

Chapter 2
HAZARDOUS HOUSEHOLD CLEANERS:
THE NEED FOR ALTERNATIVES
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Introduction

Every year the number of cleaning products available to the consumer increases; old ones are "improved" and new ones promise superior performance. Though many may argue that the benefits of these products far outweigh any harmful aspects, the fact is that not enough is known about the products; evidence shows that some ingredients of household cleaning products are hazardous substances with harmful effects on humans and the environment.

The number of chemicals that circulate in our environment totals over one-half million different types, with approximately 800 new chemicals added to this total every year (OSU, 1978). After use, these chemicals must be disposed of in some way. Though small generators of hazardous wastes contribute only eight percent of the total hazardous wastes disposed of in the Bay Area (about one ton per month) (Jackson, 1983), the consumer's contribution cannot be readily dismissed.

This report focuses on the problems created by the use of hazardous household cleaners in the city of Berkeley. Evaluation of the presence and scope of the problems is based on a survey of Berkeley residents and research. Problems include short- and long-term health effects, as well as environmental effects. In order to minimize these problems, suggestions for proper use of, proper disposal of, and alternatives to household hazardous cleaners are given.

There are many types of cleaners on the market today. Household cleaners, in the broad sense, include disinfectants, furniture polish, dry cleaning fluid, floor cleaners and waxes, laundry products, and rug cleaners. The type of cleaners covered in this report is limited to a select few due to the complexity and number of chemicals involved in these products; to cover them all would be a lengthy task. This report deals with bleach, disinfectants, drain cleaners, general purpose household cleaners, ammonia, oven cleaners, scouring powders, and toilet bowl cleaners.

Past Work

There are a myriad of pilot studies, surveys, projects, and test programs that deal with the problems of household hazardous substances and wastes. The most recent report is a handbook designed for California officials which focuses on the regulations, problems, and possible solutions concerning the issue of household hazardous wastes (Doherty, 1983).

A recent report on the sources of toxic compounds found in household wastewater stresses the issue of hazardous materials present in many consumer products, and the dangers posed through their use and disposal in the home (Hathaway, 1980). A somewhat related report for Nassau County, New York, includes a survey of consumer products which are suspected of contaminating groundwater in the area (Dowling, 1971). The Center for Science in the Public Interest investigated the plethora of household products which may pose problems to the consumer. In-depth information on the contents, health hazards, and possible alternatives to many consumer products is presented in The Household Pollutants Guide (CSPI, 1978).

The most intensive research on the subject of household hazardous substances and wastes to date is a study done by the Metro Toxicant Program in Oregon. The final report consists of five separate components discussing everything from toxicants in consumer products to public opinions and actions on the topic of hazardous wastes (Ridgely, 1982).

Federal and State Regulations

There are both federal and state regulations that apply to users and generators of hazardous substances and wastes. On the federal level, two major acts control toxic and hazardous substances: the Resource Conservation and Recovery Act (RCRA), aimed primarily at the regulation and control of hazardous wastes, and the Toxic Substance and Control Act (TSCA), which focuses on toxic substances rather than wastes. TSCA provides blanket approval for every chemical already on the market before 1976, meaning they do not require any testing for product safety whatsoever (Doherty, 1983).

State law makes a distinction between hazardous substances and hazardous wastes, as well as stating strict regulations on their management by both large and small users and generators. According to the Health and Safety Code, Section 28743, almost all cleaners are hazardous substances. The definition of a hazardous waste in Section 25117 of the Health and Safety Code encompasses many household substances, including cleaners. Therefore, all state regulations that deal with hazardous substances or wastes apply to any user of hazardous household cleaners. However, the letter of the law is often broken since enforcement is difficult, and many consumers are unaware that they themselves are handlers of hazardous substances and wastes.

Consumer protection laws which govern the marketing of hazardous consumer products deal with chemical testing and labels on the product containers. In California, Section 28755 of the Health and Safety Code requires every container of a hazardous substance to bear a specific label. Each label must state: (1) the name and place of business of the manufacturer, packer, distributor, or seller; (2) the common, usual, or chemical name of the components which contribute substantially to the danger of the produce; (3) signal words such as "DANGER", "WARNING", etc., according to the degree of toxicity; (4) precautionary measures in handling the product; and (5) instructions for

first aid treatment, as well as the warning "Keep out of the reach of children."

Labels are not required by law to list all ingredients, only those which contribute substantially to the danger of the product. Therefore, most ingredients may legally be listed under broad categories, such as "whitener" or "surfactant," or simply as "inert" ingredients; laws allowing this were made to protect the manufacturer's trade secrets. The labelling of "no phosphorus" or "no carbon tetrachloride," often seen on labels, is a result of those ingredients being specifically restricted by law (Dowling, 1971).

Ingredients

The ingredients of hazardous household cleaners have several properties that make their real dangers hidden to the consumer. Potentially hazardous substances found in most cleaners include caustic acids, designed chemically to attack organic matter, and organochlorines, a mixture of hydrogen, carbon, oxygen, and chlorine. Organochlorines are rarely, if ever, found in nature. Thus, they are poorly degradable or non-degradable, persist in the body and the environment, are fat soluble, and have the potential of concentrating in the food chain (Epstein, 1979). Although it is difficult to determine the exact ingredients of all cleaners, especially because of trade secret laws, many of the major ingredients are known for most cleaners (Table 1).

In general, most consumers do not give ingredients a second thought, and rely on the belief that the products must be safe since they are allowed on the market. Several factors make it difficult for the consumer to identify potentially hazardous cleaners. One problem is the general lack of knowledge about and familiarity with chemical ingredients. First of all, the scientific names themselves can be quite confusing; a name such as "Bis (2-Chloroisopropyl) Ether" means next to nothing to the common consumer. To make matters worse, common names and synonyms can legally be used in place of the scientific name. Some chemicals have more than 20 synonyms or trade names. For example, chloroethane, an ingredient found in many general cleaners, has twenty-one synonyms or trade names (Hathaway, 1980).

Other labelling practices cloud the picture even further. Ingredients labelled "inert" by the manufacturer are not necessarily inert according to the toxicologist, physician, or public health official. For example, methylene chloride, a harmful chemical, is labelled as "inert" on several household disinfectants (Dowling, 1971).

Long-Term Effects of Hazardous Substances

Of the two million known chemicals, only about 6,000 have been laboratory tested for carcinogenicity (OSU, 1978). There are several deficiencies in the assessment methods for long-term effects of suspected carcinogenic substances. Since many chemicals are tested for acute effects only, little is known about the possible risk of normal (long-term, low level) exposure to the average consumer

<u>Cleaning Agent</u>	<u>Common Ingredients</u>	<u>Dangers</u>
<u>Bleach</u>	<ul style="list-style-type: none"> • chlorine • sodium hypochlorite • sodium hydroxide • sodium carbonate 	Poisonous chloramine gas produced when mixed with ammonia or any cleaners containing ammonia.
<u>Ammonia</u>	<ul style="list-style-type: none"> • (Found in oven cleaners, all-purpose cleaners, floor polishes, and window cleaners.) 	<p>Vapors irritating to eyes, respiratory tract, and skin. Gives off deadly chloramine gas when mixed with any cleaner which contains bleach and its derivatives. Can cause burns on skin, and in eyes, mouth, and throat. Strong vapors at high concentrations may cause temporary blindness.</p>
<u>Disinfectants</u>	<ul style="list-style-type: none"> • Phenol compounds • Iodophors • Pine oil 	<p>Vapors may cause lung and eye irritation. Mild skin irritant; severe eye irritant. Thought to be absorbed through skin; long term toxic effects unknown.</p>
<u>Drain Cleaners</u>	<ul style="list-style-type: none"> • Lye • sodium nitrate • sodium chloride • sodium hydroxide • potassium hydroxide • hydrochloric acid • sulfuric acid 	<p>Extremely dangerous to all parts of body, especially eyes and skin; can cause blindness. There is no effective antidote. Vapors in respiratory tract may produce glottal edema, bronchitis, pulmonary edema, or death. Highly corrosive; may produce burns and scarring on skin.</p>
<u>Oven Cleaners</u>	<ul style="list-style-type: none"> • Lye • potassium hydroxide • sodium hydroxide • ammonia 	<p>Same as drain cleaners. Aerosol cans may explode at high temperatures. Fumes can damage the lungs. Causes serious burns.</p>
<u>Toilet Bowl Cleaners</u>	<ul style="list-style-type: none"> • calcium hypochlorite • hydrochloric acid • oxalic acid • sodium bisulphate 	<p>Corrosive to mouth, esophagus, and stomach; irritant to eyes and respiratory tracts. Sodium bisulphate sulfuric acid when mixed with water. Chronic skin irritant.</p>
<u>Scouring Powders</u>	<ul style="list-style-type: none"> • sodium phosphate • bleach • abrasive (silica volcanic ash, feldspar) 	<p>Do not combine with ammonia cleaners. Strong concentrations attack skin, eyes, and lungs. Chlorinated TSP currently being tested for carcinogenicity.</p>
<u>All-Purpose Cleaners</u>	<ul style="list-style-type: none"> • detergents • ammonia • ethylene glycol ether solvent 	<p>Those with petroleum distillates most harmful to lungs. May irritate skin and eyes. Data for long term effects not available.</p>

Table 1. Typical Compounds Found In Cleaning Agents And Dangers Associated With Them.
Source: Doherty, 1983.

(Ridgely, 1982). Current carcinogenicity tests are deficient in their simplistic nature, such as in testing only one chemical at a time. The tests thus do not accurately reflect the potential consequences of multiple and sequential exposure to the many possible carcinogens in the general environment. Furthermore, interactions between a non-carcinogenic substance with a carcinogenic substance may increase the potency of the carcinogen (Epstein, 1979).

In spite of test deficiencies, several trends have been observed. Industrial chemicals are now believed to make a great contribution to the incidence of cancer. For example, males show a higher cancer mortality rate in counties with heavy concentrations of petrochemical industries. Higher lung cancer rates are also correlated with areas near chemical and paper industries (Epstein, 1979). It is estimated that as much as eighty-five percent of cancers are induced by human contact with environmental carcinogens in the water, air, food, and some consumer products (Schnaiberg, 1980).

Another long-term health effect of chemicals in the environment is called Immune System Dysregulation, or, more commonly, Environmental Illness. This illness can develop over a long period of time due to repeated infectious diseases and/or cumulative exposure to toxic chemicals found in our everyday environment (Dadd and Levin, 1982). The chemicals cause the immune system to malfunction, resulting in an intolerance to these chemicals. There is an Environmental Illness Association based in Berkeley, with approximately 325 members from around the Bay Area (Bonbay, 1984, pers. comm.).

Berkeley Survey

To investigate the use of cleaning products by the residents of Berkeley, a survey was conducted by four members, including the author, of the Senior Seminar. A survey prepared by the Association of Bay Area Governments (ABAG) was used as a framework to which the surveyors added their own questions. The survey was conducted by telephone during approximately one week. Details of the methodology are discussed in the Appendix to Section IV.A. There were 69 responses to the survey. The results are summarized in Table 2.

Health Hazards - Initial Contact

It was found that of the 69 respondents in the Berkeley survey, more than 24 percent reported some type of health effect with initial contact while using cleaners. There are several ways in which a user of cleaning products can come in contact with its hazardous ingredients. The user may need to come in direct contact for normal use, accidentally spill some of the substance on himself, breathe fumes given off by the cleaner, or get small amounts of the cleaner in the eyes or mouth. The potential health hazards with initial contact are summarized in Table 1.

Questions and Percent Response For Each Answer (As % of Total N = 69)				
1. Do you use household cleaners? (bleach, disinfectants, detergent, oven cleaners, window cleaners)				
	Yes: 96 No: 4			
2. If yes to the above, do you ever dispose of any excess or waste, or dispose of any containers that still contain some of the product?				
	Yes: 12 (As percent of 96%) No: 88			
3. If yes to disposal above, what method do you use?				
	Down drain: 38 (As percent of 12%) Put in trash: 38 Storm drain: 12			
4. Do you use chemical drain openers?				
	Yes: 41 No: 59			
5. If yes, do you ever dispose of any excess or waste, or dispose of any containers that still contain some of the product?				
	Yes: 7 (As percent of 41%) No: 59			
6. What method, if yes?				
	In trash: 67 (As percent of 7%) Store: 33			
7. Do you usually read the medical and precautionary information on the labels before you use any cleaning product?				
	Most of the time: 70 Sometimes: 19 Seldom: 7 Never: 6			
8. How often do you use:				
		Times per Week		
	0-2	3-5	5	
Strong Cleaners (drain, toilet, oven cleaners, ammonia, bleach)	87	13	1	
All-Purpose Cleaners/Disinfectants (scouring powders, bathroom cleaners)	70	22	8	
9. In using any of the above cleaners, have you ever:				
	Yes	No		
Experienced eye irritation?	26	74		
Experienced burns or skin irritation?	20	80		
Been overcome by strong fumes?	26	79		
Required medical attention?	0	100		
10. Do you ever use any of the following in your cleaning practices? (a=all the time, b=sometimes, c=seldom, d=never).				
	a	b	c	d
bleach and water	18	30	33	20
chlorine and water	4	8	10	76
cornstarch	1	0	11	85
soap and water	92	2	1	2
steel wool pads	23	33	21	21
vinegar	8	13	18	59
baking soda	4	36	27	31
11. Do you wish that the labels on your household cleaners contained more information about the ingredients of the cleaners?				
	Yes: 64		No: 33	
			Don't care: 2	
12. Do you wish that you were more informed about some of the health hazards of the chemicals in your cleaners?				
	Yes: 81		No: 15	
			Don't care: 2	
13. Do you wish that you were more informed about some of the environmental hazards of the chemicals in your cleaners?				
	Yes: 97		No: 2	
			Don't care: 0	

Table 2. Questions Pertaining To Household Cleaners From The Berkeley Survey
Source: Berkeley Survey, 1984.

Skin contact - Users of cleaning products may come in direct contact with the chemicals through normal use. Most cleaners have the potential of irritating the skin if this contact is for any period of time. Disinfectants containing phenols and phenolic compounds and ammonia can irritate the skin if not washed off immediately. Other stronger cleaners containing caustic acids, such as drain, toilet bowl, and oven cleaners, can cause very serious burns on contact. The Berkeley consumer survey found that about twenty percent experienced burns or skin irritation with normal use of household cleaners.

Eye irritation and fumes - Cleaners such as general purpose cleaners, cleansers, disinfectants, drain cleaners, oven cleaners, and toilet bowl cleaners, all have the potential of irritating the eyes in case of accidental contact. In the Berkeley survey, twenty-six percent reported experiencing eye irritation at some time with normal use of cleaners. One woman said she came very close to requiring medical attention.

A much more dangerous occurrence with some hazardous cleaners is fumes. Aerosol products, especially oven cleaners, are very dangerous to the respiratory tract, as are disinfectants and ammonia fumes. The most deadly of all fumes are those produced by the mixture of ammonia with chlorine. Mixing solutions of ammonia and sodium hypochlorite (bleach) produces monochloramine (NH_2Cl) and dichloramine (NHC_2) fumes. On contact with the tissues in the lungs, these gases decompose to ammonia and hypochlorous acid, which in turn form hydrochloric acid (Gapany-Gapanavicius *et al.*, 1982).

Two fatal cases show the extent of potential harm of these fumes. One twenty-seven year old woman mixed small amounts of ammonia and bleach in a small, poorly ventilated bathroom; twelve hours later she was in a hospital. Forty-eight hours after exposure, her lung capacity was only sixty-six percent of normal (Gapany-Gapanavicius *et al.*, 1982). Another woman made the same mixture, and died from the toxic fumes that were generated. The woman's niece tried to revive her using mouth-to-mouth resuscitation and she too was overcome by fumes and died (CSPI, 1978). The same deadly fumes can be generated mixing certain toilet bowl cleaners or vinegar with chlorine bleach.

The Berkeley survey revealed that approximately twenty-six percent had at one time been overcome by fumes when using cleaning products. One man said he nearly lost consciousness after using a cleaning product containing methyl ether ketones. Others stated that they were forced to leave the room due to the presence of strong fumes from various products.

Accidental ingestion - Although this is a hazard with virtually everything that is not designed to be eaten, statistics show that 698 out of 4131 total calls made to the Oakland Children's Hospital Poison Control Center in 1983 were for cleaning and polishing agents, shampoo, soaps, and detergents. Compared to other categories, this one represented the largest fraction of calls (Mick, 1984, pers. comm.).

Use and Disposal Patterns

The way in which household cleaners are used and disposed of makes them unlikely contributors to the hazardous substances found in the environment. Yet, they have the potential to be harmful to the environment if disposed of incorrectly. Most cleaners are mixed with water and washed down the drain with use; only one of the sixty-nine responses in the Berkeley survey stated that they poured concentrated cleaners down the drain as a disposal method. Most other respondents stored unused cleaners as a method of disposal. Berkeley waste water is treated by the EBMUD sewage system. With normal use and proper disposal, there are no dangers posed to the environment, since most of the chemicals in cleaners can be handled by the sewage treatment process.

If cleaners are disposed of improperly, and are allowed to come in direct contact with the environment, there are elements in the cleaners that may harm the environment. Toilet bowl cleaners, bleach, drain cleaners, liquid household cleaner, and powder household cleaner all contain certain amounts of Cd, Cr, Cu, Pb, Ni, and Zn (Gurnham, 1979). The chances that large enough amounts of cleaners would be disposed of directly into the environment to cause substantial harm are very small, especially compared to the other hazardous substances discussed in this publication. By far the greatest danger is in the health hazards in using hazardous household cleaners.

Proper Use and Disposal

There are several precautionary measures that should be taken while handling hazardous household cleaners. The Household Pollutants Guide states that "no conscientious chemist would handle chemicals such as pesticides and oven cleaners without laboratory hood and rubber gloves What professionals won't do through an acquired respect for the danger of most chemicals, the manufacturers of household chemicals instruct the average housemaker to do 'with care'" (CSPI, 1978). As a general rule, the following steps should be taken when using any hazardous cleaner:

1. Thoroughly read the label before use.
2. Observe and follow instructions on ventilation and protection.
3. Educate yourself about ingredients and potential health hazards associated with skin contact, mixing, eye contact, and accidental ingestion.
4. Limit the variety and frequency of use of your cleaners.
5. Keep all hazardous substances out of the reach of children.
6. Consider alternative cleaning products.

To dispose of any unused hazardous cleaners, it is best to store them until future use or give them to a friend who may use them. If you do pour them down the drain, dilute first. Never put any amount of unused cleaners in the garbage, or pour on the ground. The best disposal is, of course, none at all; instead, consider the alternatives!

Alternatives

Alternatives to common cleaning products are relatively simple and inexpensive, yet they are not being used. All cleaning chemicals could be replaced by six simple and inexpensive substances: soap, baking soda, vinegar, ammonia, washing soda, and borax (CSPI, 1978). Table 3 shows the many alternatives that may be used in place of some common hazardous household cleaners. Although the process of cleaning may take more time and effort using some of these alternatives, the area being cleaned will be no less clean or germ-free than if the standard hazardous chemical cleaner was used. Store-bought disinfectants reduce but do not kill all germs present (CSPI, 1978).

The Survey shows that these alternatives are not being used in Berkeley. Figure 1 shows the low incidence of use of some alternative cleaners. One explanation may be growth of a consumer

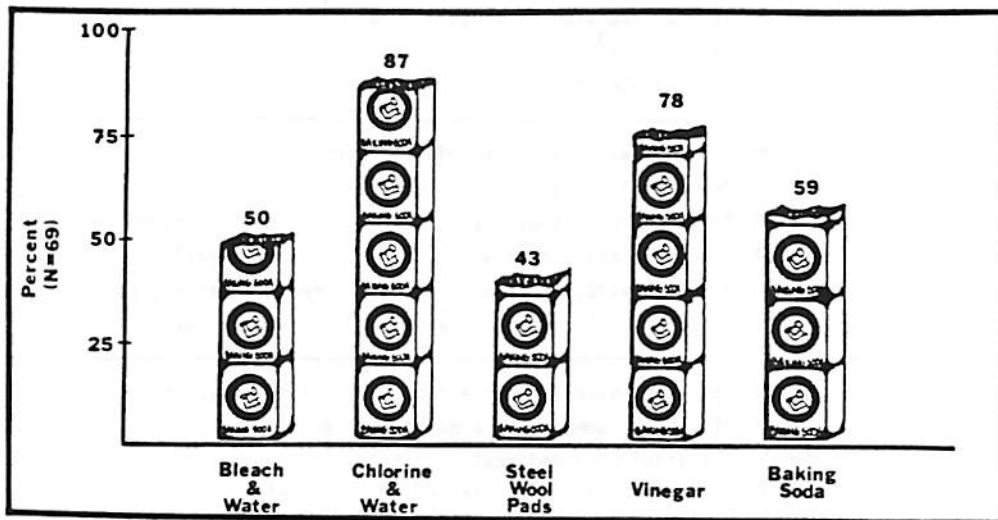


Figure 1. Percentage of Berkeley Residents That Seldom or Never Use Selected Alternative Cleaners. Source: Berkeley Survey, 1984.

culture fostered by commercial advertisement based on the belief that "cleaner is better." Products are presented to the consumer as being the only way to have a germ-free home. Consumers are trapped in the belief that commercial cleaning products are the best methods for cleaning. Consumers are also under the impression that these hazardous cleaners are the only methods available to them. The lack of knowledge about the potential hazards of some of the ingredients in cleaners, coupled with the lack of knowledge on alternatives to these cleaners, backs the consumer into a corner of needless buying and potentially hazardous conditions.

Conclusion

It is the conclusion of this report that the use of cleaners in Berkeley is creating a potentially dangerous situation. Although the condition of the environment is not substantially threatened

Cleaner	Alternatives
Disinfectants	<ul style="list-style-type: none"> ● Twenty Mule Team Borax¹ ● Zephiran Chloride Aqueous Solution¹ ● ½ cup bleach + 1 quart warm water²
All-Purpose Cleaners	<ul style="list-style-type: none"> ● Arm & Hammer Baking Soda, Bon Ami Cleaning Cake, Boraxo Powdered Hand Soap, Granny's Old Fashioned All-Purpose Cleaner, Green, Lifeline Biodegradable Natural Cleaner, Lift Biodegradable Household Cleaner, Rugged Red, Twenty Mule Team Borax.¹ ● ½ cup borax, ½ t. liquid soap, + 2 t. TSP into 2 gallons warm water¹ ● Several tablespoons vinegar + water³ ● Baking soda³ ● Diluted bleach + water²
Chemical Drain Openers	<ul style="list-style-type: none"> ● Pour hot water + ½ cup soda down drain³ ● Mechanical plunger or plumber's snake² ● Pour 1 handful soda + ½ c. vinegar down drain; cover 1 minute¹ ● Pour 3 T. sal soda down drain 1-2 times per week¹ ● Mix 1 c. soda, 1 c. salt, and ½ c. cream of tartar; pour down drain followed by 1 c. boiling water 1-2 times per week¹
Oven Cleaners	<ul style="list-style-type: none"> ● Sprinkle water and large amount of baking soda; scrub with wool pads¹ ● Place ½ c. ammonia in nonaluminum pan with water in oven overnight; use steel wool pad next morning³ ● Sprinkle warm stains with salt and scrub²
Scouring Powders	<ul style="list-style-type: none"> ● Bon Ami Polishing Cleanser, Good Earth Scouring Powder¹ ● Sprinkle baking soda on surface and scrub¹ ● Sprinkle borax or salt on surface and scrub¹ ● Use scouring pad with liquid soap¹ ● Soak area with water; scrub²
Toilet Bowl Cleaners	<ul style="list-style-type: none"> ● Sprinkle with ½ c. borax, scrub and let sit 30 mins. or overnight¹ ● Any all-purpose cleaner substitute² ● Dilute chlorine bleach²
Bleach, Ammonia	<ul style="list-style-type: none"> ● Dilute well before use. NEVER mix² ● Other general cleaner and disinfectant alternatives

1. (Dadd and Levin, 1982).

2. (Doherty, 1983).

3. (CSPI, 1978).

Table 3. Alternatives To Hazardous Household Cleaners
Source: See footnotes.

through the normal disposal of hazardous household cleaners, the results of the survey revealed that a significant amount of consumers are experiencing harmful health effects in using hazardous household cleaners.

It is suggested that research be continued and intensified on the potential long-term effects of these hazardous cleaners on the environment and human health. More rigid standards should be placed on new products as they enter the market, such as longer waiting periods for carcinogenicity tests, increased numbers of mandatory tests, and more detailed listings of ingredients and precautionary information on the labels of potentially hazardous products.

It is evident that a comprehensive consumer education program is necessary in the city of Berkeley. A majority of the surveyed Berkeley residents stated that they wished they knew more about both the health and the environmental effects of their hazardous household cleaners (Table 2). The program should be supported by the local and state governments. Its goal would be to change consumer habits and attitudes, as well as to inform consumers about the immediate dangers, the possible environmental dangers with improper disposal, and safer alternatives to hazardous household cleaners. This would be accomplished through education campaigns through the media, as well as published information and perhaps public seminars. The branch of the media with the most impact is most likely the audio and visual media. Perhaps through an intensive effort using these resources, the consumer could become more aware of the dangers of household cleaners, and be given the chance to make a choice for alternatives.

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