Managing Household Hazardous Waste

W. David Conn

Many household products contain hazardous chemicals. When discarded, these products become household hazardous waste (HHW), which poses a potential threat to human health and the environment. Planners may be called upon to assist local government officials, who increasingly are coming under pressure to implement special HHW programs, especially collection day events. However, there has been little systematic examination of the actual risks created by HHW, or of the full costs, benefits, and liabilities associated with collection days and other programs. This article synthesizes the current literature on HHW and identifies directions for needed research.

In a recent commentary in this journal, Andrews (1987) argued that “local planners have key roles to play in fostering awareness and effective responses on the part of local governments” to the problems posed by hazardous materials. In his list of major issues facing local planners, Andrews included those associated with hazardous materials used in households. These materials are contained in such products as household cleaners, detergents, furniture polishes, pesticides, paints, thinners, solvents, and items used in the care and service of motor vehicles. When discarded, products of this kind become what is commonly known as “household hazardous waste” (HHW).

Presently unregulated in most states, HHW is likely to end up in municipal sewers, septic tanks, and solid waste facilities, such as sanitary landfills and incinerators, or directly in the environment, unless provision is made to handle it separately from other waste. For a variety of reasons, including concern about potential HHW-related liability, a growing number of local governments have started to address this problem, typically by holding “collection day” events at which householders are invited to bring in their HHW, at little or no charge, for recycling, treatment, or disposal by professional waste handlers. Planners often play a role in organizing these events, which (to be successful) require a great deal of advanced planning and coordination among a variety of individuals and groups.

This is not, however, the only level at which planners have a role to play. Planners can also mediate among the varying points of view regarding HHW. Not everyone believes that the risks posed by HHW are significant enough to warrant the substantial costs typically associated with collection days and other special programs. Some people feel that, even within the waste management area, higher priorities exist. In addition, there are some who are skeptical about the effectiveness of the special HHW programs developed to date. Hence, communities are often faced with conflicting views on these issues, along with pressure from citizens and others to “do something” about HHW. Planners can try to help to resolve this dilemma by bringing knowledge to bear on the issues.

This article contributes to the task by synthesizing current literature regarding (1) the risks to human health and the environment posed by HHW in the absence of special programs; (2) these programs’ likely costs, effectiveness in risk reduction, and other benefits; and (3) the implications for HHW-related liability. The article also identifies directions for needed research.

**HHW and Municipal Solid Waste Management**

As we consider the risks posed by HHW and the options available for dealing with it, it is important to keep in mind the current trends in waste management. Evidence suggests that a significant amount of HHW may be discarded into municipal sewers and septic tanks.

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Furthermore, some localities have been moving away from compartmentalization of waste management and toward the integration of wastewater and solid waste programs. Still, the HHW problem generally has been viewed first and foremost in the context of municipal solid waste (MSW) management.

The past few years have seen ever-increasing quantities of municipal waste, along with problems in finding sites both accessible and technically suitable for landfills, increasing concern about the impacts of waste disposal on public health and the environment (resulting in more stringent controls), and growing public opposition to the siting of any kind of waste-handling facilities. Consequently, the costs of managing MSW have soared in many parts of the country and the MSW problem has come to be viewed as a “crisis” (Carra 1988). One result has been a significant increase in the attention paid to waste reduction and recycling as a means of decreasing the amount of waste requiring disposal. In addition, more of the remaining waste stream is now being incinerated. This proportion is expected to continue to grow in the coming years (Porter 1988).

**Risks Associated with Household Hazardous Waste**

A central issue for those people deciding what, if anything, to do about HHW is the extent to which the waste poses a threat to public health and the environment. It is commonly asserted that consumers tend to dispose of potentially hazardous products without thinking of the possible consequences. Typical disposal methods are said to include the pouring of remains down drains or storm sewers, backyard burning or burial, or the use of a household waste collection service. Each of these methods has the potential of harming human health and the environment. For example, the disposal of HHW down drains or storm sewers could corrode plumbing; release harmful fumes; create problems in septic systems and wastewater treatment plants; pollute groundwater, rivers, and streams; contaminate public water supplies; and possibly cause toxic accumulation in food chains. The incineration of HHW in municipal waste-to-energy facilities could cause explosions, release toxic fumes into the air, and concentrate toxic substances in the ash. The burial of HHW (without adequate precautions) could contaminate the soil and groundwater, cause fires or explosions, and release toxic fumes. HHW picked up by a municipal garbage collection service could injure workers during handling.

At the present time, however, reliable evidence as to the extent of these risks in practice (other than anecdotal evidence regarding particular incidents) appears to be scarce. A careful review of the academic and professional literature has revealed few studies that cast light either on the nature and extent of HHW in the municipal waste stream or on the damage actually caused by HHW. The following sections outline what is currently known.

**Household Hazardous Waste in the Municipal Waste Stream**

A report prepared for the U.S. Environmental Protection Agency (SCS Engineers 1986) summarizes the results of two “limited” waste characterization studies (in which the composition of solid waste samples was measured directly) and a household survey (in which householders were asked to recall, among other things, what they had discarded during the previous year, and by what means). Other studies of both types have been reported, but in each case there have been limitations of one kind or another that make it impossible to draw firm conclusions that can be generalized. One limitation stems from inconsistencies in the definition of HHW and resulting differences in the precise nature of what is being measured. Another limitation stems from “special” factors that may bias particular measurements, such as the holding of a collection day program (with its attendant publicity) shortly before a waste characterization project has been undertaken in the same community.

Yet another limitation stems from the fact that individual studies typically fail to examine all portions of the waste stream in which HHW might be found. A study conducted in Seattle, for example, suggests that estimates of HHW quantities in solid waste based on characterizations of samples obtained from residential pick-ups would be expected to be low, since a significant amount of HHW appears to be taken by “self-haul” directly to a transfer, treatment, or disposal facility (Savage and Sharpe 1987). Finally, a limitation of at least some of the household surveys relates to the willingness and ability of respondents to recall and report correctly their past actions in disposing of hazardous products.

Another portion of the municipal waste stream in which HHW is likely to be found is that which goes “down the drain,” i.e., wastewater influent. Indeed, the results of a major study for EPA show that residential sources can be important contributors of certain priority pollutants in wastewater, contributions from residential and commercial sources being almost equal in some cases (Levins et al. 1979). An influential study conducted for Seattle Metro produced similar conclusions, namely that the average concentrations of priority pollutants found in influent from residential sources are at least as great as those originating from commercial sources (Gall and Houck 1984; Gilvin et al. 1984). Overall, existing studies cannot be considered conclusive in measuring the nature and quantity of HHW in the municipal waste stream. They are consistent, however, in suggesting that the proportion of HHW in the municipal waste stream is very small, less (perhaps considerably less) than 1 percent by weight.

**Damage Caused by HHW**

Even if the quantity of HHW is less than 1 percent of the municipal waste stream, this amount could still cause significant damage, in part because the magnitude of the overall stream is so great and in part because the potential for damage is a function not only of the quantity
of waste but also of its nature and the manner in which it is handled. In a discussion of potential HHW problems, Galvin (1987) has noted that most existing municipal landfills lack groundwater monitoring systems or any type of leachate control, and that 20 percent of all National Priority List (Superfund) sites are old municipal landfills. According to the EPA (1986), municipal landfills still receive around 95 percent of all municipal waste.

However, systematic documentation of damage due to HHW is scarce. Various studies conducted on the nature of the leachate from municipal waste landfills, both real and simulated, have revealed that these leachates (even in rural areas) typically contain many hazardous constituents, including organics, such as phthalates, phenol, methylene chloride, trichloroethylene, and toluene. All of these organics are found in consumer products, but this observation does not establish their origin, because they may also be formed in reactions within a landfill, after deposition of the waste.

To the best of my knowledge, all of the studies conducted to date suffer from a common problem: the researchers could not be certain that the landfill waste from which the leachate was derived did not contain hazardous materials from sources other than households. Such materials may have been deposited legally in older landfills, prior to the advent of regulatory controls. Even today, in many states it remains legal to deposit in municipal landfills hazardous waste from “conditionally exempt” small-quantity generators (those generating less than 100 kilograms in a calendar month). Furthermore, it is commonly acknowledged that regulatory compliance in most states is currently far from complete. Most municipal landfills in practice continue to receive at least small amounts of hazardous waste from a variety of commercial and industrial sources.

Concentrated levels of heavy metals and complex organics have been identified in sludge residues, fly ash, and grate ash from municipal incinerators. Similar contaminants, as well as dioxins and benzo(a)pyrene, have been detected in the atmospheric emissions from these incinerators. Unfortunately, due to the presence of wastes from “conditionally exempt” hazardous waste generators (and probably also from some small-quantity generators evading regulation) in the feedstock of most municipal incinerators, there is again a lack of definitive evidence of a link between these contaminants and the occurrence of HHW in the waste stream, even though one might expect that batteries (for example) and other household products would be significant contributors of mercury. Furthermore, studies have shown that complex reactions within incinerators themselves can lead to the formation and subsequent emission of hazardous organic contaminants, in a manner that shows little or no dependency on the particular composition of the feedstock (Taylor and Dellinger 1988; Hinchee 1985). It should also be noted that some of the contaminants probably come from products not normally categorized as HHW at all, such as inks in paper. Several studies are now being undertaken to characterize and quantify the sources of contaminants in incinerator residues and to explore the associated risks (Franklin 1987).

Even if we could establish conclusively that HHW is a significant source of hazardous constituents in releases from landfills and/or in residuals from incinerators, as well as in wastewater influent, this finding would not be enough by itself to prove that HHW causes damage. It is very difficult to establish cause and effect, particularly in relation to health damage. According to Binder (1987), very little work has been done to quantify the health risks from municipal landfills, irrespective of whether or not they contain HHW. In recent years, some attention has been given to the health risks from municipal incinerators, but again there apparently has been no effort to separate out the impact of HHW. Indeed, the primary focus of most of the incinerator studies has been the risks created by dioxin and benzo(a)pyrene emissions, whose generation may be largely unrelated to recognized hazardous constituents in the incoming solid waste.

Another kind of damage commonly attributed to HHW involves injuries to refuse collectors. Galvin (1987) cites a study by the City of Los Angeles that found chemicals implicated in 158 injuries during 1980 to 1985. However, once again, more extensive documentation is lacking. At one time during the 1970s, the EPA (1975) initiated a national database on refuse collectors' injuries, but this project was subsequently discontinued (and past records provide no clue to the extent of damage due to HHW). Furthermore, as far as I have been able to determine, the insurance industry does not maintain data in a form that would allow one to examine the level of HHW-related claims by refuse workers.

Costs, Effectiveness, and Other Benefits of HHW Programs

Most people involved in programs addressing HHW recognize that the best approach is to try to prevent hazardous constituents from entering the waste stream in the first place. Nevertheless, these people are also realistic enough to recognize that some HHW will always slip through. HHW programs developed to date have included preparation and dissemination of public information materials, provision of toll-free “hot-line” assistance, establishment of permanent HHW collection sites, and activities involving collection and recycling of particular wastes, such as paints and batteries. As I have already mentioned, however, by far the most popular approach has been the holding of collection days. By November 1987, approximately 849 collection days, organized and financed in a variety of different ways, had been held in 42 states nationwide (Carra 1987). While data on the other programs remain sketchy (in part because there exist relatively few documented examples of each), information about collection days, including their estimated costs, has been accumulating rapidly. Much is contained in a computerized database established by the Center for Environmental Management at Tufts University. The following sections review our present knowl-
edge of the costs, effectiveness, and other benefits of HHW programs.

**Costs**

Although many cost figures have been published, they must be viewed with caution, not only because they are derived largely from uncorroborated reports by program organizers, but also because of the absence of a common method of accounting. Duxbury (1987) and others have called for such a method to be established as soon as possible.

For illustrative purposes, Table 1 provides cost data for collection days held in various locations throughout the United States. As far as I have been able to determine (through direct questioning of the original sources, where possible), the figures are reasonably comparable; for the most part they reflect "out-of-pocket" expenditures on items such as publicity (printing, postage, advertising space, etc.), site charges, and payments to a waste management firm for contractual services rendered (receiving, sorting, packaging, transporting, treating, and disposing of the waste). Generally excluded are costs that are not separately accounted for, such as time committed by "on duty" public safety officers and other local government staff. I examine these further on in this section.

Assuming that the figures in Table 1 do have a roughly comparable basis, they reveal striking differences between the costs per participant paid by different communities. These differences appear to be due not only to different participation rates but also to such factors as:

- Whether "bulking" is permitted;
- Whether recycling is permitted; and
- The type of treatment/disposal method employed.

**Bulking**

At the collection days held in Fairfax and Chesterfield Counties, Virginia, each item of HHW was packaged separately and only a few packages were placed in each drum for transport away from the site. In contrast, at the collection days held in East Providence and North Kingston, Rhode Island, where the costs per person were significantly lower, the practice of "bulking" was permitted. This involved the combining of similar wastes in a drum, not in separate packages, and resulted in the use of many fewer drums for a given amount of waste collected. Costs are generally tied directly to the number of drums that are shipped. Bulking is not permitted everywhere because it is considered by some people to be too dangerous. At a minimum, a highly trained field chemist must be on site to supervise the procedure. Some waste management firms will not conduct bulking, even if it is permitted by the collection day organizers.

**Recycling**

The lowest costs per participant listed in Table 1 are for collection days held in Madison, Wisconsin. Here the organizers permitted residents to take for reuse household products, such as cleaners and some types of pesticides, that had been brought in by other residents. In this way, the quantity of HHW that had to be packaged for shipment off site was kept to a minimum. Most collection day organizers do not permit recycling of this kind because of the dangers posed by misidentified (e.g., mislabeled) and/or contaminated products, as well as the possibility that the sponsor might be held liable for any damages that might result from the handling or use of the recycled items.

**Waste Treatment Disposal**

The treatment/disposal method selected also affects the costs charged by waste management firms. For example, Fairfax County, Virginia, opted to have HHW collected at its "Clean-Up" days incinerated rather than landfilled in order to reduce the county's potential long-term liability for the waste. Chesterfield County, Virginia, on the other hand, reduced its costs significantly by sending HHW for land disposal. It should be noted that the land disposal option will no longer be available for most untreated hazardous wastes once the provisions of the Hazardous and Solid Waste Amendments of 1984 are fully implemented.

Table 1 lists the total accounted costs and the costs per participant. Purin et al. (1987) have suggested other ways of looking at the costs, to provide a perspective on

<table>
<thead>
<tr>
<th>Location</th>
<th>Participants</th>
<th>Cost ($)</th>
<th>Cost ($ per participant)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuquerque NM</td>
<td>1,071</td>
<td>87,213</td>
<td>81.00</td>
</tr>
<tr>
<td>Anchorage AK</td>
<td>300</td>
<td>90,000</td>
<td>300.00</td>
</tr>
<tr>
<td>Austin TX</td>
<td>450</td>
<td>64,500</td>
<td>143.00</td>
</tr>
<tr>
<td>Bellevue WA</td>
<td>160</td>
<td>17,000</td>
<td>106.00</td>
</tr>
<tr>
<td>Broome Co. NY</td>
<td>107</td>
<td>9,000</td>
<td>84.00</td>
</tr>
<tr>
<td>Chesterfield Co. VA</td>
<td>142</td>
<td>16,370</td>
<td>115.00</td>
</tr>
<tr>
<td>Concord NH</td>
<td>290</td>
<td>14,100</td>
<td>49.00</td>
</tr>
<tr>
<td>Denver/Boulder CO</td>
<td>1,116</td>
<td>78,000</td>
<td>70.00</td>
</tr>
<tr>
<td>East Providence RI</td>
<td>210</td>
<td>8,561</td>
<td>41.00</td>
</tr>
<tr>
<td>Fairfax Co. VA</td>
<td>251</td>
<td>46,881</td>
<td>186.00</td>
</tr>
<tr>
<td>Fairfax Co. VA</td>
<td>477</td>
<td>65,000</td>
<td>136.00</td>
</tr>
<tr>
<td>Linn Co. IA</td>
<td>317</td>
<td>38,357</td>
<td>121.00</td>
</tr>
<tr>
<td>Madison WI</td>
<td>340</td>
<td>12,000</td>
<td>35.00</td>
</tr>
<tr>
<td>Madison WI</td>
<td>550</td>
<td>15,918</td>
<td>29.00</td>
</tr>
<tr>
<td>Mansfield CT</td>
<td>100</td>
<td>11,400</td>
<td>114.00</td>
</tr>
<tr>
<td>Middlebury VT</td>
<td>90</td>
<td>5,000</td>
<td>56.00</td>
</tr>
<tr>
<td>North Kingston RI</td>
<td>186</td>
<td>7,285</td>
<td>39.00</td>
</tr>
<tr>
<td>Palo Alto CA</td>
<td>80</td>
<td>6,100</td>
<td>76.00</td>
</tr>
<tr>
<td>Phoenix AZ</td>
<td>250</td>
<td>14,000</td>
<td>56.00</td>
</tr>
<tr>
<td>Ridgefield CT</td>
<td>85</td>
<td>5,000</td>
<td>59.00</td>
</tr>
<tr>
<td>San Diego CA</td>
<td>226</td>
<td>36,125</td>
<td>160.00</td>
</tr>
<tr>
<td>Westport CT</td>
<td>200</td>
<td>18,600</td>
<td>93.00</td>
</tr>
<tr>
<td>York Co. PA</td>
<td>558</td>
<td>50,000</td>
<td>90.00</td>
</tr>
<tr>
<td>York Co. PA</td>
<td>560</td>
<td>62,000</td>
<td>111.00</td>
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the broader benefits asserted for collection day programs (these benefits are discussed further on in this section). Proposed measures include (1) costs per person served, referring to any person having direct contact with the collection day services, including someone who attends an educational presentation or simply calls with an inquiry; (2) costs per person reached, referring to any person or household targeted in a media campaign; and (3) costs per household in the area, referring to any household within the program's service area. Proponents of collection programs recognize that decision makers may find the costs less daunting if they are viewed in these different ways.

Unaccounted Costs
At a collection day held in October 1985 by Fairfax County, Virginia, it was casually observed that many public safety officers and other county personnel were present at the two sites involved. This observation prompted an investigation of the types of compensation, if any, received by these employees and an inquiry as to whether costs of this kind are normally included in the published accounts of collection days.

Personnel observed at the two sites during a second Fairfax collection day (in April 1986) included policemen, firemen, sanitation workers, other county employees, and even bomb squad officials. Table 2 presents a list of these personnel (provided by the organizers) and identifies their means of compensation. Table 3 presents the county's own estimate of the total costs associated with the two collection days, including imputed personnel costs. The figures show a significant increase over those listed in Table 1, which, as far as I can tell, were prepared without attempting to include the full costs of labor.

### TABLE 2: Estimates of “hidden” costs associated with collection day, Fairfax County, Virginia (two stations), April 24, 1986

<table>
<thead>
<tr>
<th>Location</th>
<th>Workers</th>
<th>Job</th>
<th>Compensation</th>
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</thead>
<tbody>
<tr>
<td>South Lakes HS</td>
<td>6</td>
<td>Firemen</td>
<td>Overtime (1 1/2)</td>
</tr>
<tr>
<td>South Lakes HS</td>
<td>1</td>
<td>Bomb squad officer</td>
<td>On duty</td>
</tr>
<tr>
<td>South Lakes HS</td>
<td>1</td>
<td>Police officer</td>
<td>On duty</td>
</tr>
<tr>
<td>South Lakes HS</td>
<td>1</td>
<td>County officer</td>
<td>Overtime</td>
</tr>
<tr>
<td>South Lakes HS</td>
<td>2</td>
<td>County sanitation workers</td>
<td>Overtime</td>
</tr>
<tr>
<td>South Lakes HS</td>
<td>8</td>
<td>County staff personnel</td>
<td>Compensatory</td>
</tr>
<tr>
<td>W Springfield HS</td>
<td>6</td>
<td>Firemen</td>
<td>Overtime (1 1/2)</td>
</tr>
<tr>
<td>W Springfield HS</td>
<td>2</td>
<td>Bomb squad officers</td>
<td>(unavailable)</td>
</tr>
<tr>
<td>W Springfield HS</td>
<td>2</td>
<td>Police officers</td>
<td>On duty</td>
</tr>
<tr>
<td>W Springfield HS</td>
<td>2</td>
<td>County sanitation workers</td>
<td>Overtime</td>
</tr>
<tr>
<td>W Springfield HS</td>
<td>3</td>
<td>Firemen</td>
<td>On duty</td>
</tr>
<tr>
<td>W Springfield HS</td>
<td>7</td>
<td>County staff personnel</td>
<td>Compensatory</td>
</tr>
</tbody>
</table>

**Effectiveness in Risk Reduction**
Assuming that the primary purpose of conducting HHW programs is to reduce the risk posed by HHW to human health and the environment, planners contemplating such programs need to know about the programs’ likely effectiveness in risk reduction. A program most directly affects the risk by causing the physical diversion of potentially damaging HHW from the municipal waste stream, so that it might be recycled, treated, or disposed of under controlled conditions. In general, participation rates in the most commonly employed programs—the collection days—are quite low. According to the EPA-sponsored report by SCS Engineers (1986), “[F]ew programs can boast participation of even 1 percent of households in the community, and several programs report participation of less than 0.2 percent.” Consistent with this statement are the findings of a detailed study of some 40 HHW collection days held in the San Francisco area between November 1983 and January 1987: comparing “households participating” with “households in service area” (based on California Department of Finance data), the participation rates at any single event varied from a low of 0.09 percent to a high of 1.55 percent (Meiorin 1987). We must bear in mind that it may be difficult to define the service area, particularly in a community that does not exclude nonresidents from its HHW program. There is also the possibility that collection days held at different times in a particular community may serve different households (each of which may have been “saving up” its HHW in the meantime), so that the overall participation rate may grow over time. Nevertheless, even when these factors are taken into account, it is evident that collection day programs divert only a very small proportion of the total quantity of HHW from the municipal waste stream. Furthermore, organizers have often commented (e.g., at the 1987 National HHW Management Conference in San Diego) that greater participation by households, resulting in a larger quantity of HHW diverted, would almost certainly cause the waste-handling capacities (and budgets) of many collection day events to be exceeded.

Among the possible causes of low participation rates at collection days is the apparent unwillingness of many householders to store their HHW until the next event is scheduled, once they have decided to dispose of this...
waste (which is likely to occur, for example, when they move house). The causes of low participation rates have yet to be fully investigated. Nevertheless, if this explanation is correct, programs involving permanent collection facilities, possibly located at local fire stations or at existing waste transfer, treatment, or disposal sites, might be expected to produce a greater diversion of HHW from the municipal waste stream. Whatcom and Thurston Counties, Washington, and San Bernardino and Monterey Counties, California, are among the first communities in the United States to try this approach (Goldberg 1987), although others are beginning to follow. However, the literature does not yet provide adequate information to assess their effectiveness in reducing HHW-related risks.

Other Benefits

Proponents of collection days and other HHW programs typically assert that these programs have significant benefits in addition to the direct diversion of HHW from the municipal waste stream. Specifically, they claim that, in raising the public’s awareness about HHW and hazardous materials in the household generally, the programs result in more responsible behavior in the purchase, use, and disposal of a wide variety of potentially damaging products. Although intuitively this assertion seems reasonable, as far as we know there exists little or no reliable evidence either to confirm it or to quantify the impact produced. Also difficult to confirm or deny, because of its intangible nature, is the benefit of “empowerment” that some proponents assert; this benefit is based on the claim that HHW programs give citizens an opportunity to do something constructive about a societal problem they see as significant. Another possible benefit to be gained by establishing an HHW program is that it may produce a reduction in a community’s HHW-related liability, as discussed in the following section.

Liability Reduction

The mere mention of liability almost always captures the immediate attention of local officials. In considering the HHW-associated liability involved in a collection day or other special program, it is pertinent first to examine the present status of HHW under federal and state legislation. Most hazardous wastes are regulated under the provisions of Subtitle C of the federal Resource Conservation and Recovery Act (RCRA) or equivalent state legislation. Based on EPA’s interpretation of congressional intent, however, HHW is excluded from regulation under RCRA. Indeed, the definition of hazardous waste contained in the regulations unconditionally exempts household wastes from being designated as hazardous, even when accumulated in quantities that would otherwise be regulated, or when transported, stored, treated, disposed of, recovered, or reused. It is important to note, however, that the exclusion does not apply when HHW is mixed with any other RCRA-regulated hazardous waste, including waste from “small-quantity generators” (generating between 100 and 1000 kilograms of waste in a calendar month). When this happens, the entire mixture becomes subject to the applicable RCRA regulation(s).

Unless mixing of this kind takes place, it is evident that those organizations concerned with HHW are not subject to liability under RCRA. However, they may be subject to common law liability and to liability under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, more commonly known as “Superfund”). The latter governs a much broader range of hazardous substances than the wastes covered by Subtitle C of RCRA, including substances likely to be found in HHW; under CERCLA, potential liability applies regardless of whether the material is picked up as part of a special HHW collection program or as part of a routine municipal waste collection service (Lehman 1985).

CERCLA’s liability provisions are far-reaching; they establish responsibility for the payment of cleanup costs (and, under some circumstances, damage costs) in situations that involve the release of hazardous substances into the environment. The law provides for joint and several liability (meaning that any one of a number of parties contributing to a problem may be held liable for the resulting costs in entirety, regardless of that party’s individual contribution). Thus, culpability is held to be irrelevant, and there is no time limit on claims.

It is apparent that localities are faced with the liability issue whether or not they decide to implement a special program. If they do not implement such a program, it might be considered more likely that HHW will be disposed of in ways that might, for example, injure a garbage collector, damage a collection vehicle or a sewer, or contribute to a hazardous substance release from a municipal landfill. A locality could be faced with major costs as the result of any of these occurrences, especially the last. For example, some $15 million to $50 million may be needed to clean up just one Superfund landfill in Delaware, and EPA is expected to seek repayment of a large proportion of this cost from the county involved (Dougherty 1987).

On the other hand, even where a special program is initiated, it is most unlikely to result in the complete elimination of HHW from the municipal waste stream; consequently, at least some of the potential liability remains. Some people assert that this liability is likely to be reduced if a locality can demonstrate an effort to minimize the risk from HHW (e.g., by implementing a special program), but it is unclear how a court would react to this argument.

In addition, the program itself is likely to create potential liability. For example, there are risks to the homeowners who bring their HHW to a collection day; to the contractors who sort, wrap, transport, treat, and dispose of the waste; and to others—both volunteers and paid staff—who are involved in the program. If the program is properly managed, these risks should be minimal, although they cannot be ignored; to the best of my knowledge, while there have been a few minor spillages at collection sites, only one significant hazardous-waste-
related injury has been reported to date, and it is not known whether a claim has been filed.

Technically, a locality could be held jointly and severally liable for a hazardous substance release at any time from any facility to which its collected HHW is taken. To minimize this risk, many communities prefer to have their waste incinerated rather than landfilled. Since EPA does not wish to discourage HHW collection, agency officials have stated on several occasions that the sponsors of such a program would be unlikely to be held liable for a major recovery of costs under CERCLA; the primary “target” in a superfund enforcement action is generally the operator of a site, who nowadays not only must meet very strict operating standards but also must demonstrate the financial capability to address foreseeable problems. Only a very small proportion, if any, of the cost is likely to be assigned to the contributor of such a relatively small volume of waste (compared to the volume normally contributed to a site by industrial generators). Furthermore, under the Superfund Amendments and Reauthorization Act of 1986 (SARA), there is now a statutory obligation for EPA to expedite settlements with small (“de minimis”) contributors and to release the latter from the possibility that they might be held liable for future costs if the original remediation action is found not to be effective (Dougherty 1987).

Although absolute protection from liability under CERCLA cannot be assured, it seems justifiable to accept the conclusion reached in a staff analysis issued recently by New York’s attorney general, namely that “there is good reason to believe that the significance of the risk is probably not great” (Washington 1988).

Conclusions

As suggested at the start of this article, planners have a role to play in bringing knowledge to bear on the issues associated with HHW. My examination of the current literature yielded the following general observations: (1) HHW makes up a very small proportion of the municipal waste stream, probably less than 1 percent by weight in most places; (2) although the potential for damage is evident and there is anecdotal evidence at least that it does occur, the degree of risk actually posed by HHW remains unknown; (3) the accounted costs of holding collection days to date have varied widely (from under $30 to over $300 per person served), depending in part on the collection and disposal procedures followed; (4) the “hidden” costs of holding collection days (e.g., the use of on-duty regular employees), which can be quite significant, are sometimes overlooked; (5) the amount of HHW directly diverted from the municipal waste stream by collection day programs is a small fraction of the total amount thought to be generated, although other programs (e.g., the establishment of permanent collection sites) may prove more effective in this regard; (6) other asserted benefits of HHW programs, such as more responsible behavior by households generally in the purchase, use, and disposal of hazardous materials, resulting from a greater awareness of the issue, have not been confirmed nor their impact quantified (although intuitively they may seem reasonable); (7) the effect of holding collection days on a community’s HHW-related liability is probably favorable overall but this has not yet been tested in court. These findings, based on the largely inconclusive evidence presently reported in the literature, fail to support unequivocal recommendations to localities regarding the management of HHW.

As already mentioned, it is also important to keep in mind changes that are taking place generally in the field of MSW management. There is a growing emphasis on waste reduction and recycling, an increase in the amount of MSW going to incinerators, and (if regulations cur-
Experts provided by the hazardous waste collection, treatment, and disposal firm examined each item brought to the site, identified it, and determined the appropriate packaging, treatment, and storage. (Photo by Denise Whittington Scott)

Much of the hazardous waste collected was packaged in drums and shipped to a treatment, storage, or disposal facility. Waste identified as nonhazardous was separated out and deposited in a sanitation truck stationed at the site. (Photo by Denise Whittington Scott)

rently proposed by EPA, 1988a, are ultimately adopted) a considerable tightening of federally mandated controls on sanitary landfills. The growth in incineration may promote greater efforts to remove HHW from the waste stream, to minimize the accumulation of hazardous contaminants in the air-borne and solid residuals; according to Galvin (1987), even at a hazardous waste incinerator in Denmark, such household products as batteries and pharmaceuticals are pulled out in order to reduce subsequent pollution by heavy metals. On the other hand, it is conceivable that the proposed tightening of controls on sanitary landfills, particularly the groundwater protection requirements, will have the opposite effect, in that communities may presume that the newly controlled landfills will be able to accept HHW without threat to human health or the environment. Communities should realize, however, that the new standards will not be fully implemented for several years at least, and that even "state-of-the-art" technology is unlikely to make a landfill permanently secure (e.g., Robinson et al. 1985).

Many people, including this author, have long argued that waste reduction should always be the first priority in waste management (e.g., Conn 1977). After eighteen years of emphasizing "end-of-pipe" pollution control technologies, EPA recently drafted a proposed policy statement that finally commits the Agency to the "prevention of wastes, discharges, and/or emissions . . . to the environment through the implementation of source reduction practices" (EPA 1988b). As already mentioned, for most of those involved in HHW programs, reduction of the amount of HHW generated is indeed the favored approach; various means are available, such as product redesign or reformulation, substitution of one product for another, avoidance of excess purchasing, product reuse, and so on. However, it is recognized that some generation of HHW is inevitable. From a municipal solid waste management perspective, simply keeping this HHW out of the regular waste stream (e.g., by means of a collection program) can itself be viewed as a form of waste reduction, since it does seek to reduce at their source the potential risks associated with MSW.

Ultimately, each community must decide what, if anything, to do about HHW in light of its own particular circumstances. Some localities might see investing in programs aimed specifically at HHW as worthwhile, while others might give a higher priority to alternative programs in waste management or other areas. Other possible approaches in the waste management area currently include the early upgrading of existing municipal waste facilities (in anticipation of new federal and state requirements to minimize the risks posed by all constituents of the municipal waste stream, including HHW) and programs to address the particular needs of the small-quantity generators of hazardous waste whose waste in many states may still be taken to municipal facilities. The optimum approach is likely to be an integrated set of programs that address all of these concerns. But financial constraints may prevent this from being a realistic option.

Although collection day programs have featured most prominently in the literature to date, other ways of providing for the separate handling of HHW have also been suggested. Perhaps the most promising method involves the establishment of permanent collection facilities. While it is too early to draw conclusions about the general applicability of this approach, first indications suggest that the costs need not be greater than those of some collection day programs, while it might be expected that a much larger proportion of the HHW generated would be captured.

A community opting against the implementation of any kind of collection program faces a dilemma in that it must decide how to respond to inquiries from its citizens...
about proper methods of disposal for various HHW constituents. For many types of HHW, there are reasonable suggestions that can be made (e.g., in areas other than those suffering significant air pollution, discarded cans of oil-based paint can be left open so that the solvent evaporates away, leaving a relatively harmless residue that can safely be placed in the trash). These suggestions can be found in a number of publications. However, for certain kinds of hazardous waste items, these publications simply exhorted the householder to "store carefully until a collection program is organized in your community." Obviously, this advice is not very helpful if such a program is unlikely to be offered in the foreseeable future. Under these circumstances, a decision must be made as to the "next-best" solution (which in some cases might involve wrapping a small amount of hazardous material in many layers of absorbent material before placing in the trash) since, as an alternative, the waste might be dumped into the nearest creek by a frustrated householder who was told to wait for a collection program that never comes!

**Suggestions for Further Research**

Given that much of the evidence currently reported is inconclusive, directions for future research need to be identified. Three major aspects of HHW management call for further investigation: risks, costs, and effectiveness, and liability.

**Risks Posed by HHW**

We need more information about the risks actually posed by HHW and how these compare to other kinds of risks addressed by communities. After establishing a common definition of HHW, researchers need to obtain better data on the amounts and type generated, its present fate, and the resulting damage.

Several new solid waste characterization studies are underway, but these will provide at best an incomplete estimate of HHW generation because of the diversity of methods used for disposal (other than by placing it in the trash). Studies to characterize wastewater influent are also of limited value in this context owing to the impossibility (in most cases) of discriminating among the variety of possible sources. The most direct approach to determining the amount and type of HHW generated would be to inventory this waste physically in people's homes. According to Ridgley (1987), a pilot study of this kind was attempted by the University of Minnesota's Center for Urban and Regional Affairs. Considerable problems were encountered, however, in that householders were unwilling to schedule interviews or failed to be at home at the scheduled times. The research team decided that the method is unworkable, and the study was abandoned. In view of the potential invasion of privacy involved in this approach, a repeat attempt does not seem wise.

Consequently, we may have little choice but to employ household surveys to obtain more inclusive data on HHW generation and disposal methods selected. As already mentioned, several surveys have been conducted in which respondents have been asked to recall particular instances of disposing of items of HHW, generally within the past year. Unfortunately, these surveys have suffered from a number of problems, including confusion over what constitutes an item of HHW, imperfect recall, and (possibly) deliberately biased responses. Since these problems are not easy to overcome, the best that we may be able to hope for is to minimize them by careful questionnaire design.

Researchers face a very difficult task in attempting to increase our knowledge of the fate and impacts of unsegregated HHW in wastewater and solid waste systems, owing to the fact that wastes from households are almost invariably "contaminated" (legally or illegally) with wastes from other sources, including commercial and industrial hazardous waste generators. Nevertheless, it may be possible to isolate cause-and-effect relationships in some instances—for example, where unique or tagged constituents can be tracked through a system or where it is possible to control the waste input (e.g., in an experimental incinerator burn). Owing to the long time scale involved in many subsurface processes, studies of landfill systems (even in laboratory settings) pose special difficulties. The use of models rather than physical systems may provide an alternative approach, but given our very limited understanding of the processes involved, the current state of modeling, and the problems of validation, it is not clear how much confidence could be placed on the results.

Improving our knowledge of HHW-related damage to human health and the environment would represent the next major challenge, and would require further research on such topics as the transport of hazardous constituents, human and environmental exposure to these constituents, and dose-response characteristics. Research interest in these topics is not limited to those involved with HHW; rather, it extends broadly across the field of environmental protection. Consequently, further discussion is outside the scope of this paper.

**Costs and Effectiveness of HHW Programs**

A high priority should be placed on the development of a uniform accounting system that records both the direct and the indirect costs of HHW programs. Once developed, the system should be utilized to gather data on actual programs—both collection days and other types of programs that involve innovative approaches. These data should be used to identify (among other things) the principal cost determinants and their relationship to local variables, and the results should promptly be made available to communities that are trying to decide what measures, if any, to take in addressing the HHW problem. Planners may also use them in attempting to increase program efficiency.

Additional information should be sought on the programs' effectiveness in reducing the generation of HHW,
in removing HHW from the municipal waste stream, and/or in producing other alleged benefits (such as an increase in environmental awareness that might decrease environmentally damaging behavior). Much of this information will probably have to come from surveys, because of the problems involved in attempting to make direct observations of some of the relevant behaviors. Factors affecting program effectiveness (e.g., those factors influencing participation rates at collection days) should also be examined, to provide information relevant to program design.

Liability

Finally, we should make a continuing effort to keep track of developments affecting liability. We should pay attention not only to changes in statutes and regulations but also to court decisions, guidance documents issued by government agencies such as the EPA, legal opinions, and actions by other interested parties, such as waste haulers and insurance companies. Although arguably “the question of potential liability should probably not be the determining factor in setting waste management policy” (Washington 1988), for many communities it is likely to remain a major consideration affecting their approach to HHW management.

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REFERENCES


NOTES

1. See, for example, Bomberger et al. 1987; Laderman et al. 1985; Rathje et al. 1985; Rathje et al. 1987; Savage and Sharpe 1987; Scott 1987; Wilson and Rathje 1987.

2. Estimated discards of municipal solid waste lie in the range of 2 to 5 pounds per person per day, making a total of more than 130 million tons nationwide in 1984 (Franklin Associates 1986).


4. The Monterey facility is operated by the Monterey Regional Waste Management District, which serves the western portion of the county.

5. Both participants and nonparticipants in areas served by collection days have been surveyed to investigate their awareness of HHW as an issue, their present disposal practices, and so on (e.g., Ridgley 1987). However, as far as we know, nobody has systematically documented changes in disposal behavior among nonparticipants as a result of increased awareness of the issue.


7. See, for example, Enterprise for Education, Inc., 1986; Environmental Hazards Management Institute 1987.


Lehman, John P. 1985. Memorandum to Basil G. Constantelos, Director, Waste Management Division, Region V, reproduced in Appendix E of SCS Engineers (1986).


