste generated in Ontario (1989):	4 million tonnes/year
Household hazardous waste generated in Ontario is estimated at:	86,000 tonnes/year
Total amount recycled:	100 tonnes

Highlight the above disparities, and ask for possible reasons. Distribute **Resource #7 "Create hazardous waste? Who, me?"**

Challenge students to find as many items as possible with clear links to hazardous materials, and to identify those links at the bottom of the poster. **Resource #6** can be used as a quick way to accomplish this, or the exercise can be used as a research project for individuals or teams. Sources which provide this information are found in:

Hazardous Waste Educational Resource Kit, Federation of Ontario Naturalists, Toronto, Ontario. 1985. "Hazardous Substance Fact Sheets" and "Hazardous Household Products Handbook"

Profit from Pollution Prevention. Pollution Probe Foundation, Toronto, Ontario. 1982.

Environmental Citizenship: Focus on Toxic Chemicals. National Survival Institute, Ottawa, Ontario. 1988.

INTEGRATE REFLECTIONS INTO CONCEPTS

Group discussion. When the discussion is over, students should have a clearer picture of their relationship to hazardous waste. Check how they feel now about this relationship. Would they change their position on the "responsibility line" of Step 2?

Students should also look at the possibility of a closer personal connection through production and not just consumption. Are jobs in their family or community dependent on a situation that generates hazardous waste?

Note: To avoid stigmatizing a portion of the class, this issue should be raised after their own links and responsibilities as consumers are clearly established. Emphasize that most generators are responsible about their wastes, given existing constraints on disposal possibilities.

Going further: Here, or in conjunction with a consumer studies, social studies or man-in-society class, students could examine further their consumer lifestyles. What affects their decision to buy? Their friends? Their "culture"? Advertising? Are they "responsible" consumers? What does "responsible" mean?

ACTIVITY 3.2: Where do we go from here?

Rationale: To move the focus away from individual involvement and toward a greater awareness of hazardous wastes in Ontario.

Preparation: None.

Time: 15 minutes in class.

Action: Review what's been done to date. Students now understand:

- that problems exist related to hazardous wastes;
- the identity of some hazardous wastes and how they are generated, and their relationship to consumer items or services;
- their own relationship to hazardous wastes.

INTEGRATE REFLECTIONS INTO CONCEPTS

What still needs to be known in order to make informed decisions about hazardous wastes in Ontario? Have students brainstorm topic areas that still need to be covered. Such a list might include:

- individual waste types and their hazards
- how hazardous materials are managed now and in their production, use, transport and disposal.
- the general problems associated with hazardous wastes.
- how the waste issue could be addressed.
- are hazardous materials produced or disposed of locally?
- what happens to hazardous materials in the school?

Transition: Indicate that the next step will be to look at the status and management of hazardous wastes at the provincial level, with special attention given to key hazardous wastes.

DEVELOP CONCEPTS AND CONTENT

STEP 4

GOALS: To satisfy the "need to know more", created in Step 3, and to describe the situation at a general/provincial level — providing some of the questions and answers about hazardous wastes.

ACTIVITY 4.1: Hazardous waste overview

Rationale: This activity provides students with general background information on hazardous waste in a provincial context. This information helps students identify themselves as part of the problem, and will help them make action decisions during later steps.

Preparation: Copy if required:

Resource #2	**What are Hazardous Wastes**
Resource #8	**Ontario's hazardous waste facts**
Resource #9	**Hazardous Waste and the 3Rs**

Time: Variable (0-60 minutes outside class); 30 minutes in-class discussion

Action: A number of options are possible here:

- the above information can be provided in a lecture format
- the fact sheets can be provided and read as homework in preparation for a general discussion on the topic
- the information can be researched by the students. Possible sources include:

1) publications available from the FON Hazardous Waste Educational Resource Kit:
   - Coping with Chemicals
   - Hazardous Wastes In Ontario
   - Disposal and Control
   - You and a Good Future

2) *Heath Science Connections 10*, J.L. Candido et al, C.D. Heath Canada Ltd., 1988, "The Problems of Hazardous Wastes" and "Managing Hazardous Wastes"

3) *Science 10: An Introductory Study*, W.A. Andrews, ed. Prentice Hall, 1988. "Hazardous and Radioactive Wastes"

4) *Hazardous Waste: Environmental Questions for Educators 1*, National Survival Institute, 1984 ($10.00)

5) *Environmental Citizenship: Focus on Toxic Chemicals*, National Survival Institute, 1988 ($10.00)

Points to emphasize in discussion:

- hazardous wastes are a serious problem in Ontario and around the world
- the problems are being addressed through the 3 Rs and through proper handling, treatment and disposal
- the Government of Ontario has created a Crown corporation, the Ontario Waste Management Corporation to develop a hazardous and liquid industrial waste management system for the province
- a detailed look at industrial hazardous waste is beyond the scope of this learning unit. Sufficient information is presented here to help put the problems in perspective.

ACTIVITY 4.2: Recovery and Proper Disposal

Rationale: In this section, the students have an opportunity to narrow their focus to specific hazardous wastes and to see how wastes can enter and affect the environment. Representative examples, including some commonly mentioned in the media, are used again to show the link between the consumer and hazardous wastes, particularly in the local environment.

Preparation: Copy Resources #10 A to J for distribution if required

Time: Variable - 15 to 60 minutes outside class, 30 minute class discussion

Actions: The same options provided in ACTIVITY 4.1 are possible here. As a research option, teams of 3 to 5 students could be assigned a specific hazardous waste on which to report. The enclosed fact sheets are abstracted from "Hazardous Substance Fact Sheets" in the FON kit. Additional information also can be found in:

Environmental Citizenship: Focus on Toxic Chemicals, National Survival Institute, 1988

Dangerous Properties of Industrial Materials, 4th ed., Irving N. Sax, Reinhold Publishing, New York, 1975

Second Annual Report of Carcinogens, U.S. Department of Health and Human Services, December, 1981

Hazardous and Toxic Effects of Industrial Chemicals, Noyes Data Corporation, Park Ridge, N.J., 1979

As an art activity, or in conjunction with an art class, students could draw a "Wanted" poster or caricature of a hazardous waste

DEVELOP CONCEPTS AND CONTENT

Recommended:	Have student teams use the resource sheet information to locate a source of a hazardous waste in the community. Have students contact a representative waste generator to determine how their waste materials are presently handled and how that might change in the future. Encourage students to ask receptive industry representatives to come in and talk about the problems of handling and disposing of hazardous wastes.
Points to emphasize in discussion:	Although point source emissions and accidents often have dramatic consequences nearby, the effects of hazardous materials are often widespread, chronic and difficult to identify. Everyone's body contains some level of contamination from hazardous substances We can do something about it - waste levels can be reduced We must be responsible for our use and disposal of these materials, both as individuals and as a society
Going further:	Have students play the Renew Game (available in the Hazardous Waste Kit of the Federation of Ontario Naturalists) as a fun way to summarize the pros and cons of the ways in which hazardous wastes are being managed currently. Discuss how they can encourage the pros and discourage the cons.
Transition:	Tell the students that they will now have an opportunity to take what they have learned and work with it, either as individual consumers or within the school setting.

WORK ON CONCEPTS/ LOCALIZING INFORMATION

STEP 5

GOALS: To apply the content and concepts learned in **Step 4** to an individual, school or community situation.

ACTIVITIES: To gather local information that will help them plan future steps.

Rationale: Options are provided which allow an individual, school or community focus. All provide a shift to student manipulation of content - a chance to work with information, and test it for themselves.

Option 5.1: Individual

The Disposal Game

Preparation: Copy and prepare the Disposal Game for use.
(One set per six students)

Time: 30 minutes in class

Action: Divide the class into groups of six and distribute copies of the Disposal Game. Tell the students that the game gives them an opportunity to test their knowledge of home disposal options. Highlight the challenge procedure and the need to keep an eye on their neighbours' disposal practices.

For discussion after: It can be fun to "trip up" fellow students within the context of a game. How would you deal with a neighbour who used poor disposal practices?

Going further: The Haz-away (available from Ontario Waste Management Corporation or the FON Hazardous Waste Kit) provides another approach to the same concept.

Evaluating Alternative Products

Preparation: Copy **Resource #9 Hazardous Wastes and the 3 Rs**

Time: 5 minute introduction in class; 30 minutes outside class; 15 minute wrap-up of ACTIVITY 5.1 in class.

Action: Distribute **Resource #9** and/or refer back to the discussion of waste reduction methods in **Step 4**. Students will have an opportunity to test one or more of these less hazardous options against products normally used in their home, and report on the results. Students should be prepared to answer the following questions:

- What other materials might be better to use?
- Which material does a better job?
- How do costs compare? This exercise will require estimates of comparative amounts used and a way to determine the cost per use

WORK ON CONCEPTS/ LOCALIZING INFORMATION

For discussion after:

After getting a sense of the results, focus on those materials that do almost as good a job for a bit more effort. Would the major product users in their homes be willing to compromise in order to use less hazardous options? Do they think the general public would be receptive to making the switch? What promotion/education would be required? Is this a reasonable approach to reducing hazardous wastes?

Going further:

Students can research and test additional substitutes by looking for new, less toxic products or by using many "old time" methods. Organic gardening stores or books, and health food stores can suggest non-chemical alternatives.

Action:

Ask students what they know of hazardous waste issues and practices in the school. Challenge them to find out through development and use of a school hazardous waste survey. Students should use the household survey as a base and modify it to fit the needs of the school.

Students should identify key sites to visit (science labs, photo labs, shop areas, cleaning storage, etc.) and divide the class into investigating teams. Have the students contact an appropriate teacher or maintenance person and set up an appointment to evaluate their site with them. During their "site visit", students should focus on the use, storage and disposal of hazardous materials or residues. Stress that their's is a fact-, not a problem-finding effort, and that they should not be disappointed if things are well-run.

For discussion after:

Review survey results and evaluate the practices, products and systems for potential problems.

Going further:

Given enough time and interest, clear issues, and receptive companies, students may evaluate the hazardous materials practices of a local industry. This would carry forward the process begun at the end of Step 4, Activity 4.2.

Note that dealing with a contentious issue requires a skills background that goes beyond the scope of this unit.

Contact the nearest MOE office for assistance and information on local industries and practices. A representative may be willing to discuss a particular issue with the class. A field trip may be required to see and understand the problems and prospects of managing hazardous waste.

INTEGRATE DISCOVERIES INTO UNDERSTANDING

STEP 6

GOALS: To provide an opportunity for students to draw together information and experiences into a coherent plan, activity or statement

ACTIVITIES:

Rationale: The activities will continue the individual, school or community focus of Step 5. Students move from working with, to making decisions about, hazardous waste information on issues based on what they've discovered to date.

Option 6.1: Individual — Games and more games

Preparation: None required. The games **Haz-away, Renew,** and the **Disposal Game** (available from OWMC or the FON **Hazardous Waste Kit**), as well as publications which show the range and variety of game formats could be made available for review.

Time: 10 minute introduction in class; variable in/out of class time to develop games; 30 minutes in class to play/discuss games.

Action: Discuss the value of games generally, and as a way to learn. Focus on the role and use of the Disposal Game in the previous step. Challenge the students, in groups of 2-3, to develop their *own* hazardous waste games. The games can focus on one aspect of hazardous waste, or draw together much of the content provided, but should have a definite, stated goal. Games can then be tested in class by other groups of students.

For discussion after: Evaluate as a class the value of the games developed. Were they accurate? Effective? Fun? What did the students learn from developing the games?

Option 6.2: School hazardous waste survey (cont.)

Preparation: None

Time: 30 minutes in class, 30 minutes outside of class

Action: Continuing from Step 5, students could develop a plan to address any areas of concern arising from their school survey. Are there better alternatives? Can the 3-R's apply? Are there better disposal methods? As a class, rank areas of concern and areas of opportunity. That is, what is most important, and what might we have a good chance of changing?

Going further: Students should summarize and share the information, impressions and feelings generated in Step 5. A range of presentation options should be available, including art, song, dance, articles or photo essays (submit the best to the school and/or local paper), and videotaped newscasts.

ANALYZE APPLICATIONS AND FUTURE PLANNING

STEP 7

GOALS: To test information and findings against reality.

To evaluate activities to date and develop action plans for the future.

ACTIVITIES:

Rationale: Students can begin to take real steps related to hazardous waste management by the individual, school and/or community. At whatever level, the steps should include some public commitment by each student to definite action, and a plan by each student to monitor, evaluate and describe, in some medium, their experiences.

Option 7.1: Individual concern

Preparation: None.

Time: 30 minutes outside of class.

Action: Have students draw up contracts stating what they will do individually regarding their direct and indirect generation, use and disposal of hazardous materials, including purchases and use of hazardous materials and/or alternatives, and correct disposal of any wastes generated.

Going further: In cooperation with their families, students could develop and implement a household hazardous materials management plan. Stress the 3-R's. How can they reduce, re-use, recycle and recover household hazardous wastes, or ensure that someone else does?

Option 7.2: School hazardous waste survey (cont.)

Preparation: None.

Time: 30 minutes in class.

Action: Have students evaluate the plan developed in Step 6, and determine which item or items to focus on, and what potential alternatives are most appropriate. Stress the need to start with small, relatively simple changes

Note: In planning for change, discuss tactics and approaches that will most likely result in change. Stress the need to be cooperative and understanding with respect to the characteristics and limits of school administrations, while being firm in their commitment to get something done. Brainstorm and evaluate various approaches, and choose the best. Discuss alternative approaches to take if there is resistance, and how far they can go as a class to achieve their goals.

ANALYZE APPLICATIONS AND FUTURE PLANNING

Going further:

Community action

Students may wish to develop a plan for a small, "do-able" piece of community action related to the production, consumption, or disposal of hazardous wastes, or work with local community action groups who are already involved in hazardous waste issues. Again, independent action on contentious issues can be extremely time-consuming and frustrating, and lies outside the scope of this unit. Encourage *positive* actions such as:

- Coordinating a hazardous waste conference
- Running a household hazardous waste day
- Helping develop a local hazardous waste exchange

See the Resources section for additional guidance in setting up these programs.

COMPLETE ACTION PLANS

STEP 8

GOALS: To carry through plans developed in Step 7

To monitor and record the experience in some way that includes personal actions and feelings, group actions and feelings, and the results of those actions.

ACTIVITIES: **(all options): Do it!**

Rationale: Students have the opportunity to learn through experience — the experience of dealing with real hazardous waste issues, however small, in a meaningful way.

Preparation: Variable, based on plans.

Time: Variable (out of class) based on plans

Action: Plan components are carried out individually, in small groups, or by the group as a whole. Ensure that a record of the experience is being made

SHARE THE EXPERIENCE

STEP 9

GOALS:

To share the results of the experience in some personally meaningful way

To provide an opportunity for students and the teacher to evaluate the results of any actions, and the behaviours which led to those results.

To highlight key actions or approaches which should, or should not, be taken the next time the unit is done.

ACTIVITY 9.1: Student presentations

Rationale: Sharing provides an opportunity to make personal sense out of the often confusing or disjointed jumble that is "experience". By using methods that they enjoy, or at least feel comfortable with, students may be clearer about their own thoughts and feelings in relation to the experience that they just had.

Preparation: Students must complete and prepare for presentation a "summary" of their experience. This summary can take any form that the student or group wishes, so long as it can be clearly explained or understood.

Time: 60 minutes in class; variable outside of class.

Action: Each student or group should be given an opportunity to explain or present their summaries. Key elements to highlight or probe are:

- Whether their actions could be termed successful, and why.
- The value of the experience, successful or not.
- The possible causes of any difficulties or failures.
- What they might do differently next time.
- Individual feelings about their role in the actions, including feelings about:

  The value of their goals.

  The value of their actions.

  How they performed as team members.

  Difficulties encountered and surmounted.

  Difficulties encountered and not surmounted.

SHARE THE EXPERIENCE

ACTIVITY 9.2: Written evaluations

Rationale: The intent here is to personally involve each student in the evaluation of his or her actions throughout the unit. Skills in self-evaluation must be developed for experiential learning to be effective, particularly in situations where "formal evaluators" are removed from all or part of the action, or absent altogether. The teacher's evaluation provides a comparative measure to learn from.

Preparation: The teacher will need to prepare written evaluations of each student's performance throughout the unit.

Time: 30 minutes outside of class.

Action: Ask the students to take some time to think about their experiences and actions throughout the entire hazardous waste unit. Based on the type of questions raised in the discussion section of **Activity 9.1**, each student should evaluate their own performance throughout the unit. How effective were they in individual and group situations? How did they react to changing conditions and requests. Did they participate fully all of the time, or only in some situations. If only some, then why? Did their behaviour change at any point during the unit? Were there some portions of the unit that did not work for them? Why? Should that be changed? In what way? Written evaluations are to be copied and exchanged for the teacher's evaluation. Discrepancies are to be worked out in conference, and the results used as the basis for a unit grade.

ACTIVITY 9.3: The unfinished letter

Rationale: Returning to the beginning gives the student the opportunity to measure change in their own attitudes and potential behaviours that has occurred over the course of the unit.

Preparation: None.

Time: 30 minutes.

Action: Have students reread their initial conclusion to Resource #1, The unfinished letter. Do they still agree with what they wrote? Why or why not? Have their feelings changed, or their response to those feelings? How does that change relate to what they have experience in this unit? Students may wish to rewrite their conclusions.

Going further: A repeat of the influence circles and responsibility continuum of STEP 2 would provide visual evidence of group shifts in attitude. Compare with previous distributions.

UNFINISHED LETTER

RESOURCE 1

Dear Chris,

Today was my first day back at school since being evacuated because of the PCB fire. Who would have guessed that something like that could happen in St. Basile-le-Grand?

At first I was really excited about being evacuated. I thought it was going to be like an extended summer vacation. Instead, my whole family got stuck in an evacuation centre for almost three weeks!

Being evacuated was really awful. At the evacuation centre there were so many people - young, old, disabled, ill,... well, you get the picture. Mrs. Johnson was there, too - she's the elderly lady whose grass I cut during the summer. She was very upset because she had to leave her home. I felt really bad for her because she was having such a rough time getting around. She was also very worried about her cat who was being kept at the humane society. The whole thing was a terrible experience for her, as it was for many other people. You don't fully realize how secure "home" can feel until something like this happens and you don't have one for a while.

Although we're back at home now, Mom and Dad are still angry at the fact that we were evacuated. Because they both work near where the PCBs were being stored, they couldn't go to work during the evacuation. Now they're not sure if they can make this month's mortgage payment to the bank. They've even cut my allowance off for awhile. They know that they will get paid for lost wages some time, but that doesn't help at the moment. I can't believe this is happening to us.

At school, everyone was talking about what happened to them as a result of the PCB fire and evacuation. One girl who lives on a farm said that her family is worried that their crops are contaminated. Another kid talked about how his family's vegetable market lost a lot of money because the produce went rotten during the course of the evacuation. It seems as if this whole thing was a drag for everyone. The worst thing is that no one seems to know all the answers to what the PCBs might do to us in the long term.

I've been thinking a lot about the whole thing and right now I feel..

See you soon,

WHAT ARE HAZARDOUS WASTES?

RESOURCE 2

In general, the term "hazardous" is applied to substances which are

Corrosive.
Substances that eat and wear away at many materials (car battery acid, drain cleaners)

Flammable
Liquids that can ignite (lighter fluid, turpentine, gasoline)

Reactive
Materials that can create an explosion or produce deadly vapours (bleach mixed with ammonia based cleaners)

Toxic
Materials that are poisonous or lethal to humans or animals even in small quantities (rat poison some potent medicines, cleaning fluids, pesticides, bleach)

Remember!

1) Never pour hazardous materials down the drain. Doing that may corrode plumbing, release toxic fumes, damage sewage treatment systems and contaminate surface and ground water.

2) Never put hazardous materials out for garbage collection. That may result in injury to sanitation crews.

3) Never bury hazardous materials. They may contaminate the soil and eventually the local surface and ground water.

Follow these tips for safe handling and disposal of hazardous substances

1) Never buy more than you need to do the job.

2) Keep the various hazardous products in your home separated.

3) Never mix hazardous substances.

4) Store in a safe well-ventilated place away from children and pets.

5) Make sure containers are not broken and keep them securely capped or sealed

6) Keep bleaches and ammonia away from acids

WHAT ARE HAZARDOUS WASTES?

7) When pesticides, bleaches and ammonia, etc. are all used up, rinse the containers three times, and dispose of the containers in the garbage. Spread the pesticide rinsings where you applied the full strength product.

8) Keep unused pesticides, bleaches, ammonia, etc. in a safe place until a special collection day is held in your area or give the extra amounts to neighbours..

9) Never use chemical containers for other purposes.

10) Never burn, crush or puncture aerosol containers.

11) Deliver waste automotive oil to a service station which participates in an oil recycling program.

12) Some acids and alkalis may be diluted and flushed down the toilet but you should first seek advice from the Ministry of the Environment.

13) Car batteries can be traded in or given to service stations or recyclers.

14) Medicines can be flushed down the toilet to prevent misuse by children.

15) As much as possible, try to exchange or give unwanted materials to neighbours who may be able to use them. This, of course, excludes medicines or other personal items.

16) When a special hazardous waste collection day is held in your area, bring your hazardous materials to the collection depot.

HAZARDOUS SUBSTANCES IN THE HOUSEHOLD

CHEMICAL TYPE	HOUSEHOLD PRODUCTS	POTENTIAL HAZARDS OF CHEMICAL TYPE
Acids – chromic, sulphuric, hydrobromic, hydrochloric, hydrofluoric, nitric, perchloric, formic	battery acid; acidic chemical cleaners; glass or metal etching solutions; leather dyes	corrosive; irritant; damage to kidney, liver, and digestive system, pulmonary edema
Alcohols – methanol (wood alcohol), ethanol (grain & rubbing), isopropyl (rubbing alcohol), butanol, amyl alchohol	antifreeze; frost removers; cleaners; solvents for dyes/resins/shellacs; metal polishes; engine and radiator flushes; paint remover	volatile and flammable; methanol is very toxic if swallowed; eye, nose, and throat irritation
Aldehydes – formaldehyde, other aldehydes	preservative; hospital disinfectants, etc.; urea-formaldehyde-foam (UFF) insulation; particle board; chipboard; cosmetic products; adhesives; disinfectants, printing ink	skin, eye, respiratory irritation; causes reactions; suspected cause of birth defects
Aliphatic hydrocarbons – butane, pentane, hexane, heptane	solvents; aerosol propellants; car wax & polish	flammable; irritant; central nervous system depressant
Alkalies – ammonia, lime (calcium oxide), potassium hydroxide, sodium hydroxide, sodium silicate	alkaline battery fluid; cleaning solutions; lye (caustic soda); fertilizers; refrigerants; bleaches; paint and varnish removers	caustic; irritant; inhibits reflexes
Aromatic hydrocarbons – benzene toluene (toluol), xylene (xylol); aromatic solvent naphtha; styrene, phenol (carbolic acid)	wood filler & wood putty; solvent for paint/lacquer/varnish; adhesives and cements; dry cleaning; aerosols; gasoline additive; automotive cleaners; wood strippers; toilet cleaners	flammable; benzene is a carcinogen; long-term effects of xylene and toluene not known; strong narcotic properties; skin irritation; a spill of concentrated phenol on skin will cause skin burns and spills over a large area may be fatal or may damge liver, kidney, spleen, and cental nervous system
Arsenic	once used in dyes and paints; used in the manufacture of products such as fertilizers and pesticides	cancer-causing; irritates eyes and respiratory system; damage to kidney, liver, lungs, and central nervous system
Asbestos (silicates)	asbestos cloth; brake and clutch linings; plastic filler; insulation and fire-proofing materials; pipes; roofing; (most of these, in new products, do not contain asbestos)	highly carcinogenic, micoscopic particles may cause lung diseases and lung cancer; contact dermatitis

HAZARDOUS SUBSTANCES IN THE HOUSEHOLD

CHEMICAL TYPE	HOUSEHOLD PRODUCTS	POTENTIAL HAZARDS OF CHEMICAL TYPE
Chlorinated aliphatic hydrocarbons – halogenated hydrocarbons, chlorinated paraffins; carbon tetrachloride, chloroform, trichloroethylene (TCE), trifluoroethane, perchloroethylene, trichloroethane (methyl chloroform), methylene chloride (dichloromethane), dichloropropane (aliphatic hydrocarbons that have some hydrogens replaced by chlorines are less flammable and better solvents than hydrocarbons, but decompose more slowly in the environment)	spot removers, degreasers; dry cleaners; paint & varnish removers; aerosols; metal cleaners; flame retardants; rust preventatives; automotive cleaners; laundry stain remover; drain cleaners; cesspool cleaners; refrigerants; water-proofing agents	slow decomposition; trichloroethylene & perchloroethylene are suspected carcinogens; trifluoroethane is suspected of damaging the earth's ozone layer; liver and kidney damage
Chlorinated aromatic hydrocarbons – chlorobenzene, dichlorobenzene, polychlorinated biphenyls (PCBs), chlorinated naphthalenes, chlorinated pesticides (DDT, kepone, etc.)	chemical deodorizers; pesticides; radiator cleaners; engine conditioners; leather dyes; wood preservatives; air-filter adhesives; capacitors & transformers; toilet cleaners	flammable; toxic, PCBs and DDT are restricted; accumulate in the food chain
Chlorofluorocarbons, fluorocarbons, fluorinated hydrocarbons, halogenated hydrocarbons	aerosol propellants; illegal drug (inhalant)	very slow decomposition rate means they reach the ozone layer and break it down; toxic in high doses; restricted
Cutting Oils	welding and metal work	human carcinogen due to presence of a variety of nitrosamines; may cause dermatitis
Cyanides – ferrocyanides	photographic development	toxic; may be fatal
Esters – methyl acetate, ethyl acetate, butyl acetate	solvents used in lacquers, varnishes, and paints	toxicity varies with specific chemical, causes eye, nose & throat irritation and anaesthesia (groggy, drugged behaviour)
Ethers – ethyl ether, isopropryl ether, glycol ether	anaesthetics; driveway degreasers	highly flammable; potentially explosive
Explosives – ammonium nitrate, NAFO, dynamite, mercury fulminate, nitroglycerine, 2, 4, 6-trinitrotoluene (TNT), watergel explosives	fireworks; ammunition	explosive; causes dermatitis, "dynamite headache"; can cause anemia and hepatitis

HAZARDOUS SUBSTANCES IN THE HOUSEHOLD

CHEMICAL TYPE	HOUSEHOLD PRODUCTS	POTENTIAL HAZARDS OF CHEMICAL TYPE
Gases – acetylene, ammonia, carbon monoxide, chlorine, ethyl chloride, hydrogen, hydrogen sulfide, methyl chloride, nitrogen dioxide, oxygen	welding gases; laboratory gases; local anesthetic aerosol cans; medical oxygen cylinders; refrigerants	asphyxiation; pulmonary edema; skin and eye irritation
Glycols – methyl cellosolve, ethylene glycol, diethylene glycol, carbitol	solvents for resins, lacquers, inks, paints, varnishes, and dyes; antifreeze; lubricants; cosmetics; lacquers	poison by skin absorption, ingestion, and sometimes by inhalation; eye irritant; narcosis; kidney damage; anemia; 85 mL of ethylene glycol can be fatal to adult
Ketones – acetone, methylethyl ketone, hexane, MIBK, MBK	nail-polish remover; paint, plastic, and resin solvent; general solvents; engine and radiator flushes	flammable, may cause respiratory ailments; toxic, toxicity varies with specific ketone
Lead	lead-based paints; rustproofers; printing ink; batteries; pesticides; some solders	damage to digestive, genito-urinary, neuromuscular, and central nervous system; anemia; palsy; retardation and brain damage
Pesticides	See Pesticide Handbook	
Petroleum distillates – petroleum ether; gasoline (petrol), white spirits, mineral spirits (Stoddard solvent), kersosene, fuel oil, lubricating oils, petroleum naphtha, lamp oil	fuel; anaesthetics; household cleaners; hobby products; aerosol containers; cesspool cleaners; radiator flushes; metal polishes; auto additives; driveway degreasers; asphalt and roofing tar; paint thinners	highly flammable; associated with skin and lung cancer; irritant to skin, eyes, nose, throat, lungs; entry into lungs may cause fatal pulmonary edema
Sodium cyanide	pesticides	interferes with enzymes which supply oxygen to cells; may be fatal; irritates eyes and respiratory tract
Sodium hypochlorite	swimming-pool chlorine; laundry bleach	irritates skin, eyes, respiratory tract; may cause pulmonary edema and skin burns; may cause vomiting and coma if ingested; contact with other chemicals may cause chlorine fumes
Turpentine	dissolves waxes & oils; used in paint products; disinfectants; polishes; perfumes	skin, eye, throat irritation; central nervous system depressant; kidney damage

TOXICITY RATINGS OF HOUSEHOLD PRODUCTS

RESOURCE 4

TOXICITY RATING NUMERIC	DESCRIPTIVE	QUANTITATIVE *	HOUSEHOLD PRODUCTS
1	practically non-toxic	more than 1 litre (L)	some foods and candies, lead pencils, eye makeup
2	slightly toxic	0.5 -1.0 L	dry cell battery solution, glass cleaner, deodorants, anti-perspirants, hand soap
	moderately toxic	30 - 500 mL	antifreeze, automotive cleaners, bleaches, detergents, dry cleaners, 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
	very toxic	4 - 30 mL	most toilet bowl cleaners, some deodorizers, engine motor cleaners, some fertilizers, some paint and varnish removers, some mildew proofing, air sanitizers, some paints, lacquer thinner, some paint brush cleaners, many pesticides: DDT, chlordane, heptachlor, lindane, mirex, diazinon, malathion, diquatibromide, endothall, 2-4-D
3	extremely toxic	7 drops to 4 mL	mercury cell battery solutions, some fertilizers, some insecticides, fungicides, rodenticides and herbicides such as aldrin, eldrin, bidrin, methyl parathion and paraquat
	super toxic	a taste (less than 7 drops)	a few pesticides like: paroxon, phosdrin, parathion, isobenzan, pyrazoyan

Note: the three level numeric rating scale is a simplification of the descriptive and quantitative categories

* lethal dose for a 68 kg human

adapted from: R E Gosselin et al, *Clinical Toxicology of Commercial Products*, 4th ed., Williams & Wilkins, Baltimore, MD., 1976

HOUSEHOLD HAZARDOUS MATERIALS SURVEY

RESOURCES

Many people are unaware that some of the common products they have in their homes are potentially hazardous. This activity is an inventory of possibly harmful products in your home.

Caution: Do not disturb or spill any of these products. Some of them might be harmful. Wash your hands carefully after handling any container that might be leaking. It might be wise to wear disposable gloves if you have a large number of suspicious substances.

1 Go through your house and inventory the types of household products on the attached form. You may want or need to involve other family members.

2 Check off any listed items that you find and write down the names of similar, unlisted items. Indicate what the items are used for (if it isn't obvious).

3 Note if each item has a warning label; if so, place a code from the **Hazardous Waste Symbols** sheet in the **Label** column (e.g.: C2 = corrosive, level 2; I3 = Ignitable, level 3).

4 Read the label. Does it contain any warnings about use, storage or disposal?

5 Find out how each item is used around your house. Is any special care taken? Are warnings followed?

6 Estimate how much of each item gets used each year.

7 Indicate the approximate volume of each item.

8 Indicate the condition of the container (0 = OK; X = leaking, rusted, or otherwise unsafe)

9 Determine whether some can be sent for proper disposal. Indicate how your family will likely dispose of the material and/or container.

When you return to class with your survey form completed, you can add toxicity ratings and potential hazards from information provided by your teacher

Save this form for use later.

DO YOU HAVE?	LABEL		USE		HOW MUCH		CONTAINER CONDITION	WILL IT GET USED?	DISPOSAL NOW	BETTER DISPOSAL	HAZARD	SAFER ALTERNATIVE
	Code	Warning (Y/N)	Care (Y/N)	Warning followed (Y/N)	Used /yr.	Have Now						
GARAGE OR BASEMENT												
Waste auto oil												
Gasoline												
Diesel fuel												
Used brake or transmission fluid												
Old batteries car other												
Carburetor cleaner												
Stains or preservatives												
Solvents for painting turpentine												
Paint thinner lacquer thinner												
[illegible]												
[illegible]												
Insecticides kill bugs [illegible] roaches etc.												

HOUSEHOLD HAZARDOUS MATERIALS SURVEY

DO YOU HAVE?	LABEL		USE		HOW MUCH		CONTAINER CONDITION	WILL IT GET USED?	DISPOSAL NOW	BETTER DISPOSAL	HAZARD	SAFER ALTERNATIVE
	Code	Warning (Y/N)	Care (Y/N)	Warning followed (Y/N)	Used /yr.	Have Now						
Herbicides (weed killers)												
Slug bait												
Mildew proofing												
Other												
LAUNDRY ROOM												
Detergent												
Dry cleaning fluids spot removers												
Bleach												
Other												
HOUSE												
Flea collars, sandane												
Flea sprays												
Furniture polishes												

HOUSEHOLD HAZARDOUS MATERIALS SURVEY

DO YOU HAVE?	LABEL		USE		HOW MUCH		CONTAINER CONDITION	WILL IT GET USED?	DISPOSAL NOW	BETTER DISPOSAL	HAZARD	SAFER ALTERNATIVE
	Code	Warning (Y/N)	Care (Y/N)	Warning followed (Y/N)	Used /yr	Have Now						
Herbicides (weed killers)												
Slug bait												
Mildew proofing												
Other												
LAUNDRY ROOM												
Detergent												
Dry cleaning fluids spot removers												
Bleach												
Other												
HOUSE												
Pet flea collars (nicotine)												
Flea sprays												
Furniture polishes												

HOUSEHOLD HAZARDOUS MATERIALS SURVEY

DO YOU HAVE?	LABEL Code	LABEL Warning (Y/N)	USE Care (Y/N)	USE Warning followed (Y/N)	HOW MUCH Uses /yr.	HOW MUCH Have Now	CONTAINER CONDITION	WILL IT GET USED?	DISPOSAL NOW	PROPER DISPOSAL	HAZARD	SAFER ALTERNATIVE
Household batteries												
Mothballs												
KITCHEN/BATHROOM												
Glass cleaners												
Drain cleaners												
Toilet bowl cleaners												
Abrasive cleaners												
[illegible]												
[illegible]												
[illegible]												
[illegible]												
[illegible]												
[illegible]												

CONSUMER LINKS TO HAZARDOUS WASTES

This table lists a variety of consumer products and processes which are directly linked to the generation of hazardous wastes. An asterisk (*) beside a hazardous waste indicates a waste with significant environmental and/or human health impacts.

PRODUCTS & PROCESSES	HAZARDOUS WASTE SUBSTANCES	ENVIRONMENTAL & HEALTH EFFECTS
Aerosols	chlorofluorocarbons*	ozone depletion
	nitrous oxide*	brain damage
	propane	
	hydrocarbons	irritant, central nervous system depressant
Batteries		
Watch	mercury*	mental and motor disorders kidney damage, genetic disorders
	lithium	
Car	lead*	brain damage, immunity deficiencies, lead poisoning
Household	copper	
	zinc	
	manganese	manganese poisoning or manganese pneumonia
Rechargeable	cadmium*	anaemia, kidney damage, prostate cancer, liver and lung disease
	nickel	

RESOURCES

CONSUMER LINKS TO HAZARDOUS WASTES

Cosmetics		
Nail Polish	toluene	mild anaemia affecting the central nervous system
	acetone	
	dibutylphthalate	
Make-Up	iron oxides	
	O-Hydroxyanisole	
	polyvinylpyrrolidone	liver, kidney and lung damage
Skin Creams	boric acid	extremely toxic
Shampoo & Conditioners	coal tar	cancer-causing
	diethanolamine	
	selenium sulphide	skin irritation
Drycleaning	perchloroethylene*	dizziness, eye and nose irritation, headaches, nausea, respiratory irritation, loss of mental functions, liver dysfunction, death
	petroleum solvents	irritation, dizziness and headaches
	fluorocarbons	degradation of the ozone layer
Leather	acids	corrosiveness, irritants, damage to kidney, liver and digestive system
	chromium*	cancer, lung and allergy problems
	chlorinated aromatic hydrocarbons	
	sulphide	
	ether solubles	
	dyes	
	organic materials	

CONSUMER LINKS TO HAZARDOUS WASTES

Paint	lead*	lead poisoning, hypersensitivity, brain damage
	cadmium* (yellow & orange paints)	anaemia, kidney damage, prostate cancer, liver and lung disease
	chromium*	cancer, lung and allergy problems
	solvents	air pollution
	xylene toluene	nausea, dizziness, respiratory problems, skin irritation
	chloride zinc cobalt benzene* nickel	
Paper	chlorine*	skin irritation, respiratory problems
	dioxin* mercury*	brain damage, disrupts central nervous system, liver and kidney damage, birth defects, accumulates in the food chain, reduces water quality
	organics sulphates	
Photography	chromium*	cancer, lung and allergy problems
	silver*	toxic
	ferro cyanide*	toxic
	cadmium* ammonium salts trisodium phosphate	degrades water quality
	sodium nitrate	degrades water quality
	phosphate	degrades water quality
	bromide borate formaldehyde	irritation and hypersensitivity

CONSUMER LINKS TO HAZARDOUS WASTES

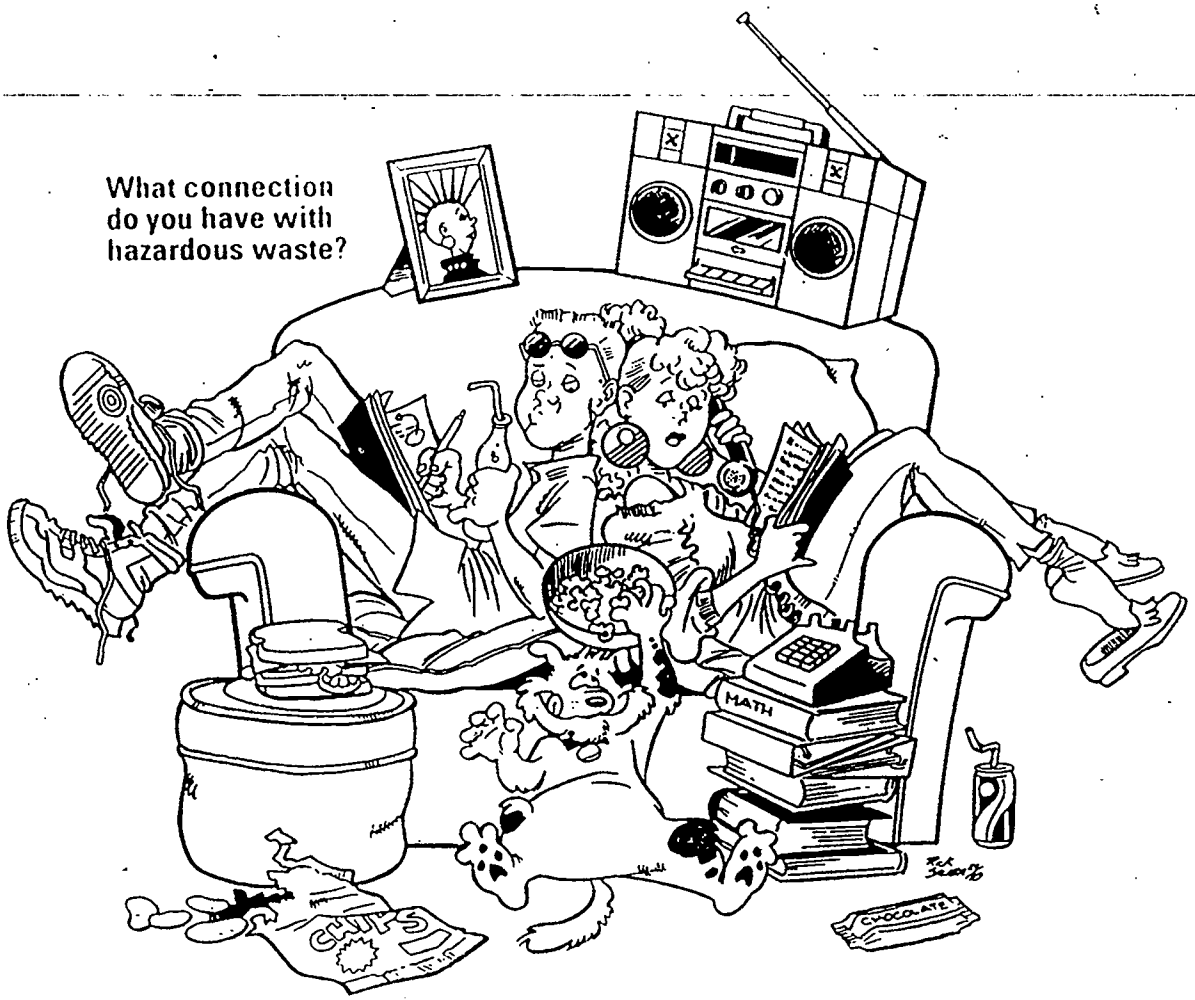
Plastics	benzene*	central nervous central depression, leukaemia
	chromium oxide	liver and nervous system damage
	vinyl chloride	reproductive problems, cancer
	carbon tetrachloride	nausea, liver and kidney failure
	diazomethane	skin and respiratory irritation, shock
	styrene	irritation of skin, eyes and respiratory tract, nausea
	acrylonitrile	
	lead	lead poisoning, birth defects, kidney and brain damage
	nickel	
	cadmium*	anaemia, heart and lung failure
Plated Metal	chromium*	cancer, lung and allergy problems
	acids	highly toxic
	copper	cancer, lung and allergy problems
	nickel	highly toxic, skin irritant
	tin	cancer, lung and allergy problems
	cyanides	cancer, lung and allergy problems
	cadmium*	skin irritant, cancer
Printing	carbon black*	
	cadmium*	skin irritant, kidney damage, cancer
	aldehydes	skin, eyes and respiratory irritation
	silver	
	lead chromate	
	molybdate	
	benzidenes	
	mercury sulphide	
	phthalocyanide	
	toluidines	
	formaldehyde	hypersensitivity and irritation

CONSUMER LINKS TO HAZARDOUS WASTES

Textiles	benzidine dyes*	toxic, bladder cancer
	alkalis*	caustic, irritant, central nervous system depressant
	detergents*	degrade water quality
	phosphorus compounds*	degrade water quality
	nitrogen compounds*	degrade water quality
	disperse dyes and naphthol dyes	dermatitis
	caustic soda oils	skin irritation
	acids	irritan
	polyvinyl alcohol acid dyes mordant dyes basic dyes vat dyes oxidation base dyes formaldehyde	
Transportation		
Gas	benzene*	central nervous system disorders, cancer
	lead*	brain damage, hypersensitivity, lead poisoning
	mercury*	mental and motor disorders, kidney damage
Oil	lead* polynuclear aromatics	lead poisoning
Electricity	PCBs*	liver damage, skin irritation
	sulphur dioxide*	causes acid rain
	low level radioactive waste flyash bottom ash	

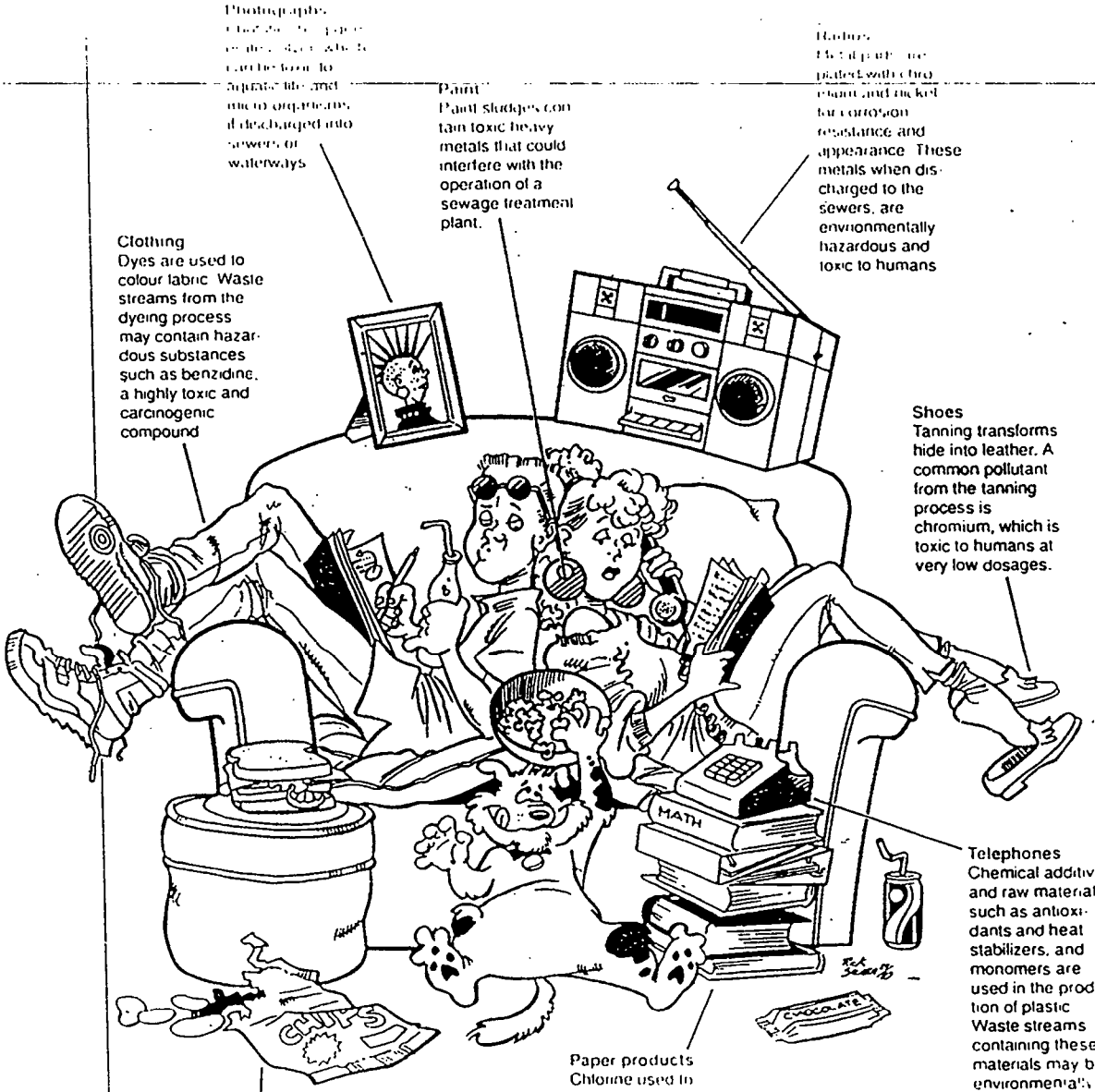
"CREATE HAZARDOUS WASTE? WHO, ME?"

RESOURCE 7



ITEMS	RELATED WASTES	ENVIRONMENTAL HAZARDS

"CREATE HAZARDOUS WASTE? WHO, ME?"



ONTARIO HAZARDOUS WASTE FACTS

RESOURCE 8

Ontario produces 49% of Canada's hazardous wastes (see attached figure — for provincial distribution).

30-60 million litres of liquid industrial and hazardous wastes are produced each year in Ontario.

More than 3.6 million tons of hazardous and liquid industrial wastes are produced each year in Ontario, about 175 kg/person (see attached figure — for generation by industry type).

Although legally disposed of under existing legislation, 45% of Ontario's hazardous wastes are sewered, landfilled, or have an unknown disposal method.

There are an estimated 3,000 unrecorded disposal sites.

1,000 spills or accidents serious enough to be reported to the Ministry of the Environment occur each year.

200 toxic chemicals are found in Lake Ontario water.

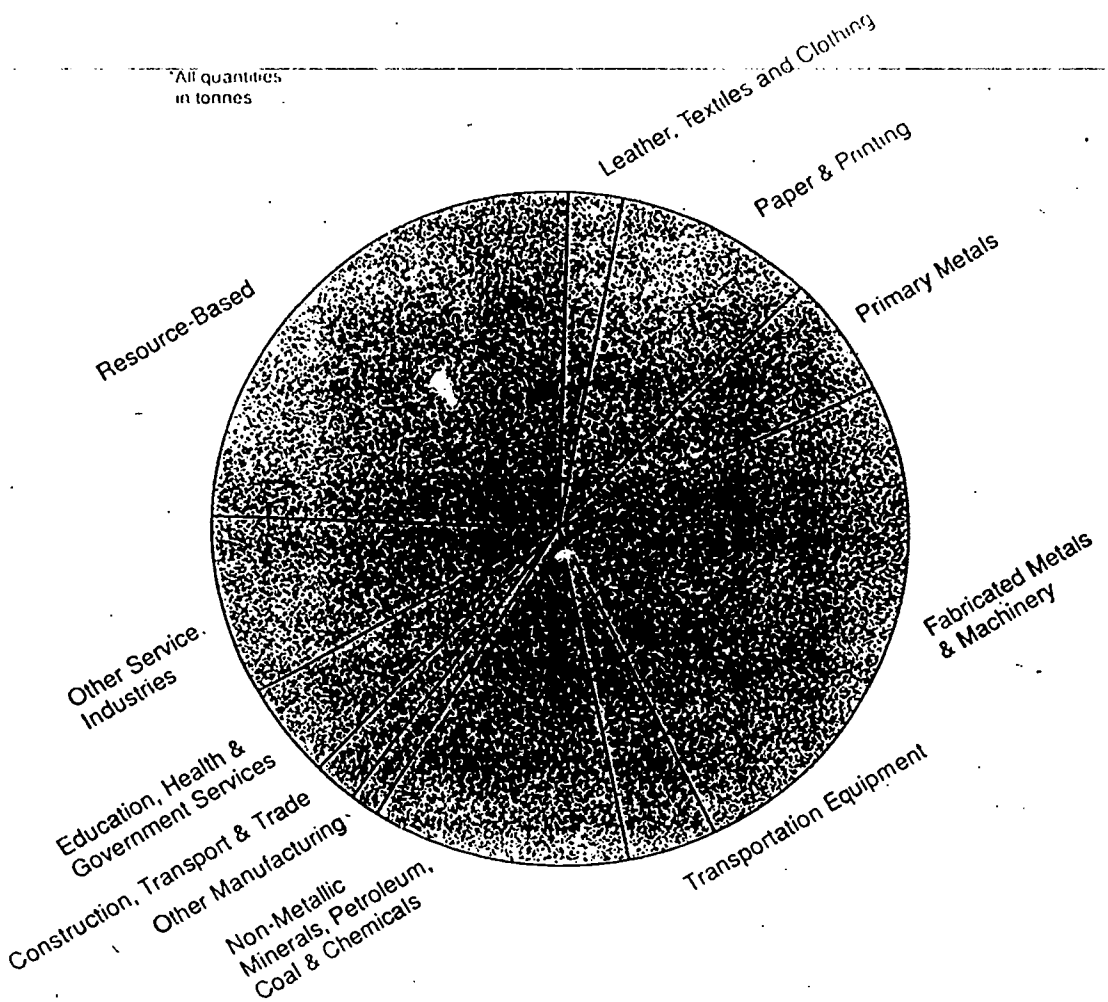
PRIMARY WASTE GENERATION BY REGION OF ONTARIO

REGION	TOTAL	% of TOTAL
Southwestern	822 000	22.9
South Golden Horseshoe	357 000	10.0
North Golden Horseshoe	200 000	5.6
Central	1 105 000	30.8
Eastern	249 000	6.9
Northern	850 000	23.7
	*3 582 000	100.0%

Source: Ontario Ministry of the Environment, Generator Registration Database as at July 21, 1987

WASTE GENERATION BY INDUSTRIAL SECTOR

*All quantities in tonnes



	TOTAL	% of TOTAL		TOTAL	% of TOTAL
Resource-Based	*879 000	24.5			
Leather, Textiles and Clothing	74 000	2.1	Non-Metallic Minerals Petroleum, Coal & Chemicals	451 000	12.6
Paper & Printing	325 000	9.1	Other Manufacturing	48 000	1.3
Primary Metals	210 000	5.9	Construction, Transport & Trade	73 000	2.0
Fabricated Metals & Machinery	917 000	25.6	Education, Health & Government Services	158 000	4.4
Transportation Equipment	154 000	4.3	Other Service Industries	293 000	8.2
				*3 582 000	100.0%

Source Ontario Ministry of the Environment, Generator Registration Database as at July 21, 1987

HAZARDOUS WASTES AND THE 3 Rs

RESOURCE 9

What can we do to reduce hazardous wastes?

As a society, we are only now beginning to realize that we are producing far more hazardous waste than we know how to handle.

Until recently we have been treating the symptoms of the disease rather than looking for preventive measures and permanent cures. Our solutions have often tended to be "end-of-pipe" solutions because they are usually treatment and disposal procedures that take place after waste has been produced. They are necessary and important, but they do nothing to reduce the total amount of waste generated.

What are the 3 Rs?

Minimizing the huge amount of hazardous waste generated is not an easy prospect. Recently, industry and government have been working together to implement a general strategy of waste reduction known as the 3Rs - Reduction, Recycling and Reuse. All four provide ways for companies to actively manage the wastes they produce. The first three can also be practised by individuals, families and schools to manage their own hazardous waste.

Reduction is a general term for the many practices companies can use to reduce the total amount of hazardous wastes produced during manufacturing. Reduction also refers specifically to efforts to reduce waste by making a physical improvement somewhere in the manufacturing process, resulting in lower waste output.

Another way to reduce hazardous waste, especially in a home or school setting, is to use less hazardous alternatives. Table 4.3.1 shows alternatives which use common household items in place of more hazardous materials.

Reuse is another waste management technique that can take place in the manufacturing plant. Reuse occurs when a waste stream is fed back into the process from which it came. An example of reuse happens in a pulp and paper mill, where trimmings from paper production are gathered and reprocessed with raw pulp to make new paper.

Recycling or exchange allows another company to use a waste as raw material for a different process. For example, spent solvents from the electronics industry can be re-used to clean parts in a machine shop or paint manufacturing plant. This reduces the need for, and the cost of fresh solvents by the secondary user

The recycling of home or school hazardous waste is not an easy task Ask your local municipal solid waste department or Ministry of the Environment office about special waste days or collection depots - especially for wastes such as used oil, solvents and household batteries. Contributing to regular recycling programs will help, too Although newspaper, cans and bottles are not hazardous, using them to make new products usually reduces the amount of hazardous waste generated in the manufacturing process

HAZARDOUS WASTES AND THE 3 Rs

Users can usually be found for extra pesticides, lubricants, paint, antifreeze and cleaners. Paint drives by local organizations can provide free "primer," or even a paint for fences and other outdoor applications. By exchanging items that are surplus or are no longer required, disposal costs and problems can be avoided, as well as the cost of materials received in exchange.

Where can industry go for assistance?

Ontario Waste Management Corporation has established a waste reduction program that provides technical advice to industries to assist them in reducing the volume and toxicity of their wastes at the point of origin. In related efforts, OWMC publishes the Waste Reduction Bulletin, an industry newsletter reporting case histories and the latest developments in reduction technologies. And in a joint venture with the Ministry of the Environment, the Corporation funds and manages a program called the Ontario Waste Exchange - a kind of waste swap service coordinated by experienced technical staff. OWMC also funds research to investigate specific reduction and detoxification techniques and participates in local and regional waste management seminars.

Even together, these waste management techniques are not able to eliminate the total amount of hazardous industrial wastes produced in Ontario. But, with continued research and greater effort throughout industry, they do give us the best hope for reducing the overall volume of wastes today and in the future. Since there will always be some amount of hazardous waste that must receive special handling, treatment and disposal, OWMC is proposing to build and operate a hazardous and liquid industrial waste treatment and disposal facility to provide a proper destination for hazardous wastes.

For more information regarding hazardous waste management, contact:

Ontario Waste Management Corporation
2 Bloor St. West
4th Floor
Toronto Ontario M4W 3E2

(416) 923-2918
1-800-268-1178
FAX: (416) 923-7521

ASBESTOS

RESOURCE 10 of 14

ALIASES: Asbestos Dust, Amianthus, Calcium Magnesium Silicate

DESCRIPTION: A general term that applies to a number of naturally occurring, hydrated mineral silicates. Incombustible in air and easily separable filaments.

FOUND IN: More than 5,000 products. About three-quarters of asbestos is used in the construction industry in products such as floor tile, roofing shingles, insulation, and asbestos cement products. The other one-quarter of asbestos is found in products such as textiles, brake linings, clutch facings, paints, and electrical insulation.

SOURCES: Asbestos fibres are released into the environment as a result of wear and deterioration of asbestos products, and the natural occurrence of the fibres at many locations around the world. The general population is exposed to asbestos fibres from air, drinking water, and consumer products containing asbestos. Greatest risk is to those exposed to asbestos through their occupations such as asbestos workers, miners, building demolition workers, and construction workers. The disease developed from excessive exposure to asbestos is called "asbestosis".

EXPOSURE LEVELS: The time-weighted average exposure for crocidolite (blue asbestos) and amosite (brown asbestos) is 0.2 fibres/cm^3 and 0.5 fibres/cm^3 respectively where the fibres are greater than 5 um in length. Chrysolite (white asbestos), most widely used in industry, has an exposure level of 2.0 fibres/cm^3.

HAZARDS:

HUMAN: Chronic exposure to asbestos has been associated with lung cancer and mesothelioma, another rare form of cancer.

PROPER MANAGEMENT: Handling of asbestos should only be carried out if proper ventilation methods and respiratory protection are used. Waste should be stored in approved impermeable containers and sent to an approved landfill site. Transportation in bulk requires a license.

Adapted, with permission, from: the Hazardous Waste Education Resource Kit, Federation of Ontario Naturalists.

CADMIUM

RESOURCE 10-B

ALIASES: None

DESCRIPTION: A bluish-white, corrosion-resistant metal used as a protective coating for iron, steel and copper. Commonly found with zinc, and as an impurity in zinc products (e.g. galvanized iron). As an element, it is unchangeable, and will exist indefinitely in the environment.

FOUND IN: Pocket calculators, nickel-cadmium batteries, dental amalgam, PVC plastic, nuclear reactors, solder, pesticides, paints, ceramic glaze, glass, superphosphate fertilizer. Used in the manufacture of: fluorescent lamps, jewellery, automobiles, aircraft.

SOURCES: 90% results from human activity: burning coal, oil or petrochemicals; leakage from heavy metal waste dumps; use of fertilizers and sewage sludge in agriculture. Plants absorb it from the soil, water or air and pass it up the food chain. High levels can be found in plants such as lettuce, celery and cabbage, and in shellfish. It is found in tobacco. There is no evidence of biomagnification. There is also risk of occupational exposure, and exposure to emissions from nearby manufacturing plants.

EXPOSURE LEVELS: Human cadmium content (primarily stored in kidneys) has consistently increased since the last century. It keeps accumulating in the body. 1-2% of ingested and 11% of inhaled cadmium is retained. The average level in a 50 year-old Canadian (50 ppm) is equal to the maximum safe level set by the World Health Organization (WHO). Average Canadian food intake: 67 ug/person/day (WHO guideline maxima: 57-72 ug/day). 0.1 ug absorbed/cigarette.

HAZARDS:

HUMAN: Potentially carcinogenic. Acute poisoning (rare) results in kidney failure and cardio-pulmonary depression. Chronic poisoning results in bone decalcification and deformation.

ENVIRONMENTAL: Failure of plants to produce chlorophyll; reduced growth, reproductive and survival rates in aquatic organisms; changes in aquatic community composition; reproductive disturbance in some mammals. Effects at concentrations as low as 1 ppb.

PROPER MANAGEMENT: Cadmium should be recycled at an appropriate facility or disposed of in a secure landfill site.

NOTES: Sweden banned the use of cadmium and cadmium compounds, and the import of articles containing cadmium, for certain purposes in 1982. The average dietary intake is now only 17.2 ug /person/day

Adapted, with permission, from: the Hazardous Waste Education Resource Kit, Federation of Ontario Naturalists

BENZENE

RESOURCE 10-C

ALIASES: Benzol, phenyl hydride, coal naphtha, cyclohexatriene.

DESCRIPTION: A clear, volatile, colourless, highly flammable liquid with a characteristic odour

FOUND IN: Used as a component in motor fuels, as a solvent for fats, inks, oils, paints, plastic and rubber, and in the extraction of oils from seeds and nuts. Used as a chemical intermediate. By alkylation, chlorination, nitration, and sulfonation, chemicals such as styrene, phenols, and maleic anhydride are produced.

SOURCES: Used extensively as a solvent in the chemical and drug industries, a gasoline additive and a starting and intermediate material in the synthesis of numerous chemicals. Over 75% of benzene exposure is from vehicle emissions. Increasing market demands for benzene in the chemical and petrochemical industries are forecast at approximately 5% annually.

EXPOSURE LEVELS: Due to the widespread use of benzene, over 75% of the population has probably been exposed to this chemical. Ambient atmospheric levels of benzene range from 1 ppb to 100 ppb. The highest values were reported in Metropolitan areas due to motor vehicle emissions. The U.S. National Cancer Institute estimates that an individual could ingest up to 250 ug/day.

HAZARDS:

HUMAN: Suspected human carcinogen. Several case reports suggest a relationship between benzene exposure and leukaemia.

ENVIRONMENTAL: Benzene has been identified in drinking water and subsurface water.

PROPER MANAGEMENT: Recycling when possible through a professional solvent recycling operation or an on-site solvent reclamation process. Contact local solvent recyclers for further information. If not possible, proper disposal through incineration can be achieved.

Adapted, with permission, from: the Hazardous Waste Education Resource Kit, Federation of Ontario Naturalists.

FORMALDEHYDE

RESOURCE TOOL

ALIASES: Oxomethane, oxymethylene, methylene oxide, formic aldehyde, formaldehyde, formalin.

DESCRIPTION: A clear, water-white, slightly acidic gas or liquid with a pungent odour. Formaldehyde is water soluble.

FOUND IN: Fungicides, germicides, disinfectants, and embalming fluids. It is also used for the production of resins which are widely used in the construction, automotive, furniture and appliance industries.

SOURCES: Most of the population is exposed to formaldehyde through its use in construction materials (wood, insulation), wood products, and home furnishings. Ambient air levels expose a large part of the population. Other sources include particle board, plywood, and urea-formaldehyde foam insulation (banned in Canada in 1981).

EXPOSURE LEVELS: Residents of homes containing particle board and plywood have an average exposure of 0.04 ppm. Persons living in homes insulated with urea-formaldehyde foam have an average exposure of 0.12 ppm. The time-weighted average exposure guideline is 1 ppm, while the short-term exposure is 2 ppm.

HAZARDS:

HUMAN: If swallowed, formaldehyde causes violent vomiting and diarrhoea. Frequent or prolonged exposure can cause hypersensitivity. Formaldehyde is a suspected carcinogen.

ENVIRONMENTAL: Storage tank ruptures or spills of formaldehyde are cause for concern because of the toxic concentrations or irritating vapour in the immediate area.

PROPER MANAGEMENT: Become involved in a waste exchange program through the Ontario Waste Exchange, or contact a local licensed disposal company.

Adapted, with permission, from the Hazardous Waste Education Resource Kit, Federation of Ontario Naturalists.

CHROMIUM COMPOUNDS

RESOURCE NOTE

ALIASES: Chromium trioxide, chromic anhydride, chromic acid, and chromium oxide.

DESCRIPTION: A very hard, steel-grey, lustrous metal. Chromium may exist in one of three oxidation states in compounds, 2+, 3+, and 6+.

FOUND IN: Chromium and its compounds are used in metal alloys such as: stainless steel, protective coatings on metal (chrome plating) pigments for paints, rubber, and floor coverings, and in photo mechanical processing.

SOURCES: Chromium is widely distributed in air, water, soil and food. In trace amounts, the 3+ form is an essential part of our diet.

EXPOSURE LEVELS: Hexavelant (6+) chromium compounds are of greater health concern than trivalent (3+) or divalent (2+) compounds. Guidelines for chromium metal, and 2+ and 3+ chromium compounds are 0.5 mg/m³. For chromates, dichromates, and other 6+ chromium compounds, the guidelines are 0.05 mg/m³.

HAZARDS:

HUMAN: A number of chromium compounds are considered to be carcinogenic such as calcium chromate, lead chromate,and zinc potassium chromate. There is an increased incidence of lung cancer among workers in the chromate producing industry. Chromic acid and its salts are corrosive to the skin and mucous membranes.

ENVIRONMENTAL: Extremely toxic to aquatic life. Can damage the effectiveness of municipal sewage treatment facilities.

PROPER MANAGEMENT: Resource recovery technologies are widely available in the electroplating industry. Disposal requires the hexavalent chromium to be reduced to trivalent chromium before precipitation and disposal in a secure landfill site.

Adapted, with permission, from: the Hazardous Waste Education Resource Kit, Federation of Ontario Naturalists.

POLYNUCLEAR AROMATIC HYDROCARBONS

RESOURCE 10-F

ALIASES: PAHs, PNAs, PPAHs (particulate polycyclic aromatic hydrocarbons) and POMs (polynuclear organic materials).

DESCRIPTION: Polynuclear aromatic hydrocarbons (PAHs) are organic compounds composed of three or more benzene rings fused together with two or more carbon atoms per ring shared between two or more rings. There are several hundred PAHs. PAHs are highly soluble in fatty tissue and lipids, and only very sparingly soluble in water.

FOUND IN: PAHs are found at low levels in water, air, and food. The consumption of PAH-contaminated foodstuffs accounts for approximately 99% of the daily oral intake.

SOURCES: PAHs can be formed in any hydro-carbon combustion process. The less efficient the combustion process, the higher the PAH emission factor is likely to be. The major sources include heat and power generation, refuse burning, industrial activity, such as coke ovens and vehicle emissions.

EXPOSURE LEVELS: An individual's annual intake of total PAH from both food and water has been estimated to be in the range of 1 to 10 mg. Current knowledge is insufficient to justify establishing any safe level of exposure. Exposure should be kept as low as possible.

HAZARDS:

HUMAN: PAHs are thought to be involved with lung cancer and skin cancer. Humans possess a detoxification enzyme system that converts the PAH to polar metabolites that can be partially excreted. In the course of metabolic degradation certain PAHs are converted to active intermediates that are toxic to cells and possess carcinogenic properties.

ENVIRONMENTAL: PAHs can enter surface water from domestic sewage, industrial effluents, storm-water run-off from contaminated areas, and atmospheric deposition.

Adapted, with permission, from: the Hazardous Waste Education Resource Kit, Federation of Ontario Naturalists.

TETRACHLORODIBENZO-P-DIOXIN

RESOURCE 10-F

ALIASES: Dioxin or TCDD.

DESCRIPTION: There are 22 different TCDD's, of which only one is of major concern. 2, 3, 7, 8 - tetrachlorodibenzo-para-dioxin, commonly referred to as TCDD, is one of the deadliest chemicals ever produced by man. TCDD and other dioxins are formed as contaminants in the manufacture of all chlorophenols.

FOUND IN: TCDD is not manufactured commercially. However, it may be present as a contaminant in a number of commercial products, particularly pesticides, herbicides and defoliants such as 2, 4, 5 -TCP; 2, 4, 5-T (trichlorophenoxy-acetic acid); o-chlorophenol; silvex; ronnell; and hexachlorophene.

SOURCES: TCDD is formed during the production of 2, 4, 5-TCP (trichlorophenol), and is associated with all synthetic compounds derived from 2, 4, 5-TCP. In addition to pesticide use, other sources of environmental exposure are through combustion of gasoline, diesel fuel, wood and cigarettes.

EXPOSURE LEVELS: There are no numerical limits. It is extremely toxic and all contact should be avoided.

HAZARDS:

HUMAN: Exposure to TCDD from two accidents has shown the health affects to include: a severe skin condition called chloracne, impairments of the central nervous system, miscarriages, and cancer, mainly of the respiratory tract and liver. The precise toxicology of TCDD is not known.

PROPER MANAGEMENT: Dioxins must be burned at very high temperatures (1200-1400°C).

Adapted, with permission, from: the Hazardous Waste Education Resource Kit, Federation of Ontario Naturalists.

LEAD

RESOURCE 10-4

ALIASES: Tetraethyl lead (TEL), tetramethyl lead (TML), organic salts, inorganic compounds such as lead oxides, lead salts and metallic lead (Pb).

DESCRIPTION: Both TEL and TML are colourless liquids, but they are generally mixed with dyes to aid in their identification. Inorganic lead is a blue-grey metal that is very soft and malleable and includes: lead oxides, metallic lead, lead salts and organic salts.

FOUND IN: The liquid forms of lead (TEL and TML) exist in gasoline. Metallic lead is used for lining tanks, piping and other equipment requiring corrosion-resistance. Lead can also be found in lead-based paints and glazes, printing ink, batteries, pesticides, plastics, electronic devices and glass.

SOURCES: In Canada, over 70% of all atmospheric lead-pollution comes from the burning of leaded gasoline. Industrial exposure can occur during mining, smelting, refining and high temperature operations such as welding and spray coating of metals with molten lead. Lead is also an element naturally existing in the air, water and soil. Other consumer sources of lead include lead-based paints and some old earthenware pottery glazes.

EXPOSURE LEVELS: The lead level absorbed by humans from the atmosphere has increased 1,000 times since the existence of primitive man. However, during the past decade, the switch to primarily using unleaded gasoline in cars is slowly reducing the average airborne lead levels in Canada. It is estimated that we are currently absorbing 20 mg/day from food, 1 mg/day from water and 10 ug/day from the air. Maximum recommended occupational exposure levels are:

0.15 ug/cu.metre (time-weighted average exposure)
0.30 ug/cu.metre (short-term exposure level)

Lead tends to accumulate in the body, although not all lead is absorbed and retained. Most of it is eliminated through bile and urine.

HAZARDS:

HUMAN: Early symptoms of lead poisoning include gastro-intestinal disorders, colic and constipation. Excessive exposure can lead to central nervous system and brain damage.

ENVIRONMENTAL: Suspected of vegetation damage. Accumulates in vegetation and animal tissues.

PROPER MANAGEMENT: Several methodologies exist for on-site recovery of lead from waste material. If disposal is required, contact Ontario Waste Exchange for potential alternatives or a licensed chemical disposal company. There are also several lead recovery plants in the Province of Ontario

NOTES: The use of lead as an ingredient in certain paints was banned in 1948

Adapted, with permission, from the Hazardous Waste Education Resource Kit, Federation of Ontario Naturalists

MERCURY

RESOURCE 10-1

ALIASES: Quicksilver

DESCRIPTION: At room temperature, mercury is a silvery-coloured odourless liquid. The liquid vaporizes easily to exist in a gaseous form in the air. There are 3 major forms of mercury: inorganic, aryl organic, and alkyl organic which is the most toxic of the three.

FOUND IN: Dental fillings, fluorescent lights, street lights, floor waxes, furniture polishes, anti-bacterial agents, medicines, agricultural fungicides, plastics, paper, clothing, camera film, thermometers, batteries. The only food source likely to have dangerous levels of mercury is fish, although vegetables grown near mercury-producing industries tend to have a high level of mercury.

SOURCES: Chlor-alkali plants are major industrial users of mercury, of which only one is still in operation in Ontario. Other sources of mercury include: coal-burning plants, pulp and paper mills (a major source), petroleum combustion, municipal wastewater treatment plants, and mining, milling and smelting of ores. Mercury can bioaccumulate and biomagnify in food chain.

EXPOSURE LEVELS: Mercury can affect the body if it is inhaled or comes in contact with skin or eyes Exposure levels are recommended to be a maximum of:

0.01 mg/cu. metre of air (time weighted average exposure)
0.03 mg/cu. metre of air (short-term exposure level)

HAZARDS:

HUMAN: Mild exposure can result in diarrhoea, vomiting, skin and eye irritation. Acute exposure through inhalation may cause severe respiratory irritation, digestive disturbances, kidney damage, and neurological damage.

ENVIRONMENTAL: Bioaccumulation and biomagnification in the food chain.

PROPER MANAGEMENT: Use approved containers for safe storage and handling. Proper ventilation measures in the workplace should be implemented in order to maintain concentration levels below recommended guidelines For disposal, contact supplier registered licensed disposal company for details and check local legislation if recovery systems are not available

Adapted, with permission, from: the Hazardous Waste Education Resource Kit, Federation of Ontario Naturalists

POLYCHLORINATED BIPHENYLS (PCBs)

RESOURCE LOT

ALIASES: Chlorobiphenyls, polychlorinated diphenyl, PCB.

DESCRIPTION: PCBs can vary in appearance from mobile, oily liquids to white crystalline solids to hard non-crystalline resins, with all forms insoluble in water. They are considered quite stable to chemical alteration. They are members of a class of chlorinated organic compounds which are of increasing concern because they are widespread and persistent in the environment, and have a tendency to accumulate in the food chain.

SOURCES: Although banned in new products since 1977, PCBs were used extensively in electrical transformers, in insulation for electric cables and in the production of electric condensers. Also used as additives for extreme pressure lubricants and as a coating in foundry use. Some industries in which PCBs were found include: dye making, herbicide work, plastic manufacturing, rubber work, transformer work, and wood preservation. Consumers are often exposed through their diets; PCBs have been found in fish, cheese and eggs.

EXPOSURE LEVELS: The allowable level of PCBs depends on who is looking at the concentration and for what reason. For protection of aquatic life and recreational waters, anything above 0.001 ppb (0.001 micrograms per litre) is considered too high. For drinking water, the limit is 0.003 ppm (3 ppb). The recommended maximum in Great Lakes fish is 2 ppm. Some fish currently exceed this level. A substance is deemed to be a hazardous waste requiring special treatment if the PCB level is above 50 ppm (50,000 ppb). The routes of exposure to humans includes skin absorption, inhalation and ingestion.

HAZARDS:

HUMAN: PCBs cause lesions in the liver and the skin (chloracne). Other symptoms of massive internal exposure include: nausea, vomiting, weight loss, jaundice, and abdominal pain.

ENVIRONMENTAL: PCBs do not readily break down once they become attached with soil particles and thus are ingested by organisms low on the food chain, such as earthworms. Because of the bioaccumulation of PCBs in the food chain, adverse affects are being experienced by species at the top of the food webs. PCBs can disrupt reproductive processes and affect liver, enzyme and immunological systems.

If PCBs are incinerated improperly, small amounts of dioxins and furans may be formed. Dioxins are extremely toxic, much more so than PCBs.

PROPER MANAGEMENT: Substitution with alternative material wherever possible. Low-level PCBs (less than 50 ppm) may be destroyed in a dehalogenation process. Incineration is effective for destroying high-level PCBs only if a very high temperature with sufficient excess air is maintained in the incinerator. All precautions must be taken to ensure incineration technology is completely reliable. Currently, the only management option for high level PCBs in Ontario is careful storage until [illegible] incinerator begins operation in this province.

Adapted, with permission from the Hazardous Waste Education Resource Kit, Federation of Ontario Naturalists.

COORDINATING A HAZARDOUS WASTE CONFERENCE

RESOURCE 11

Introduction:

By now you have an increased awareness and understanding of the problems and prospects associated with hazardous wastes. You have seen that it is not only an economic and technical problem, but also one of maintaining favourable environmental quality for survival. Many essential ecosystems have been severely impaired or destroyed because of the unknowing and sometimes irresponsible actions of people.

In the not too distant future you will be the decision makers responsible for protecting and preserving environmental quality, perhaps as a professional in the field, a community leader or as a concerned citizen. However, there is no need to wait for direct action. You can take steps now to help develop positive environmental attitudes and values in your community related to hazardous waste.

Your job is to **plan, organize, and present a conference at your school or community centre to draw the community's attention to the problems and management of hazardous waste.**

Action:

The conference can be designed for a school, community, or mixed audience. In any case, effective conference coordination and presentation requires careful planning and organization. Divide your class into groups. Select group leaders and one overall team leader. Have each group select and take responsibility for one of the topics listed below. You may want to add topics to this list. Have one group solely responsible for conference logistics and promotion.

Prepare presentations, organize resources and/or secure speakers for the following areas:

What are hazardous wastes?

Current waste disposal practices and their problems.

Environmental hazards from waste.

What can individuals do about hazardous waste?

What can companies do about hazardous waste?

What can communities do about hazardous waste?

COORDINATING A HAZARDOUS WASTE CONFERENCE

Activity options:

The following are just some ways of promoting, reporting, and presenting at your conference:

1) **Language arts.** Information and critical comments can be passed on by various types of poetry, aphorisms, drawings or cartoons. Your groups may want to try to publish a booklet containing their works on hazardous wastes.

2) **Crafts/art.** The construction of collages, mobiles and posters provides an effective means of communicating information and ideas. As an added incentive, have your artistic works judged by the people attending your conference.

3) **Research investigations.** Your findings from research investigations may be reported or summarized by constructing diagrams, data sheets, graphs, models, slide shows, videotapes or displays.

4) **Speeches or panels.** Short speeches or panel discussions are an effective means of increasing awareness. In addition to having classmates participate, you may want to invite guest speakers from industry, government or the Ontario Waste Management Corporation.

5) **Public information booth.** An information booth at your conference providing free pamphlets and other materials is an excellent means of acquainting citizens with hazardous waste issues.

For free materials write to:

Ontario Waste Management Corporation
Communications Department
2 Bloor St. West
Toronto, Ontario M4W 3E2
and/or
Ontario Ministry of the Environment
Waste Management Branch
40 St. Clair Avenue West
Toronto, Ontario
M4P 1V5

6) **Radio/cable time spots.** Many local radio stations or cable companies have short time spots which they are willing to fill with announcements or discussions about interesting local activities. Prepare and tape short informative statements, or arrange interviews. Be sure to include the time and place of your conference.

7) **Newspaper articles.** Write short articles about your investigations and conference. Contact the newspaper to find out the form to be used, times for submittal and if a photograph can be included

COORDINATING A HAZARDOUS WASTE CONFERENCE

Follow-up

Be sure to write letters of thanks to all who participated. You may want to write a "Proceedings" of the conference (the results and key speeches, which can be taped and transcribed later), as well as an evaluation of how you think it went.

Adapted from:

Here Today, Here Tomorrow, A curriculum on recycling, energy and solid waste. Conservation and Environmental Studies Center, Inc., Browns Mills, N.J.

THE DISPOSAL GAME

RESOURCE 12

2-4 players 20-30 minutes

Preparation: Make copies of the 4 pages that form the playing board. Place them so that the numbers in the four corners fit together like this in the centre.

1	2
3	4

Tape the sides.

Duplicate copies of this page. Each player should have a set of instructions and 6 Disposal Cards. (Cut them out as marked).

Object of the Game: Try to get rid of all the unwanted or extra household hazardous wastes that come into your hand through the course of play. Players can work together to solve disposal problems.

To Start: Set up the board. Shuffle the cards thoroughly and place the stack in the space provided on the board. Make sure each player has a set of Disposal Cards.

To Play: Note that there are several areas of the board where substances could be USED, SHARED or STORED. For example, a can of paint could be shared with a neighbour or stored in your garage. There are only a few storage places offered so they may get used up quickly.

The first player draws a card from the Playing Cards. It may give the player something to dispose of - a can of paint, a pesticide, a household cleaner, an automotive product or solvent. The task is to decide what to do with it. You can:

- Play it on the board in an available space; SHARE, USE of STORE. (There are also a couple of illegal options so use them at your own risk).

- Choose to dispose of it using one of your Disposal Cards. (But once you've used that card, it's gone)

- Hold in your hand until another play. Besides disposal challenges, you may also draw additional disposal cards, actions, fines or penalties, or directions for all players to follow.

Adapted from: *The Disposal Game* published by The Metro Toxicant Program, Seattle, Washington. January, 1984

HOUSEHOLD HAZARDOUS WASTE DISPOSAL

HOUSEHOLD HAZARDOUS WASTE – WHAT'S IT ALL ABOUT?

To most people, hazardous wastes are found in Love Canal, in large industrial landfills or in streams of toxic chemicals flowing from factory outfalls. But hazardous waste is any substance that poses a risk to people or to the environment when disposed of improperly.

A wide range of household products fit such a definition: pesticides, automotive oil, solvents, household cleaners, antifreeze, and others. Some of the chemicals found in these products are known or suspected mutagens, carcinogens or teratogens. Often they are toxic to human beings, fish and wildlife in small amounts. Every day, tonnes of these chemicals are washed down drains or dumped in the trash. Because they come from many diverse sources (households) rather than a few large, localized sources (industries), they are difficult to control and are not currently regulated.

In addition, sales of a number of toxic household substances -- including certain pesticides and vinyl chloride-containing products -- have been banned or severely restricted. Quantities of these banned products can still be found in an average home. The consumer has had no choice, until now, but to dispose of these toxic products in ways that allow their eventual release into the environment.

Households contribute significantly to the flow of wastewater to sewage treatment plants and burying of solid waste in landfills. Household, garden and automotive products, such as paints, preservatives, pesticides, antifreeze and oil, can contaminate local stormwater runoff and streams. While relatively small in volume compared to the amounts generated by industries, household hazardous wastes can be a source of toxic contamination of local water supplies.

Adapted from: *Education Activities of the Disposal of Household Hazardous Wastes* -- Report D of the Household Hazardous Waste Disposal Product, Metro Smith-Greathouse, August Ninth Consultants, Inc.

TEACHER'S KEY FOR DISPOSAL GAME

Disposal Options	SUBSTANCES				
	Pesticides[1]	Paints[2]	Oil[3]	Antifreeze[4]	Solvents[5]
Use	Yes	Yes	No	No	Yes
Store	Yes	Yes	No	No	Yes
Sink – Septic System	No	No	No	No	No
Sink – Sewer Line	(No)	No	No	Yes	No
Garbage Can	No	No	No	No	No
Burn	No	No	No	No	No
Bury	(No)	No	No	Yes	No
Storm Drain	No	No	No	No	No
Sanitary Landfill	Yes	No	No	No	No
Share	Yes	Yes	No	No	Yes
Recycle Centre	NN	(No)	Yes	No	Yes

Yes = Acceptable option
No = Non-acceptable option
(No) = Questionable option depending on amount, toxicity, persistency, etc.
NN = Not necessary

1 Pesticides are anything that kills pests (insects, weeds, rats, etc.)

2 Paints contain solvents and pigments; older paints may be more toxic and may contain lead.

3 Motor oil contains toxic additives and when used, is contaminated with heavy metals from the engine.

4 Antifreeze contains metal contaminants from engine wear and is sweet and will attract and poison pets; bury deeply.

5 Solvents include gasoline, paint strippers, thinners, turpentine, dry cleaning fluid, wood preservative, household cleaners, waxes, polishes, drain openers, etc.

DISPOSAL CARD INFORMATION

Hazardous Waste Transportation and Landfill:

There are a number of landfills in Ontario that are allowed to accept hazardous wastes. Commercial liquid waste removers collect batches of wastes until they have enough for a shipment. Look in the Yellow Pages under "Liquid Waste Removal" and call to see if they will accept your waste. They may charge a fee. Quantities of household hazardous wastes are so small compared to industrial wastes that many firms do not really consider household wastes a market...but somewhat of a nuisance.

Recycling Centre:

There is no official recycling centre for household hazardous wastes. However, commercial waste disposal firms will accept used oil, batteries and solvents, many of which they can treat in order to re-use them. Look in the Yellow Pages under "Liquid Waste Removal". Many service stations will accept your used oil which they can deliver to a commercial treater in large quantities.

Garbage Bag:

Most landfill sites do not accept hazardous wastes and they do not accept liquids. Liquids simply increase the leachate* problem which is already significant at some landfills. However, landfills are supposed to accept household wastes. While you may get away with tossing things into the garbage, you are contributing to increased health hazards.

Down the Sink:

Anything that is poured down the sink flows into either a septic tank, or a sewer system.

Basically, anything that enters a septic tank:

- destroys the micro-organisms that normally break down the wastes in the tank;
- degrades;
- settles out in the sludge; or
- is released into rivers and lakes.

Collection Depot:

Hazardous Waste Collection Depots will accept banned or restricted pesticides, or any other hazardous substance that you no longer want to use. Householders should call their municipal offices to determine the location of the nearest depot or the date and location of the next Hazardous Waste Collection Day.

* Leachate:

A contaminated liquid formed when surface water (such as rain, snow melt, etc.) or groundwater comes in contact with waste materials in a landfill.

TEACHER'S KEY FOR THE DISPOSAL GAME CARDS

1 See general comments on antifreeze

2 See general comments on antifreeze.

3 Legal/Acceptable
1. Storage.
2. Recycling Centre.

The liquid in a battery is strong acid. The plates inside the battery are lead. It is not advisable to bury the battery because of the lead.

4 Self-explanatory.

5 Players may want to decide whether cards on the board can be removed.

6 Self-explanatory.

7 The intention of this card is to show that you should use the paint and dispose of the empty cans in the garbage. The student should put the cards in the disposal pile.

8 Self-explanatory.

9 Note that students in some areas of the country have begun stencilling storm drains or posting signs to remind or advise people that they lead to streams. "Dump No Waste".

10 See card #9. Player may hold on to this card to use later. Things that you put in a stream might contaminate fish or flow into lakes and contaminate one of your favourite beaches.

11 Player may use or hold to play later.

12 See general comments on solvents.

13 What you have, basically, are pesticides. Consider them as such.

Legal/Acceptable
1. Share with a neighbour who has a pet.

14 Legal/Acceptable
1. Share. You might want to tell your neighbour about alternatives.
2. Store in the garage.
3. Although commonly put in garbage can, disposal of liquids in a landfill is illegal.

Illegal/Questionable
1. Dangerous to burn aerosol cans

15 See general comments on solvents.

TEACHER'S KEY FOR THE DISPOSAL GAME CARDS

16 Self-explanatory.

17 Floor waxes may contain solvents, acrylics, detergents or ammonia.

Legal/Acceptable
1. Share with your neighbour.
2. Burial is acceptable for a small amount, if it is liquid.
3. Garbage Can, if it is not a liquid.
4. Down the Sink. Only for small quantities flushed with plenty of water.

Illegal/Inadvisable
1. Storm Drain. Goes directly to rivers and lakes. Solvents are a potential environmental hazard.

18 See general comments on paints.

19 See general comments on paints.

20 This is a solvent. It is contaminated with paint.

21 See general comments on paints.

22 See general comments on paints.

23 See general comments on paints.

24 See general comments on paints.

25 See general comments on solvents (gasoline) and motor oil. This cannot be re-used.

26 See general comments.

27 See general comments.

28 What you have left is paint sludge and paint brushes in a can. These should be taken to a Hazardous Waste Collection Depot.

29 See general comments on oil.

30 See general comments on oil.

31 See general comments on oil.

32 See general comments on oil.

33 Fertilizers promote plant growth in streams, which uses up oxygen, which in turn kills fish and insects.

Legal/Acceptable
1. Garbage Can. (You haven't totally avoided the problem of leachate).
2. Share with a neighbour who lives away from the stream.

TEACHER'S KEY FOR THE DISPOSAL GAME CARDS

Illegal/Questionable
1. Burial, if worried about leachate.
2. Storm Drains.

34 See general comments on pesticides.

35 See general comments on pesticides. Diazinon is a garden insecticide. Depending on conditions, it may degrade in 3 weeks to 3 months.

36 Fish fertilizer is derived from dead fish. No sunthetic chemicals have been added. It will therefore decompose as a dead fish would.

37 See general comments on pesticides.

38 See general comments on pesticides.

39 See general comments on pesticides. Obviously, this poison cannot be used in the garden for insects.

40 The only acceptable option is a Hazardous Waste Collection Depot. Store at your own risk! Banned pesticides have serious health or environmental hazards.

41 See general comments on pesticides. Slug bait may attract and poison pets. Burial may be an acceptable option for small amounts.

42 See general comments on pesticides.

43 See general comments on pesticides. Use with extreme caution.

44 See card #40.

45 See card #14.

46 Drain cleaners are usually strongly acidic or alkaline. Acutely toxic but...

Legal/Acceptable
1. Share with a neighbour.
2. Storage or Garage.
3. Down the Sink. The water in the sewer system will dilute the cleaner to the point where it is virtually harmless. Watch our for your pipes, though, if you have a lot of drain cleaner to get rid of.

Illegal/Questionable
1. Storm Drains - a direct route to waterways.
2. Garbage. Not allowed if it is liquid.
3. Burial. Not recommended due to high acute toxicity.

TEACHER'S KEY FOR THE DISPOSAL GAME CARDS

47 Carbon tetrachloride is a solvent that is no longer available to the public because of its serious acute and chronic health affects.

The only acceptable options for disposal, therefore, are:
1. Recycling.
2. Hazardous Waste Collection Depot.

48 TSP is trisodiumphosphate - a cleaning agent found in detergents and household cleaners.

Legal/Acceptable
1. Share.
2. Garbage Can.
3. Garage or Storage.
4. Down the Sink. If you use sewer lines, your sewage will eventually flow into a waterway. People whose sewage flows nto a lake or river, should not use cleaners containing phosphates.

If you use a septic tank, don't put large quantities down the sink all at once.

Illegal/Questionable
1. Burial. Potential for contamination of groundwater.
2. Storm Drains. Enters waterways.

49 See card #40.

50 See card #14.

51 See general antifreeze comments.

52 See general comments on pesticides. Also see card #41.

53 See general comments on paints.

54 Self-explanatory.

55 See general notes on pesticides.

56 This is possibly contaminated. See general comments on solvents. Also see card # 25.

57 Players may also want to decide whether cards on the board (in storage, say) can also be removed.

58 If "Wonderclean" is a disinfectant, it is considered a pesticide because it kills living creatures (bacteria). Treat it as having a low toxicity.

1 You changed the anti freeze in your car. How will you dispose of the 4 litres of used anti freeze?	**2** You changed the anti freeze in your car and have 4 litres to dispose of. However, you have a septic tank. What will you do?	**3** You just bought a new battery for your car. Dispose of the old one.	**4** It is Hazardous Waste Collection Day. All players may dispose of any pesticides, paints, solvents, or thinners they hold in their hands.
5 You volunteer to transport your neighbours unwanted pesticides to a Hazardous Waste Collection Depot. Collect all such cards from other players and dispose of them.	**6** You volunteer to work on a committee to develop recommendations on the disposal of household hazardous wastes. For your good deeds, dispose of any unwanted card you hold.	**7** You want to paint your house but are too poor to buy new paint. Collect all excess paint cards from your fellow players and dispose of them.	**8** You were just cited by MOE for dumping used anti-freeze in a local stream. Take two extra turns.
9 You find evidence of oil and anti-freeze in the local storm drain. If any player has placed a card there, issue a ticket and return his/her card. (2 extra turns)	**10** The MOE is concerned about people dumping things in the stream. Issue a fine to any player who has disposed of anything in the stream. (They take an extra turn).	**11** On your way to speak to a grade school class about hazardous household wastes, you stop by the Solvent Reclaiming Service. Check the garage and storage for any you can dispose of.	**12** You discover 12 litres of wood preservative in your garage. If you can explain why this stuff is technically classified as a pesticide, you may dispose it without a Disposal Card.
13 Your pet died and you have a box full of pet sprays, flea collars and pet insect repellents. Will you share, or dispose?	**14** You discover that your oven cleaner is toxic. You decide to switch to baking soda as an alternative. Dispose of the almost full aerosol can you have.	**15** Your brother-in-law gives you 4 litres of paint thinner. Will you share, dispose, or store?	**16** This is a Concerned Citizen Card. Because you educate your neighbours, you must give this to another player who may then use it to dispose of 1 item in his/her hand.

17 Your floor wax irritates your nasal passages. You decide to dispose of the 2 litres you have left.	**18** You have 20 litres of latex paint left over from painting the outside of your house. Will you share or dispose?	**19** You have 8 litres of white paint left over from painting the outside of your house. Will you share or dispose?	**20** You have just finished painting your house with an oil based paint. You have 4 litres of paint thinner left over. How will you dispose?
21 Your father-in-law finished staining his house a dark brown. He had 8 litres left over and gave them to you. Will you use them on the fence, share or dispose?	**22** You have 4 litres of green paint left over from painting Rover's dog house. Will you share or dispose?	**23** You have 8 litres of red paint left over from painting your brother's house. Will you share or dispose?	**24** Cleaning out the garage, you found a dozen cans of various colours of paint left over from odd projects. Will you share or dispose?
25 You decided to switch to a less noisy, push-type lawnmower. How will you dispose of the can of mixed gas and oil you have left over?	**26** Because your garage is such a mess, you find you actually have about 12 litres of turpentine in various containers. That's a lot. How will you dispose or share?	**27** You have 2 litres of lacquer thinner that you no longer want around. Will you dispose or share?	**28** There are several cans and jars of half-evaporated paint solvent in your garage. Some still have brushes in them. How will you dispose?
29 You just changed the oil in your pick-up. You have 7 litres to dispose of.	**30** You just changed the oil in your compact car. You now have 3 litres to dispose of or store. What will you do?	**31** You just changed the oil in your car. You now have 5 litres to dispose of or store.	**32** You just changed the oil in your compact car. You now have 3 litres to dispose or store.

33

You just found out that ingredients in your grass fertilizer can leach into a local stream. How can you safely dispose of the 7 kg you have left?

34

You just discovered that the fly control pesticide you have been using is toxic to bees. Your neighbour has two hives so you decide to dispose of what you have left. What do you do?

35

You have decided to cultivate your garden without pesticides this year. How will you dispose of the 1.5 kg of Diazinon you have left over? Will you share, dispose or store?

36

You choose to use fish fertilizer in your garden. You may use this card in any garden space, even if it is full.

37

You have 4 kg of "Weed-be-killed" for your lawn. Use, dispose or share?

38

You buy some Systox to get rid of aphids on your roses. The package is larger than you need and you have 200 g to dispose of or share.

39

You discover an old box of rat poison in your basement, left there by a previous owner. Dispose of quickly!

40

You find an old box of Chlordane in the basement, left by a previous owner. Dispose of this banned pesticide or ask for help from your fellow players.

41

You have 400 g of slug bait. Use it, dispose or share.

42

You bought too much Captan to treat your potatoes before you planted them. Use it, dispose or share.

43

For some reason, you have 200 g of Sevin in the garage. You read the label and note that it is toxic to bees. Will you use it, dispose or share this pesticide with a neighbour?

44

Your neighbour brings you a carton of Parathion. This pesticide is now banned. How will you dispose of it?

45

You have an allergic reaction to your oven cleaner. How will you dispose of the rest of the can? Or will you share it with a neighbour?

46

You bought two cans of drain cleaner on sale. Today, you hear that your sister is coming to visit with her two small children. How will you dispose of it?

47

On a back shelf, you find an old bottle of drycleaning fluid -carbon-tetrachloride. On reading the label, you decide you don't want it around. How do you dispose of it?

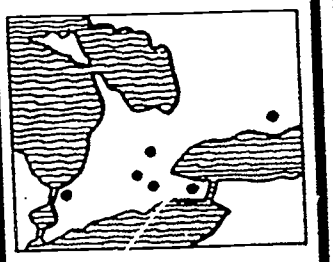
48

You bought 500 g of TSP for cleaning purposes. Having read about the effect of phosphates on lakes and streams, you decide to dispose of or share what's left.

49 Your grandmother just brought over 300 grams of DDT she had in her garage since WW II. You must dispose of it. This is a banned pesticide.	**50** Your mother-in-law sent you a carton of aerosol air fresheners for your birthday. You prefer, however, to just leave the windows open. Will you use, share or dispose?	**51** You just changed the anti-freeze in your pick-up. How will you dispose of the 4 litres of used anti-freeze?	**52** You have 1 kg of slug bait. Use it, share it, or dispose.
53 You have 4 litres of paint left over from painting your garage. Will you share or dispose?	**54** The local Municipality is holding a drive to collect unwanted pesticides. All players may dispose of any in their hand.	**55** You have 300 grams of Diazinon. Use it, share it or dispose of this common pesticide.	**56** You've found an old can of gasoline in your garage. You don't know how long it has been there or whether it has oil or water in it. How will you dispose of it?
57 Your local service station will now accept waste oil. Collect any that your neighbours have and dispose of it.	**58** You decide to switch to 250 ml of bleach in 1 litre of water as a household disinfectant. How will you dispose of the 4 litres of "Wonderclean" you have?	**59** You just changed the oil in your car and now have 5 kg to dispose of.	**60** If you can identify 4 sources of household hazardous wastes...skip the next turn.

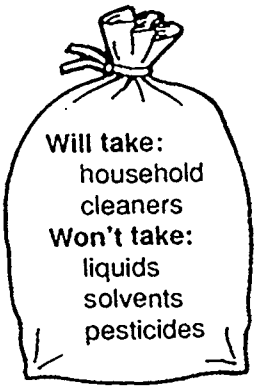
DISPOSAL GAME CARDS

DISPOSAL CARD



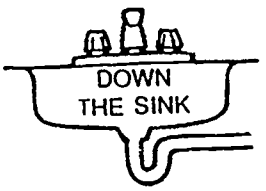
HAZARDOUS LAND-FILL TRANSPORTATION PERMIT.
Admits: banned pesticides and solvents.

DISPOSAL CARD



Will take:
household cleaners
Won't take:
liquids
solvents
pesticides

DISPOSAL CARD



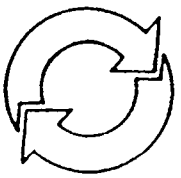
Can do:
household cleaners
anti-freeze (if not on septic system)
Can't do:
pesticides
oil
solvents.

DISPOSAL CARD

DEPARTMENT

Will take:
pesticides
Won't take:
solvents, paint, household cleaners, oil, batteries, anti-freeze.

DISPOSAL CARD
GAS STATION

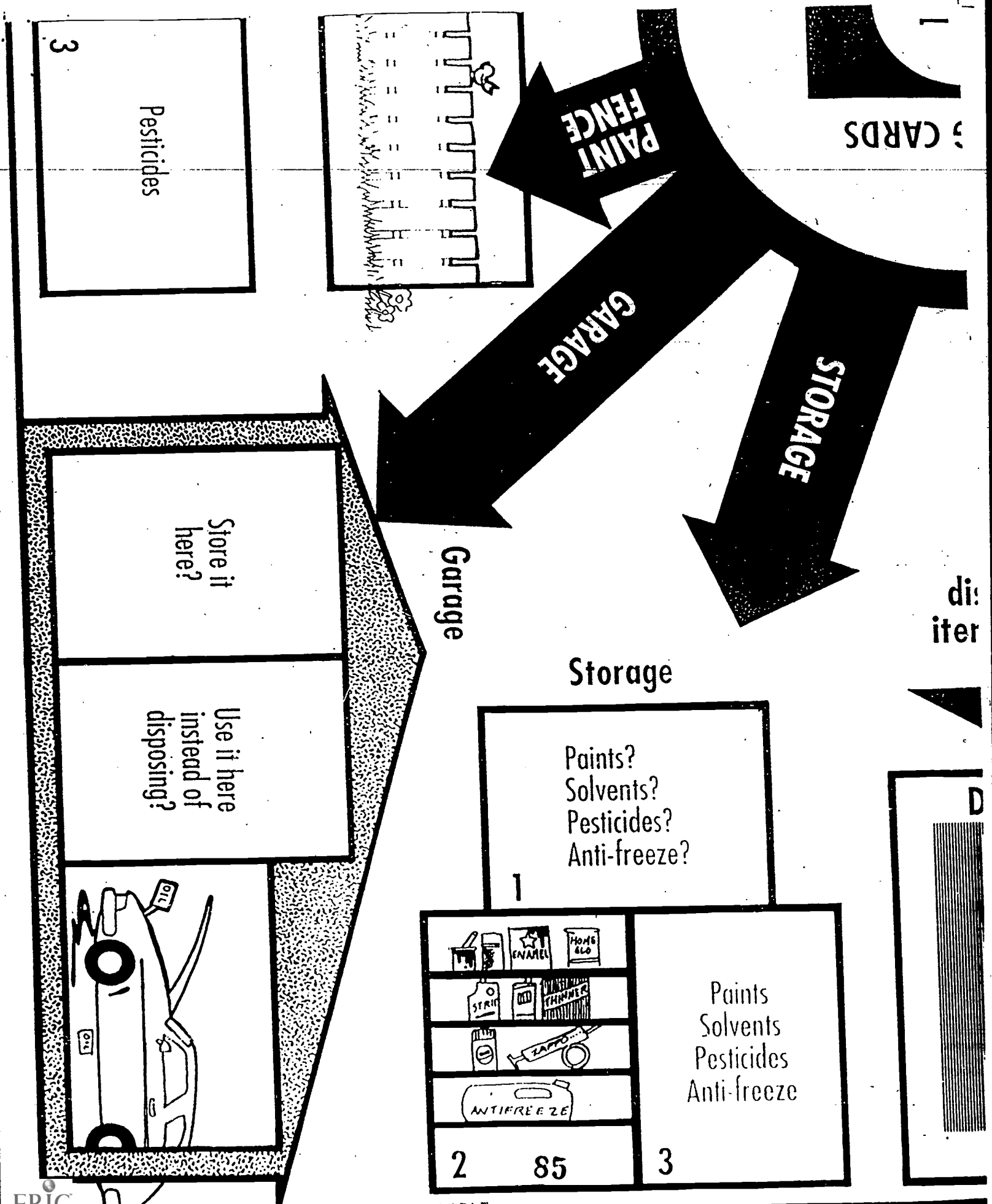


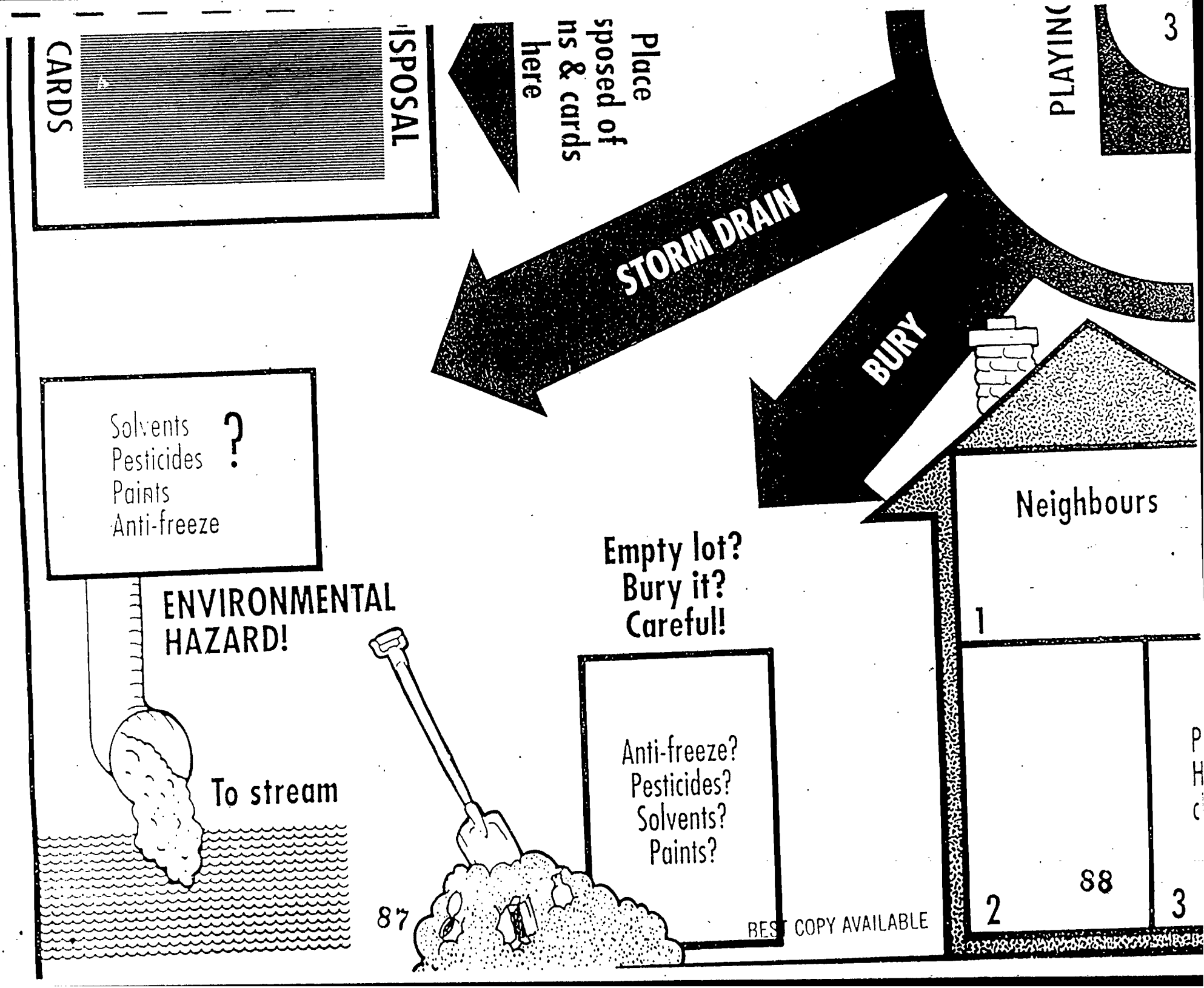
Will take:
oil, batteries, solvents
Won't take:
anti-freeze, household cleaners.

DISPOSAL CARD

Concerned Citizen Card.

Use in place of any other Disposal Card ... recycle, Dept. of Health sink/toilet, garbage can, hazardous waste dump.





4

CARDS

BURN

SHARE

SHARE

Your

2

Burning?
Careful!
ENVIRONMENTAL
HAZARD!

Pesticide
Containers

Neighbours'
garden

BEE HIVE

ints
ousehold
aners

4

Pesticides

8

Pesticides

2

Pesticides

3

APPENDIX A
BOOKS

Acid Rain Primer. The Primer examines acid rain – the rain that kills lakes, corrodes buildings, stunts trees, damages crops, and affects your health. Pollution Probe. 39 pp. 1981 $3.50

Barbour, Ian (ed.). *Western Man and Environmental Ethics: Attitudes Toward Nature and Technology* Don Mills: Addison-Wesley, 1973.

Brown, Michael. *Laying Waste: The Poisoning of America by Toxic Chemicals* Toronto: Random House, 1980.

Campbell, Monica and Glenn, William. *Profit From Pollution Prevention* A guide to industrial waste reduction and recycling. By combining general strategy information with specific waste reduction and recycling opportunities, this book demonstrates how companies can reduce their waste burden on the environment and save money in the process. Fourteen industries are discussed complete with charts, diagrams and photos. Toronto: Doubleday Canada Ltd., 1982. 404 pp. $25.00

Carson, Rachel. *The Silent Spring* New York: Fawcett, 1962.

Center for Science in the Public Interest. *The Household Pollutants Guioe* New York: Anchor, 1978.

Chant, Donald et al. *Effect on Human Health of Lead in the Environment* Toronto: Ministry of Health, 1974.

Crooks, Harold. *Dirty Business: The Inside Story of the New Garbage Agglomerates.* Toronto: James Lorimer and Company, 1984.

Dotta, Lydia and Schiff, Harold. *The Ozone War* Toronto: Doubleday, 1978.

Elder, P.S. (ed.). *Environmental Management and Public Participation* Toronto: The Canadian Environmental Law Research Foundation & The Canadian Environmental Law Association, 1975.

Edmond, D. Paul. *Environmental Assessment Law* Toronto: Edmond Montgomery, 1978.

Energy, Mines and Resources. *The Garbage Book: How to Save Energy and Money by Throwing Out Less* Ottawa: Ministry of Supply and Services, 1976.

Estrin, David and John Swaigen, eds. *Environment on Trial.* Toronto: New Press, 1977. A citizen's guide to environmental law. It gives a comprehensive coverage of environmental laws including how to use them , the government agencies responsible and the limitations of the laws. Available from: Canadian Environmental Research Foundation, 8 York St., Toronto, Ontario, M5J 1R2. 408 pp. $6.95.

APPENDIX A
BOOKS

Farallones Institute. *The Integral Urban House* San Francisco: Sierra Club Books, 1979.

Fuller, John G. *The Poison that Fell from the Sky* Berkley: Berkley Publications, 1979.

Gillies, M.T. *Drinking Water Detoxification* New Jersey: Noyes Data Corporation, 1978. Includes removal of trihalomethanes and discusses activated carbon absorption.

Goran, Morris. *Conquest of Pollution* Environment Design and Research Centre, Newtonville, Ma., 1981. Interesting discussions of how science, technology, legislation and education might work together to conquer pollution.

Grad, Frank et al. *The Automobile and the Regulation of Its Impact on the Environment* Norman, Oklahoma: University of Oklahoma Press, 1975.

Howard, Ross. *Poisons in Public* Toronto: James Lorimer & Co., 1980.

Hutchinson, G. & D. *Grassy Narrows* Toronto: Van Nostrand Reinhold, 1977.

Jackson, John, Phil Weller, and WPIRG. *Chemical Nightmare: The Unnecessary Legacy of Toxic Wastes* Toronto: Between the Lines, 1982. This book provides a current, comprehensive coverage of the hazardous waste situation in Ontario. It reviews the nature of the problem, presents information on the waste management industry, examines government controls and discusses possible solutions to the problem. 128 pp. $5.95.

Janes, J. Robert. *Danger on the River* Toronto: Clarke Irwin and Company, 1982. Offers that rare and winning blend of education and entertainment for the young reader. When pollution threatens to destroy the favourite river-bank haunt of a trio of boys and a pair of girls who alternately spy on the boys and reciprocate their teasing, this unlikely group becomes fast-bound friends and learns about responsibility for the environment as they hunt the perpetrators of the contamination.

Kruss, P. & Valeriote, I.M, (eds.). *Controversial Chemicals: A Citizen's Guide* Montreal: Multi-Science Publications at McGill, 1979.

Leiss, William. *Domination of Nature* Toronto: Doubleday, 1972.

Leiss, William (ed.). *Ecology Versus Politics in Canada* Toronto: U of T Press, 1979.

Lovins, Amory. *Soft Energy Paths: Toward a Durable Peace* Cambridge: Ballinger, 1977.

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BOOKS

McKinney, J.D. ed. *Environmental Health Chemistry – The Chemistry of Environmental Agents as Potential Human Hazards* Ann Arbor, Michigan: Ann Arbor Sci., 1981. Physiochemical factors in routes and rates of human exposure to chemicals.

Miller, G. Tyler, Jr. *Replenish the Earth: A Primer in Human Ecology* California: Wadsworth Pub., 1972. Provides an "overall ecological worldview" by developing some major ecological concepts such as the first and second Laws of Thermodynamics, the structure of ecosystems, ecosystem function, diversity and stability and cybernetics, and by applying these concepts to specific ecological problems.

Nader, Ralph *Vanishing Air* New York: Grossman Publishers, 1970.

Office of Appropriate Technology *Rural Wastewater Disposal Alternatives* State of California: Governor's Office, Office of Planning and Research, 1977.

Ontario Public Interest Research Group *Acid Rain: The Silent Crisis* Toronto: Between the Lines, 1980.

Philbrick, John & Helen *The Bug Book: Harmless Insect Controls* Charlott, Vt.: Garden Way Publishers, 1974.

Pim, Linda *Additive Alert* Toronto: Doubleday Canada Ltd., 1979. 116 pp. $4.50. Did you ever wonder why you were eating Polyoxyethylene (8) Stearate? Or what you could do about it? In this handbook for the food shopper, Linda Pim sounds the alert on suspicious food additives and explains what you can do to voice your concern.

Pim, Linda *The Invisible Additives* Toronto: Doubleday Canada Ltd., 1981. $10.50. Linda Pim looks at the risk to our health that is posed by the unintentional contamination of our daily bread by chemicals in the environment.

Pojasek, Robert B. ed. *Toxic and Hazardous Waste Disposal* Ann Arbor, Michigan: Ann Arbor Sci., 1979. Three volumes:
Vol. 1: Processes for Stabilization/Solidification
Vol. 2: Options for Stabilization/Solidification
Vol. 3: 1980 Impact of Legislation & Implementation on Disposal Management Practices – US, UK, Germany, Australia, Japan.

Rapid Assessment of Sources of Air, Water, and Land Pollution, World Health Organization, Geneva, 1982. How to calculate pollution loads from a variety of sources (e.g., air pollution from stationary combustion sources, industrial effluents, municipal solid wastes). Practical guide with working tables.

APPENDIX A
BOOKS

Resource Recovery and Recycling Handbook of Industrial Waste New Jersey: Noyes Data Corporation, 1975. Concentrates on the process technology for resource recovery and recycling – not economic factors. Categories: complex waste (municipal), ferrous metals, non-ferrous metals, food and beverage, glass and ceramics, heat, inorganic materials, natural products, organic materials, paper and wood mill wastes, plastics and fibers, and rubber.

Russell, Clifford (ed.) *Safe Drinking Water: Current and Future Problems* Washington: Resources for the Future, 1978.

Schneider, Jan *World Public Order of the Environment: Towards an International Ecological Law and Organization* Toronto: U of T Press, 1979.

Sittig, M. *Toxic Metals: Pollution Control and Worker Protection* New Jersey: Noyes Data Corporation, 1976. Condensation of vital data that are scattered and difficult to put together; interpretations; case histories for 18 toxic metals from antimony to zinc and including cadmium, chromium, lead, mercury. Covers toxicity, extent of exposure, detection, environmental standards, handling procedures, removal from air, removal from water, solid waste disposal, economic impact of controls, and references.

Sittig, M. *How to Remove Pollutants and Toxic Materials From Air and Water* New Jersey: Noyes Data Corporation, 1977. 621 pp. Covers all recent new patent information on pollutant removal processes from acetone – automotive exhaust gases – dairy effluents – EDTA – formaldehyde – ketones – mercury – paint wastes –selenium – zinc.

Sittig, M. *Hazardous and Toxic Effects of Industrial Chemicals* New Jersey: Noyes Data Corporation, 1979. Working guide for industrial hygienist and other persons concerned with the status of potentially dangerous substances in industry. Gives: description, potential occupational exposure, routes of entry, harmful effects, personal protective methods, etc. 460 pp.

Sittig, M. *Landfill Disposal of Hazardous Wastes and Sludges* New Jersey: Noyes Data Corporation, 1979. Technology including waste preparation, site selection, design (eg. leachate control), construction and operation, monitoring, economic aspects, final land use.

Sittig, M. *Priority Toxic Pollutants: Health Effects and Allowable Limits* New Jersey: Noyes Data Corporation, 1980. 65 priority toxic pollutants (reflecting 129 individual compounds) giving: occurence, physical properties, chemical properties, uses, toxic effects, current levels of exposure, special groups at risk, existing U.S. guidelines and standards, summary of proposed criteria, bases for human health criteria, references. Excellent, objective summary information. 370 pp.

Thurlow, William *Matacil Spray Report* Gander, Nfld: Gander Environmental Group, 1979.

APPENDIX A
BOOKS

Troyer, Warner *No Safe Place* Toronto: Clarke, Irwin & Co., 1977.

Van den Bosch, Robert *The Pesticide Conspiracy* Toronto: Doubleday, 1978.

Waldbott, G.L. *Health Effects of Environmental Pollutants* St. Louis: C.V. Mosby Co., 1973. 316 pp. Pollutant damage to vegetation, toxic action, body's defenses, health effects of a number of different agents (eg. lead, fluoride, hydrocarbons) categorized according to similarity of effects.

Walters, D.B. *Safe Handling of Chemical Carcinogens, Mutagens and Terratogens and Highly Toxic Substances* New Jersey: Noyes Data Corporation, 1978. Over 125 chemicals including ferric chloride, nitric acid, titanium dioxide, chrome yellow pigment.

Warshall, Peter *Septic Tank Practices: A Guide to the Conservation and Re-use of Household Wastewater* Garden City, NY: Anchor Press, 1979.

Weiss, G. ed. *Hazardous Chemicals Data Book* New Jersey: Noyes Data Corporation, 1980. Information on over 1000 substances, including physical information (boiling point, specific gravity, heat of decomposition), hazard classification, chemical reactivity, health hazards, water pollution (potential for food-chain concentration, aquatic and waterfowl toxicity) etc.

Weller, Phil and the Waterloo Public Interest Research Group *Acid Rain: The Silent Crisis* Toronto: Between the Lines, 1980.

Whiteside, Thomas *The Pendulum and the Toxic Cloud* New Haven, Conn: Yale U Press, 1979.

APPENDIX B
AUDIO-VISUAL AIDS

The number in brackets after the title refers to the appropriate source, listed at the end of this section.

A Lake in Need (4)

Through the combination of photographs and artistic illustrations, this slide show depicts the origin and growth of a lake, its role in nature, man's major threats to a lake's survival, the acid rain problem, and what an individual can do to help save our lakes. 13 mins. 5 sec. Pulsed cassette tape narration and script.

A Matter of Common Sense (4)

Garbage begins in the home. One family's approach to controlling and recycling waste is related to the broad environmental issue. Produced by the Ministry for general audiences. 13.5 minutes, color.

A Product of our Time (4)

In this documentary, Environment Ontario examines the complex issue of liquid industrial waste disposal. The facts are outlined in this 25-minute video cassette and experts discuss their ideas on dealing with a necessary byproduct of our industrial society.

Acid Rain (6)

Just a Drop of Water – 15 min. 30 sec.
The Barriers to A Solution – 17 min. 15 sec.

These two independently produced slide shows are based largely on interviews conducted with representatives from the North American scientific community and organizations prominent in the debate on finding and implementing an effective solution to the acid rain problem that is threatening our lakes. "Just a Drop of Water" summarizes the causes, effects and proposed solutions. "The Barriers to a Solution" points out many of the social, political and industrial barriers which must be overcome before a solution can be implemented. Pulsed cassette tape narrations.

Acid Rain: Requiem or Recovery (5)

An examination of the scientific, social, and cultural implications of acid rain in North America, this film shows its negative effects on lakes, plant and animal life and even historic monuments such as the Statue of Liberty. Long and short term solutions to the problem are considered, and its international nature is emphasized. Graphics and maps complement live-action filming, both in laboratories and on location. 26:50 106C 0181 527

Air! (5)

This short animated film without words makes a strong statement about the need for oxygen by all living things and underlines the plight of plants, birds, fish, and man as pollutants destroy this precious substance. 2 03 106C 0372 079

APPENDIX B
AUDIO-VISUAL AIDS

Air Pollution: Cause and Effects on New York State Plants (1973) (1)

Transportation, industry, electrical power generation, and refuse disposal are a few of the major sources of air pollution. This slide set examines the effects on plants of air pollutants, such as sulphur dioxide, ozone, nitrogen dioxide, anhydrous ammonia, chlorine, and hydrogen fluoride. This study was conducted in New York State, but similar plant life exists in Ontario. Audio tape.

Canwell: A Canadian Waste Management System (5)

A new waste treatment plant developed by the Ontario Research Foundation in conjunction with CMHC offers the alternative of converting and recycling waste. 23 min. colour 16 mm 106C 0178 021

Chemical Conquest (1956) (1)

Insects, plant diseases and weeds threaten crops. This film examines chemical research and traces development of a new pesticide from lab to land. The film notes how modern man's mono-agriculture results in an unnatural and unbalanced state that leaves crops open to attack by pests. The film examines other questions about the ultimate effects of toxic substance on food-producing, soil, humans, and non-human life, including insects considered to be of a beneficial nature. colour, 24 minutes.

Chemical Dumping in Niagara (10)

17 minutes, video tape.

Chemical-Ghosts (10)

video tape

Clean waters (2)

Points out the benefits of clean streams and waterways and demonstrates the dangers from polluted waters to public health, fish life, property values, and recreational areas. colour, 18 minutes.

Conservation and Balance in Nature (1966) (1 and 2)

This excellent film investigates the balance in natural ecological systems as related to the question: What is man doing to his environment? Inter-relations of organisms in food webs is delicately balanced. A wide variety of animal adaptations is shown and their significance to community balance is discussed. The examples are used to stress that adaptation is measured in terms of reproductive success. The role of man in altering the existing balance in biological communities is examined critically. The film is most effective if the students have some prior knowledge of such ecological concepts as: adaptation, habitat, reproductive success, succession, food chains and energy transfer in an ecosystem. colour, 18 minutes.

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Crisis in the Rain (4)

A 28 minute documentary film on the acid rain problem as it effects Canada and the United States, dealing with transboundary air transport, originating sources, scientific findings and ultimate solutions to the problem. colour.

Danger Poison (1968) (1)

The viewer learns the proper use and storage of virtually all dangerous products likely to be encountered in the home. Designed for showing to children of elementary school age who are starting to use potentially poisonous substances such as plastic glue, detergents, and cleaning fluids. colour, 14 minutes.

Dioxins (9)

Examines the various Dioxin defoliants used in the lumber industries and during the Vietnam War. 62 min. colour 16 mm. Time-Life 1979.

Dioxins (10)

17 minutes, video tape.

Dioxins in Lake Ontario (10)

5 minutes, video tape.

Drink No Longer Water (8)

A recent film exploring the feelings of Stouffville residents fighting their dump and the official positions on the situation.

Effects of Air Pollution on Plant Life (1972) (1)

Three major types of plant life – vegetables and fruit, field crops, and ornamental plants and trees – are examined and the cause of damage is identified. The slides go into very little detail and as a result the lesson is largely a visual experience. Slides, colour.

Freshwater World (5)

The ways in which bodies of fresh water can deteriorate are analyzed and proposals for their restoration are examined in this documentary. Laboratory and location projects for measuring the effects of pollution on fish, developing fish farming, and observing how freshwater creatures respond to such developments as hydro-electric generating sites are shown. 24:22 106C 0174 615

Hazardous Waste (10)

Produced by Environment Canada. This film explores various facets of the hazardous waste problem.

Hooker Dump at Hyde Park Leaching into the Niagara (10)

video tape.

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Industrial Waste Disposal (10)

5th Estate video tape.

In Our Water (7)

A documentary of the fight of a New Jersey family to close down an industrial landfill site which was contaminating their water. Contains lessons applicable to all people. 58 min. colour 16 mm, 198.

Join The Waste Watchers (6)

Includes 65 slides, tape cassette and script. Describes the various methods of waste disposal with emphasis on resource recovery. Also calls for consumer action.

Multiply and Subdue the Earth (2)

This excellent film examines the history of our attitudes towards the rest of nature and how they have become ones of mastery, conquest and dominance. The consequences are explained. The impact of the Judeo-Christian doctrine in the development of western man's attitudes is critically examined. Environmentalist Ian McHarg offers his opinions throughout the movie. The development of an environmental ethic is encouraged. Part II examines various aspects of the land use problem in a number of localities throughout the United States.

Niagara River, Toronto Drinking Water, Stouffville,
High Level Radioactive Waste (10)

1 hour videotape.

PCBs – A Plague on Our Children (10)

two video tapes, 16 minutes each.

Pesticides and Health (10)

4 video tapes.

Pesticides and Their Safe Use in and Around the Home (1969)

Designed to make people more aware of the need for safe use of these poisonous chemicals and to suggest alternatives. Viewers are advised where and when to use pesticides and how to store and dispose of containers. Slides, colour, set of 48.

Pesticides in Focus (1971) (1)

Produced by Shell Oil Company, this film supports the use of pesticides in attempting to answer questions, doubts and fears concerning pesticides. It tells of the intensive research efforts and of the continuing control and checks devoted to ensuring that pesticides can be used without hazard.

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Poisons, Pests and People (1960) (1 and 2)

Experts examine the effects of widespread use of chemical insecticides both on the insect population and on warm blooded creatures, including human beings. Part 1 examines the ravages of insects and man's centuries-old struggle to keep them under control. Part II shows experiments being conducted to find means of controlling specific insects, while not affecting others.

Project Environment (4)

This film provides a look at the pollution problems in this Province, some of the solutions, and the role of the Ministry of the Environment and its staff in managing the environment in Ontario. This is recommended as a 'first choice' for those interested in an overview of the environmental problems in the Province. 15 minutes, colour.

Promises To Keep (11)

A slidetape show from the International Joint Commission explaining the Great Lakes Water Quality Agreement. 12 minutes slidetape, 1981.

River (Planet Earth) (5)

This tongue-in-cheek film has a sober message about freshwater resources. A professor and his student, observers from outer space, discuss a river system (the Saskatchewan) and its importance to the ecology, economy, and the habitation of the region. They pay particular attention to the ramifications of natural and man-made changes to the system. 27:50 106C 0177 519

Saving The Great Lakes (5)

This film examines the problems caused by the pollution of the Great Lakes, and evaluates the efforts being made by scientists, governments, and industry to restore these bodies of water to a non-toxic state. Different approaches to sewage treatment are discussed and the tremendous need of manufacturing industries for water is illustrated. A combination of scientific know-how and political will are the crucial components required for a solution. (CBC) 15:27 106C 0176 269

SCA Pipeline to Dump in Niagara (10)

video tape.

Solution to Love Canal (10)

34 minutes, video tape.

The Biosphere (5)

The Mackenzie and Amazon River valley are 10 000 km apart from one another and are ecologically distinct. Yet, in a subtle sense they are collaborating elements within the biosphere, the Earth's thin layer of living matter. In this film are seen two of the world's myriad river ecosystems and how they are linked with the biosphere. 56:31 106C 0179 085

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The Case Against The Rain "Update" (4)

Acid rain is one of the greatest envrionmental challenges facing scientists and governments throughout eastern North America and Europe today. What does this mean to Ontario? An 18-minute documentary defines the technical causes and effects of acid rain, outlines the economic implications and explores the Ministry's ongoing research effort. Available on 3/4" or 1/2" videocassette (VHS or Beta). French version also available.

The Choice is Yours (3)

A Ministry of the Environment film designed for general audiences but perfectly suitable for classroom use. It combines elements of historical significance of water in Ontario's development, while capturing the seriousness of the present pollution problem. After stating government's responsibility in combatting the problem, the film calls for the viewers' committed assistance.

The Garbage Ourobouros (5)

Nature always recycles but man has broken a natural cycle through industrial production, which creates mounds of permanent waste. Presents the ideas and some of the mechanical monsters that scientists and technologists have created to build a recycling and reprocessing industry. 28 min. colour 16 mm 106C 0175 209

The Insect War (1972) (1)

This excellent film discusses why we are so dependent on methods of pest control in today's world, and the problem of continuing insect adaptation to chemical methods of control. The relationships that exist in the insect world and the effects of various pesticides on that world are described. The film discusses and gives examples of successful cases of biological control.

The Rise and Fall of The Great Lakes (1969) (1 and 2)

The Great Lakes have been molded by nature and by man. This film shows how they were first formed by glaciation and how they have been changed more recently by modern civilization. These changes are illustrated by the journey of a Great Lakes canoeist who travels through ice age, flood and present day pollution. The film which shows how man is contributing to the fall of the Great Lakes, is narrated largely by folk-songs.

The River Must Live (1969) (1 and 3)

This European-produced film is an excellent study of pollution and its ultimate effects when it continues unchecked in a watercourse. Solutions are proposed and treatment methods are discussed. Highly recommended.

APPENDIX B
AUDIO-VISUAL AIDS

Threat, Insult and Challenge (12)

15 minutes, VHS, Beta or 16mm film.

Toxic Chemicals (10)

14 minutes, video tape.

Vandals Prevent SCA Dumping into Niagara River (10)

video tape.

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APPENDIX B
SOURCES OF AUDIO-VISUAL AIDS

1. Film Library (517) 824-4120
   Information Branch,
   Ministry of Agriculture and Food,
   Guelph, Ontario
   N1G 2W1

2. Film Library, (416) 965-5411
   Information Branch,
   Ministry of Natural Resources,
   5th floor, Whitney Block
   99 Wellesley Street West,
   Toronto, Ontario
   M7A 1W3

3. Modern Talking Picture Service (416) 444-7347
   1943 Leslie Street,
   Don Mills, Ontario
   M3B 2M6

4. LM Media Services (416) 475-3750
   143 Sparks Avenue
   Willowdale, Ontario
   M2H 2S5

5. NFB of Canada (416) 369-4094,3
   Regional Office
   Mackenzie Building
   1 Lombard Street,
   Toronto, Ontario
   M5C 1J6

6. Ministry of Environment Slide Shows
   Communications Branch
   6th Floor,
   135 St. Clair Avenue West,
   Toronto, Ontario
   M4V 1P5

7. Dec. Films, (416) 964-6901
   427 Bloor West,
   Toronto, Ontario $65.00 rental fee
   M5S 1X7

8. Magic Lantern Film Distributors Ltd. (416) 884-7216
   872 Winston Churchill Blvd.,
   Oakville, Ontario
   L6J 4Z2

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SOURCES OF AUDIO-VISUAL AIDS

9. Marlin Motion Pictures, (416) 272-4100
   211 Watline Ave.,
   Mississauga, Ontario $66.00 rental fee
   L4Z 1P3

10. Environment Canada (416) 966-5840
    25 St. Clair Ave. E.
    Toronto, Ontario
    M4T 1M2

11. IJC Great Lakes Regional Office
    Suite 880, 100 Oulette Ave.,
    Windsor, Ontario
    N9A 6T3

12. Ontario Waste Management Corporation 1-800-268-1179
    2 Bloor St. West, 11th Floor,
    Toronto, Ontario
    M4W 3E2

TEACHERS' EVALUATION

How useful did you find this guide in preparing lesson material or teaching the subject of hazardous waste?

Is the structure or sequence of presentation logical and easy to follow?

Are the suggested activities suitable for achieving the teaching objectives?

Can you suggest any improvements to the structure and/or contents of this Teachers' Guide?

Additional comments:

Thank you for taking the time to respond.

Please return this evaluation to:

Coordinator, Communication Programs
Ontario Waste Management Corporation
2 Bloor Street West
11th Floor
Toronto, Ontario
M4W 3E2