MANAGEMENT OF HARD TO HANDLE WASTES IN VERMONT

A discussion paper

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In the year following adoption of the State Solid Waste Management Plan, the Vermont Legislature took a more direct approach in dealing with some of the identified special wastes than suggested by the plan. A number of these materials were simply banned from disposal in Vermont landfills. More recently, US EPA efforts to remove the hazardous waste stigma from some common wastes with hazardous components have created a new category of wastes called "Universal Wastes". Some of these "Universal Wastes" are the same as those banned from landfill disposal or called "Special Wastes" in Vermont. The solid waste planning requirements of Vermont's landmark 1987 Solid Waste Law (Act 78) are found in both 24 VSA §2202a and 10 VSA §6604. These Vermont laws speak first to waste reduction and then to recycling. However, protection of human health and the environment figure prominently in the approaches that must also be considered in both state and local solid waste planning.

"Hard to handle wastes" represent a wide array of products which may be found on one or more statutory or regulatory lists. These materials fall within three general groupings:

automotive waste products	including tires, lead-acid batteries, oil and oil filters
household waste chemicals	including pesticides, oil-base paint/thinners, latex paint, cleaning products, and household batteries
waste electrical products	including white goods, consumer electronics, thermostats, fluorescent lamps, and ballasts

In this discussion paper for each of these products, their hazardous constituents will be listed, the environmental media to which a constituent may be released are identified and matched with general routes of potential human exposure and environmental impact. (See summaries in Table 1 and Table 2) Emphasis will be placed on the materials themselves and their current management systems. Some future handling options are also explored.

Of necessity, this discussion paper is not intended as a comprehensive risk assessment for hard to handle wastes because of the uncertainties and the complexities inherent in risk analysis. In its publication *A Historical Perspective on Risk Assessment in the Federal Government*, the Harvard School of Public Health Center for Risk Analysis noted:

> "When the phrase 'risk assessment' is used, it means different things to different people. Some use the phrase loosely to refer to the entire risk management process, including science, economics, legislation, regulation, and communication with the public [essentially, a qualitative process]. Others see risk assessment as an algorithm for producing a regulatory number that will determine how much exposure to a toxic agent is permissible" [essentially, a quantitative process].[2]

Also beyond the scope of this paper is an analysis of environmental management standards and regulations for automotive scrap and salvage yards. Variations in how this industry operates are continuing sources of still unresolved public and legislative concern over aesthetic and environmental impacts. Nevertheless, some special wastes listed in this report do go there.

Risk vs cost as the basis for action

Management of so-called "special wastes" incur costs disproportionate to their 4% share of the solid waste stream. Although ubiquitous, these wastes are inappropriate to dispose with other solid wastes because:

- the size or weight of items prevent use of normal waste handling equipment
- the waste will damage the landfill or incinerator in which it is disposed
- the waste presents a physical hazard to those who handle it
- the waste contains hazardous chemicals which may be released to the environment.

In July of 1991 the Vermont Agency of Natural Resources released a report by its Public Advisory Committee on The Strategy for Vermont's Third Century, ***Environment 1991: Risks to Vermont and Vermonters.*** The goals of the two year Agency project were to develop more accurate understandings of risks posed by Vermont's environmental problems, to communicate this risk analysis to Vermonters and to use those new shared understandings to reduce risks. The strategy focused on three types of risk: 1) risk to ecosystems, 2) risk to human health, and 3) risk to quality of life.

A 16-member Public Advisory Committee had been appointed by the Secretary of the Agency to select the 20 most serious environmental problems facing Vermont. Ultimately, the Advisory Committee's final rankings and recommendations contradicted conventional wisdom and public opinion about the relative seriousness of some of Vermont's most politically sensitive environmental concerns. Significantly, the committee considered the risks associated with hazardous waste management or solid waste disposal to be relatively low, even though the public had rated them to be much higher .

Since 1991, waste management district and individual municipal solid waste implementation plans prepared to meet Vermont Solid Waste Law (Act 78) requirements have focused on waste generation rates, transportation infrastructure, disposal capacity, recycling, processing facilities, and above all else - management system costs. Two reports issued by the Agency's Solid Waste Management Division early in 1992, one on waste paints[3] and the other on household batteries[4], were unable to mount compelling risk-based arguments for additional legislative action. Ultimately, the projected cost of establishing and operating the programs recommended in these documents mitigated against their implementation. Cost considerations also figured prominently in recommendations contained in the Agency's 1995 Report to the General Assembly on the Management of Mercury-Containing Lamps[5]. Similarly, a 1996 industry prepared used oil filter recycling report[6] to the House Natural Resources and Energy Committee based many of its recommendations on costs associated with implementing various types of used oil filter recycling programs.

In the following subsections the recent regulatory history of each special waste will be outlined, along with those characteristics which have prompted its management as a special waste. Cost and availability of various management options also will be discussed.

Waste Motor Oils

Hazardous constituents in the waste

There is very little disagreement with data showing that spills or dumping of petroleum products can adversely impact air quality, soils, surface waters, ground waters, and even the operation of municipal wastewater treatment plants[7]. Also, until the introduction of unleaded gasolines, lead deposited in engine oil also made those oils unsafe for burning in small waste oil furnaces.

Regulatory history

Waste petroleum distillates have been classified in Vermont as a category of hazardous waste since the beginning of hazardous waste regulation in 1980. In 1988, contingent management provisions similar to federal standards for waste oil were adopted for used oils from businesses to supplement existing categorical exemption for household wastes. Concurrently, amendment of Vermont's solid waste statute in 1989 specifically prohibited landfill disposal of waste oil after July 1, 1990. After that date, waste oils from households and businesses were expected to be beneficially reused or to be collected for rerefining or for fuel use. Nevertheless, development of regional and national waste oil management infrastructures have been hampered by a variety of conflicting political, economic and sociological factors[8]. Unfortunately, delays by the US EPA in deciding whether or not to classify waste oils as a hazardous waste and in issuing management standards for used oils that are to be recycled, limited investment in collection facilities by both the public and private sectors. Also, in Vermont, various aspects of the state's Solid Waste Rules and the State Building and Fire Code have worked against establishment of the voluntary, state-wide network of collection facilities envisioned in the Agency's 1993 *Proposed Waste Oil collection and Management Plan*[9].

Current management

Starting in the 1960s, automotive engine oil marketing changed radically moving away from service stations to sales in retail stores. This created a growing population of so-called do-it-yourself (DIY) oil changers who had limited knowledge of or access to existing waste oil collection systems. Paradoxically, high energy prices in the late 1970s fostered both increased DIY activity and strong markets for used oil. However, return of crude oil prices to more historic levels by the late 1980s sharply reduced waste oil recycling when waste oil ceased to be a valuable commodity[10]. A recent study by the American Petroleum Institute reports that despite favorable state and federal standards for recycling of waste oils, the rise of a quick-lube industry and a reduced DIY market, significant barriers still prevent used oil collection programs from taking in significant quantities of the available oils. DIYers tend not to participate in collection programs for lack of public education and lack of convenient collection points. State and local government reluctance to set up collection programs tends to focus more on fears of regulation liability and contaminated oil than on inadequate funding[11].

Opportunities for DIY waste oil collection are not uniformly available throughout Vermont.

Solid waste implementation plan summaries found in Appendix III show the best served communities are in the Champlain Valley and central Vermont. Least well served are towns in the Northeast Kingdom and southern Vermont. Of 57 sites identified to the Agency as collecting used oil, almost three-quarters are sponsored by municipalities or solid waste districts which restrict access to residents of their supporting communities. Collection tanks at privately operated landfills and transfer stations, while not restricting access, often charge for disposal. Also, a few towns and solid waste districts simply publish the names of local service stations or auto parts stores that accept DIY waste motor oils.

Other Opportunities for management

Traditionally, waste oil rerefining has been the preferred management practice recommended by both Vermont's Air Pollution Control and Waste Management programs. However, since existing national rerefining capacity can process only a fraction of our nation's waste oils, waste oil shipment for industrial fuel blending has also been supported by the Agency. On a more local level, although the amount of used oil burned in small waste oil furnaces in Vermont is unknown (and will remain so under existing regulatory reporting requirements), this management option holds promise for an even lower cost utilization of the waste stream. A recent Air Pollution Control Division study evaluating the quality of waste oils has shown that these units would most likely comply with applicable ambient air standards.[12] Also, in 1998, changes to both the hazardous and solid waste management regulations have removed many of the earlier impediments to both the collection and burning of waste oil in small furnaces.

Waste Oil Filters

Hazardous constituents in the waste

The principal environmental hazard attending disposal of waste oil filters in the trash is leakage of oil from improperly drained filters with its attendant air and water pollution risks. Earlier concerns about lead contamination have abated with the advent of unleaded gasolines. Also, Terne (a lead-tin alloy used for corrosion inhibiting metal plating) has not been used in US oil filter manufacture since 1993.

Regulatory history

Regulatory reference to waste oil filters from motor vehicles first appeared in the 1991 amendments to Vermont's Hazardous Waste Management Regulations. Those rules stated that non-characteristic (i.e. not terne plated) waste oil filters would be exempted from hazardous waste regulation if drained or crushed and drained. Prior to 1991, Agency policy on waste oil filters had favored the view that they could be considered exempt from hazardous waste regulation if recycled as a scrap metal or if drained to become an empty container. The 1991 conditional exemption from hazardous waste regulation anticipated similar 1992 federal standards.

Current management
Although waste oil filters traditionally have been seen as a minor component in automotive scrap, dedicated processing of scrap filters is relatively new. In 1991, Tamco, a steel mill in southern California, was the first to specifically accept filter scrap. Today, more mills are willing to accept filter scrap that has been appropriately pre-processed. The waste filters processors supplying these mills are mainly companies supporting the auto service industry. These companies may charge garages as much as 80 cents per filter, depending on the quantity collected and the recycling process they use[13]. Even though commercial filter collection and processing is available to garages and service stations in Vermont from several competing vendors, not all use it. DIY oil changer options are more limited. Only 10 of the 57 community oil collection sites identified in Appendix III also collect waste oil filters.

Other Opportunities for management
There is no technical barrier to used oil filters entering scrap metal recycling. Lack of filter collection and crushing at municipal waste oil collection tanks continues to hamper local collection of additional DIY oil and waste oil filters continue to be disposed in the trash.

Lead-Acid Batteries

Hazardous constituents in the waste
Containing approximately 18 pounds of lead and about a gallon of concentrated sulfuric acid, the typical automotive lead-acid battery presents either immediate risk of chemical burns from contact with corrosive electrolyte or from longer term risks for lead contamination of ground waters.

Regulatory history
Because of lead's high toxicity, the US EPA has made major commitments to reduce exposure of lead to humans and the environment not only through hazardous waste regulation of lead bearing wastes but through specific regulatory exemptions designed to promote recycling of lead-acid batteries. In Vermont, batteries have been banned from landfill disposal since 1990.

Current management
Lead-acid batteries do not regularly appear in solid waste because they can move easily into a well established collection infrastructure. National data indicates that almost 80% of the lead consumed in the US goes into lead-acid battery production and of that, the recycling rates for these batteries have been reported to be as high as 95% in 1990.[14] Nevertheless, as late as 1986, lead-acid batteries still accounted for 65% of the lead in municipal solid waste.[15]

Generally, consumers in Vermont return used lead-acid batteries into the recycling chain in one of four ways: batteries are returned to retailers who must accept them[16], they are taken to recycling centers, they are dropped off at HHW/CEG hazardous waste collections, or are left in vehicles destined for auto salvage yards. Every approved municipal and solid waste district's Solid Waste Implementation Plan (Appendix III) identifies the lead-acid battery recycling options available within its jurisdiction. Also, the Agency's *Directory of Recycling Programs* lists 48 local recycling centers which routinely collect lead-acid batteries.[17]

Other Opportunities for management
Collection and recycling systems for lead-acid batteries are mature and functioning well. Opportunities and incentives for accepting these batteries into the systems are readily available throughout the state. Attempt to foster development of alternative systems are unwarranted at this time.

Household Batteries

Hazardous constituents in the waste
Mercury, cadmium and lead are the three toxic metals which are of primary national concern in municipal solid waste. Historically, household dry cell batteries have contributed significant amounts of mercury and cadmium to the solid waste stream. Prior to 1992 these batteries made up only 0.005 percent by weight of the solid waste stream yet contributed 8 percent of the total mercury and more than 50 percent of the total cadmium.[18] Lesser quantities of lead were also found coming from small sealed lead-acid batteries used in some lighting and portable electronic products. Incineration of these wastes produces immediate atmospheric release of almost all these products' mercury content. Much longer term potential for groundwater contamination by lead and cadmium is associated with the landfilling of these products or the disposal of ash from municipal solid waste incinerators.

Regulatory history
Significant changes have occurred in both regulation and manufacture of dry cell batteries in recent years. In 1991, the Vermont Legislature and several other states enacted progressive restrictions on the mercury content of dry cell batteries, their labeling and on the solid waste disposal of mercuric oxide, silver oxide, nickel-cadmium and sealed lead acid batteries.[19] Similar, but less sweeping Federal legislation known as the *Mercury-Containing and Rechargeable Battery Management Act* was enacted on May 13, 1996. Also, in 1995 Universal Waste Rules were adopted by the US EPA for rechargeable batteries in order to facilitate their collection and removal from the solid waste stream. During this same time period, battery manufactures adopted new technologies that reduced the industry's mercury usage by 99.4 percent through development of alternative battery chemistries and elimination of introduced mercury from some battery types.[20] Also, in response to state and federal legislation, nickel-cadmium battery manufacturers have established the Rechargeable Battery Recycling Corporation (RBRC) which operates a nationwide battery collection program for their products.

Current management
The term "household battery" is something of a misnomer. Since the same types and brands of small primary (non-rechargeable) and secondary (rechargeable) batteries are so widely dispersed in household, commercial and industrial usage, they are indistinguishable in mixed solid waste. Single use primary cells include alkaline, carbon-zinc, silver oxide, zinc oxide, mercuric oxide, and lithium batteries. Multiple use secondary batteries include nickel-cadmium, nickel metal-hydride, lithium ion, and small sealed lead acid cells. In general, it can be assumed that even though population demographics may influence battery consumption patterns, each person discards an average of 8 dry cell batteries per year.[21]

In Vermont, household battery collection activities are increasingly focused on rechargeable batteries. RBRC currently lists 57 retailers throughout the state who participate in its free consumer drop off program. Also, the Agency's *Directory of Recycling Programs* lists 25 local recycling centers which routinely collect household or rechargeable batteries and another dozen that direct residents to use HHW collection events.[17] Consequently, due mostly to decreasing levels of mercury in dry cell batteries marketed over the past several years (except in communities sending their trash for incineration) alkaline, carbon-zinc, zinc-air, silver oxide and lithium are now disposed as solid wastes. Rechargeable batteries continue to be collected through HHW events, local recycling centers and, more recently, through RBRC program merchants.

Other Opportunities for management
While a nation-wide system exists for Nickel-Cadmium battery recycling, no comparable program is available for sealed lead-acid batteries. For the remaining primary and secondary battery types, lack of regulated hazardous constituents and market values for recyclable components well below avoided costs of disposal currently make their recycling uneconomical.

Waste Paints

Hazardous constituents in the waste
The ignitability of oil-based and aerosol paint products continues to represent their greatest hazard within the solid waste stream. Of longer term concern are potentials for surface and groundwater contamination from the heavy metals (lead, mercury, chromium and cadmium) traditionally used in the pigment and antimicrobial systems in older oil-based and latex paints. Although not directly related to their disposal, the volatile organic compounds (VOCs) in solvent-based paints also present risks for toxicity to the workers using them and to human health and the environment from their role as ozone precursors subject to regulation under the Clean Air Act.[22]

Regulatory history
Use of lead, cadmium and mercury pigments in paints has declined steadily over the last two decades due to concerns over their toxicity.[15] Additionally, use of mercury-based biocides in

paints was eliminated in 1991 by the US EPA through a combination of outright product bans and voluntary cancellation of pesticide registrations.[23] Nevertheless, recognizing that a minimum 5-year time lag exists between product purchase and waste disposal, waste paints have been conditionally banned from landfill disposal in Vermont since 1993. The principal exception to this ban allows dried water-based (latex) paints in quantities of less than one gallon to be disposed with regular solid waste.[19]

Current management
Paints are most commonly categorized according to use into three major groups: Architectural coatings, product coatings and special purpose coatings. Architectural coatings comprise about half of the one billion gallons of paints manufactured annually in the US. By late 1987, while about three quarters of architectural coatings were water based, the overwhelming majority of product and special purpose coatings were still solvent-based systems.[24] For the purposes of this report it is important to note that homeowners almost exclusively use architectural coatings. Within this category, approximately 2.1 gallons of product per capita are purchased each year in Vermont.[3] Not all of this paint is used immediately. A 1991 survey of households in central Vermont found an average of 3.6 gallons of paint in storage per home.[25]

In response to the need for a legal disposal option for this waste, collection opportunities for oil-based paints are now available through single-day events or at permanent facilities serving all but 25 communities in the state. (Appendix III) Water-based paints are less widely collected partly because their disposal through hazardous waste management firms is more costly than for oil-based paints and partly because, when dried, small quantities may disposed by households as a solid waste. In efforts to reduce collection program costs and to preserve a useable resource, in the approximately 100 communities offering water-based paint collection programs, these collections are often combined with efforts to sort out useable product and make these paints available to the community for use.

Other Opportunities for management
Banned from landfill disposal in Vermont, there is no alternative to management of waste oil-based paints as HHW. Paint swapping for reuse of both oil-based and latex paints can help control HHW program costs. Solid waste landfill disposal of solidified water-based paint products is anticipated to become the primary route for disposal within the next several years, as most solid waste districts are expected to discontinue their collection of latex paints as a household hazardous waste.

Waste Tires

Hazardous constituents in the waste
Rubber tires are constructed from a complex mixture of natural and synthetic rubbers mixed with a number of additives such as carbon black, oxides and sulfides of zinc and titanium, silicates and carbonates, oils, tars, steel wires and synthetic fibers. Chemically combined,

these yield a product which is tough, durable, and virtually indestructible by natural forces.[26] The principal environmental hazard from disposal of large quantities of tires in any one location is the risk of an extremely difficult to extinguish fire and its resulting air and water pollution. Also, uncontrolled tire disposal provides shelter for vermin and water accumulations within the discarded casings that have potential for increasing local mosquito populations and possibilities for transmission of diseases.[27]

Burning tire derived fuels (TDF) for their energy value is not without its problems. The approximately 1.4 percent zinc content in the typical tire produces not only elevated zinc levels in TDF boiler ash but also triggers special federal air quality reporting requirements.[28] Nevertheless, ash produced from combustion of fuels supplemented with TDF is still quite similar to ash from coal fired boilers and contains markedly fewer metals than bottom ash from the combustion of municipal solid waste.[27] Groundwater impacts from potential civil engineering uses of waste tires appear to be unremarkable. Studies to evaluate the suitability of shredded tires as a substitute for stone aggregate in road fills and septic systems were able to demonstrate increased levels of barium, zinc, iron and manganese released from the tire shreds with prolonged leaching. Yet, only the concentrations of manganese exceeded drinking water criteria. Monitoring of tire storage pond water quality has revealed even lower rates of metal release.[29]

Regulatory history

Waste tires have been banned from landfill disposal in Vermont since 1992.[19] Due their hollow construction, tires will remain buoyant unless shredded. Intact tires are thus likely to "float" surface of a solid waste landfill, disrupting the landfill cap and gas collection systems.[26]

Current management

Aside from their human health, environmental and safety risks, abandoned tire piles also represent the loss of a useful product and a high value energy source. Of the approximately 3.8 million tons of waste tires produced in 1995 in the US (equaling 1.8% of the solid waste stream or almost one tire per capita) nearly 700,000 tons were recovered for recycling and 3.1 million tons discarded, with approximately half being used for fuels.[1] At 15,000 BTU per pound, shredded tire derived fuels have even greater fuel value than coal (12,000 BTU/lb) or wood (4400 BTU/lb).[30] Fuel use currently dominates the scrap tire recovery market followed by civil engineering applications and high value added products like crumb rubber. While the revenue potential difference for processed rubber is significant $.08-.50/lb as crumb vs $.01-.02/lb as fuel, high initial capital investment and limited end product markets have slowed industry growth in this area. Nevertheless, by combining increasing new uses for high value crumb rubber, expanded engineering applications and use of tire derived fuels, some industry analysts are still proclaiming that: "It won't be long before all scrap tires generated in much of the US are recovered and processors will begin to work on reducing old tire piles".[30] Although this sounds encouraging, even though guidance on acceptable uses of shredded tires in Vermont has been available from the Agency since 1990,[31] few major projects using this material have been attempted.

As a result, consumers in Vermont return waste tires into the recycling/disposal chain in several ways: tires are returned to retailers who accept them for a fee or as part of the exchange in the purchase of new tires, waste tires are taken to local recycling centers, or they are left on or in vehicles destined for auto salvage yards. To help its residents find appropriate disposal for waste tires, every approved town and solid waste district's Solid Waste Implementation Plan (Appendix III) identifies waste tire collection options available within its jurisdiction. Also, the Agency's 1996 *Directory of Recycling Programs* lists 60 local recycling centers which routinely collect waste tires.[17] Prior to the Spring of 1998, handling charges of $1.00-$2.00 per passenger car tire at unsubsidized collection points were common. However, the recent withdrawal of Palmer Shredding from the passenger car tire market in Vermont has pushed these charges significantly higher.

Other Opportunities for management
Banned from landfill disposal in Vermont, retailer take-back and designated collection are currently the only available disposal routes.

White Goods

Hazardous constituents in the waste
Small and large household appliances, collectively known as "white goods" comprise about 2% of the solid waste stream.[1] The principal hazardous components found in these products are the chlorofluorocarbons (CFCs) and petroleum distillate compressor oils used in refrigeration equipment and polychlorinated biphenyl (PCB)-containing electrical capacitors commonly used on motors and in fluorescent lighting ballasts. In some appliances, mercury-containing switches and thermocouples may also be found. These materials are most often released to the environment or dispersed in nonrecyclable waste residues when the white goods are shredded and classified into their ferrous, nonferrous metallic and nonmetallic components.

Regulatory history
White goods have been banned from landfill disposal in Vermont since 1992[19] due largely to their intrinsic value as recyclable materials and as a way to help preserve landfill capacity.

Scrap metals from Vermont destined for shredding are sent to out-of-state processors. Although scrap metal shredder residues are usually landfilled or burned in waste-to-energy facilities,[32] management of their residual "fluff" becomes quite costly when its PCB content exceeds 50 parts per million (ppm) and requires disposal under federal Toxic Substances Control Act (TSCA) rules. While Vermont currently has no scrap metal shredders, waste districts, recycling centers and scrap metal processors have been strongly encouraged for since 1990[33] to remove capacitors and ballasts from white goods. Since the January 1, 1979 effective date of EPA's TSCA prohibitions on the distribution in commerce and processing of PCBs, various estimates have been made about the number of household appliances containing

PCBs. In 1988, EPA calculated historic PCB usage in household appliances at approximately 5%.[34] Nevertheless, more recent regional waste planning studies assume that 20% of discarded appliances have PCB-containing capacitors.[35] However, the CFCs found in some appliances are even more closely regulated than PCBs. Since July 1, 1992, under the federal Clean Air Act (CAA), individuals may not knowingly vent ozone-depleting refrigerants into the air while servicing, repairing or recycling air conditioning or refrigeration equipment. Certified technicians must remove CFCs for recycling or disposal as a hazardous waste.

Current management
Waste appliances consist of approximately 75% recyclable steel.[36] As a result, consumers in Vermont are able to return white goods into the recycling/disposal chain in several ways: appliances are returned to retailers who accept them for a fee or as part of the exchange in the purchase of new appliances, white goods are taken to local recycling centers, or they are transported directly to scrap metal salvage yards. Quite often, fees of $15.00-$25.00 are charged for the removal of CFCs from refrigeration or air conditioning equipment at unsubsidized collection points. To help its residents find appropriate disposal for white goods, every approved town and solid waste district's Solid Waste Implementation Plan (Appendix III) identifies the white goods collection options available within its jurisdiction. Also, the Agency's *Directory of Recycling Programs* lists 63 local recycling centers which routinely collect white goods.[17]

Other Opportunities for management
Banned from landfill disposal in Vermont, there is no alternative to the present retailer take-back, scrap yard and designated collection point system for white goods. As long Freon removal costs are borne by the disposers of refrigeration equipment, revenues from sale of scrap metal in white goods will help support their collection sites.

Consumer Electronics

Hazardous constituents in the waste
In US EPA waste analyses[1] radios, televisions, record players, VCRs, and computers are lumped together with products like luggage and sporting equipment in a category known as miscellaneous durable goods. While this broad category of discarded material amounts to about 5.8% of solid wastes, electronics are not present in sufficient quantity to be separately listed. Nevertheless, after lead-acid batteries, consumer electronics are the next most significant source (approximately 30%) of lead in the solid waste stream.[15] The principal hazardous constituents found in this product group are: lead from printed circuit board solder and the leaded glass in cathode ray tubes (CRTs); cadmium and zinc from backup batteries and CRT phosphors; and mercury from switches. The principal routes for environmental release of these hazardous constituents are smokestack outputs from incinerators and leachates from landfill disposal of the intact products or ash from their incineration.[37]

Regulatory history
In Vermont, no specific legislation or regulations have been adopted dealing with waste electronics. Consumer electronics continue to be discarded in the solid waste stream despite the fact that their circuit boards and CRTs have a high probability of releasing regulated levels of lead if evaluated using the Toxicity Characteristic Leaching Procedure (TCLP) test procedures to determine hazardous waste properties.

Current management
At present, no formal programs exist for household electronics collection or diversion from the waste stream. The Agency's *Directory of Recycling Programs* lists only 3 local recycling centers which report collecting these materials with other so-called "brown goods".[17] Also, the Agency's recycling markets directory list of computer reuse programs and recyclers identifies principally out-of-state handlers.[38] Even though an estimated 10 million televisions and 5 million computers are being disposed annually in the US,[39] it is only recently that a new branch of the recycling industry has evolved to process these materials by recycling their component parts.[40] Significantly, electronics recyclers indicate that very few household electronic products are recycled at their facilities.[40]

Other Opportunities for management
Although reuse and recycling are preferable to and economically competitive with disposal, limited opportunities currently exist. State funding to support cooperative efforts among waste districts and municipalities to assemble truck load quantities of materials may be necessary to establish the infrastructure needed for recycling consumer electronics.

Mercury Containing Wastes

Hazardous constituents in the waste
Silent electrical switches, thermostats, fever thermometers, and fluorescent light bulbs all contain metallic mercury (3.5 grams, 2.8 grams, 0.6 grams and 23 milligrams, respectively, per unit) in order to function as designed. Although this mercury is sealed within glass in each of these products, its principal routes for environmental release are from breakage while in use or from incineration of the discarded product. Once released to the atmosphere, this mercury become part of a complex global cycle of deposition, revolatilization and potential biomagnification through the aquatic food chain. The four products listed above are the source of almost 25% of the mercury contained in the solid waste stream.[23] Additionally, fluorescent lamp fixtures manufactured prior to 1979 may have used PCB-containing capacitors in their starting ballasts.

Regulatory history
For many years, none of these products were considered hazardous wastes and were routinely discarded with solid wastes. However, in 1990, US EPA introduction of the Toxicity Characteristic Leaching Procedure (TCLP) test sufficiently changed the way characteristic

hazardous wastes were determined so that many spent mercury-containing lamps now failed the test and were classified as hazardous waste[41] Since over 80% of fluorescent lamps are used in commercial or industrial settings,[5] the Agency's Hazardous Materials Management Program has developed fact sheets with guidance for handling waste mercury containing lamps and PCB-containing ballasts. In 1995, Universal Waste Rules were adopted by the US EPA for mercury-containing thermostats in order to facilitate their collection and removal from the solid waste stream. Comparable regulatory relief does not exist for mercury-containing electric switches or fever thermometers.

Current management

In Vermont, mercury containing switches, thermostats and thermometers are routinely accepted through local and solid waste district household hazardous waste collection programs. Fluorescent bulbs generally are not accepted. However, in Chittenden, Addison and Windham counties fluorescent bulbs are collected from households and small businesses at district run recycling and transfer stations. Fluorescent lamp disposal practices by large quantity hazardous waste generators are less well documented.[5]

Other Opportunities for management

HHW collection programs capable of accepting mercury-added waste products are identified in approved solid waste implementation plans applicable to the solid wastes disposed by 96% of the state's population. Additional state assistance to help municipalities implement their unregulated hazardous waste plans is likely to be more productive than developing new management systems for mercury containing wastes.

Household Hazardous Wastes/Pesticides

Hazardous constituents in the waste

The term "household hazardous waste"(HHW) is an umbrella concept that includes some of the wastes described above (waste oil, batteries, paints) plus any number of consumer products containing hazardous ingredients. For all practical purposes, HHW is any waste which would be a hazardous waste had it not come from a household. After waste paints, automotive lead-acid batteries and motor oil, pesticides are the products next most commonly delivered to HHW collection programs. As a group pesticides are unique because quite often both their "active" and "inert" ingredients are hazardous, but for different reasons. Heavy metal contamination is rarely a feature of HHW. Usually ignitable organic solvents and corrosive cleaners present the most immediate risks to waste handlers and the longer term threats to landfill leachate collection system integrity.

Regulatory history

Household hazardous wastes are categorically exempt from regulation under both federal and state hazardous waste regulations. Nevertheless, since 1992, municipalities in Vermont have been required to include in their solid waste plans provisions for the management of "unregulated hazardous waste".[42] In the statute, unregulated hazardous waste (UHW) includes both household hazardous wastes and hazardous wastes from conditionally exempt small quantity generators of hazardous wastes (CESQGs) that may be discarded with trash. Specific Agency procedures to monitor UHW diversion at solid waste facilities was adopted in 1994.[43] At the same time, Vermont Regulations for Control of Pesticides in Accordance with 6 V.S.A. Chapter 87, have been promulgated that create no exempt categories for pesticide storage, use or disposal. Disposal of pesticide containers must comply with instructions on the product labels or other state and federal regulations. Obsolete, excess and mixtures of pesticides are directed to be disposed in accordance with Vermont Hazardous Waste Management Regulations.[44] In 1995, Universal Waste Rules were adopted by the US EPA for recalled and unused pesticides to facilitate their collection and removal from the solid waste stream.

Current management
In order to meet the need for appropriate disposal, collection opportunities for household hazardous wastes and pesticides are now available through single-day events or at permanent facilities serving all but 25 communities in the state. (Appendix III) In 1991, the Vermont Department of Agriculture used a combination of private and federal grant funding to conduct its first major collection of obsolete pesticides. Creation of a permanent funding source[45] for pesticide collection in 1996 by the Vermont Legislature will enable the Department to further coordinate collection programs for agricultural pesticides with local HHW activities. Additionally, an association of Vermont agricultural chemical dealers currently provides for pesticide container collection and recycling as a service to its customers.

Other Opportunities for management
By any measure, household hazardous waste collection and disposal is the most costly of all municipal waste management services. Economies of scale, source reduction education, more extensive local swapping of reusable product and the sharing of resources among waste districts and independent municipalities are essential for controlling costs and maintaining the program subsidies required to meet statutory requirements. With HHW collection programs identified in approved solid waste implementation plans applicable to all solid wastes disposed in Vermont and over 96% of the state's population, additional state assistance to help municipalities implement their unregulated hazardous waste plans is likely to be more productive than developing new management systems.

Additional Waste Streams (Not Discussed)

As expected in any discussion of hard to handle wastes, at some point in the research process the question arises 'What about .....?' Certainly this was the case for: antifreeze, asbestos, smoke detectors, propane cylinders, medical waste and petroleum contaminated soils. While the first five items are already handled within existing solid or HHW systems, only medical waste presents unique problems. Recent elimination of 'Infectious waste' from hazardous waste regulations has prompted new solid waste rulemaking to define how this waste will be handled. Petroleum contaminated soil is a large volume waste that needs its own evaluation.

Waste Professionals Discussion Group Outcomes

On October 1, 1997, a workgroup of waste management professionals met using an early draft of this discussion paper as a springboard to a wide ranging discussion of the issues associated with hard to handle wastes. This facilitated meeting focused on two specific goals to be achieved by the group: identification of successful programs and constructing a basis for future program activities with selected materials. In some ways, the work product of this 4 hour session mirrored some key aspects of what the Act 78 Summer Study Committee had attempted to define in a series of 16 all-day meetings.

The work session's initial review of hard to handle waste management success stories prompted immediate comparison to the list of 16 accomplishments in the Summer Study Committee report. In the discussions that followed, overlap with items #11 (development of regional diversity) and #16 (increased collection and diversion of unregulated hazardous wastes) were apparent. From the outset, it became clear that "success" comes in various forms and has a number of different meanings. Some successes have state-wide significance (like pesticide container collections or the underwriting of educational programs), some are regional (like cooperation of communities across state lines or innovative waste district programs) and some are local (like a waste oil tank or a paint swap shed at a transfer station). In all these cases the common elements were:

(1) public support or participation,
(2) a place for the activity or program to happen, and
(3) the financial resources to carry it out.

Not surprisingly, a waste management activity which might be considered very successful in one part of the state might not even be considered worth trying in other parts. While comparisons of individual waste district's experiences were instructive, the group was eager to move the discussion beyond present conditions.

In preparation for discussion of specific wastes, the group briefly explored terms that seemed to be contained in almost every of its preceding comments. The objective was to be thinking the same things when they were said. Specifically, when the group talked about "management" or "waste management" it agreed to remember that there are four basic elements to this concept:

(1) knowledge or education about materials,
(2) the actual collection of them,
(3) the transportation of materials to a destination, and
(4) the processing or ultimate disposition of them.

Similarly, "risk" or "risk assessment" was seen as embodying not only worker safety and environmental impacts from the "management" of wastes, but included more broadly defined pressures on natural resources from use of the materials in the first place.

Proceeding from that point the group began evaluating individual wastes. It quickly became apparent that factors applicable to assigning priorities were themselves waste specific. Also, the group felt that there is no standard definition of what constitutes a "hard to handle waste".

Some wastes we simply declare to be "hard to handle". The forces which compel municipalities to manage certain wastes in specific ways are:

(1) public pressure
(2) laws and regulations
(3) worker safety concerns
(4) cost
(5) environmental impacts
(6) resource preservation
(7) the inertia within existing systems

With the constraint of completing its discussion in the time allotted for the workgroup mind, the group agreed to focus on a shorter list of wastes than contained in the draft discussion paper. Using a tabular matrix to compare and put these wastes in perspective highlighted, again, the regional nature of waste management in Vermont. This table can be found on the next page.

Despite the differences among their respective programs, all those present agreed on the importance of their waste management systems being based on good science. Whether talking about risk or presence of a particular material in the waste stream, both the public and private sectors stressed the need for hard numbers on which to base their decisions. Unfortunately, for a number of the wastes subject to the report, Vermont specific data is not being collected.

Workgroup Participants:
Doug Kievet-Kylar, DEC, Facilitator

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October 1, 1997 Waste Professionals Workgroup Discussion on PRIORITIZING HARD TO HANDLE WASTES

(Assuming the waste is in the waste management system)

	waste oil filters	dry cell batteries	latex paints	pesticides	mercury lamps	PCB ballasts	asbestos	propane cylinders	smoke detectors	consumer electronics
characteristic	need to get the oil out	Hg in old/ Zn in all	liquid & some VOCs	poisons toxic inerts	Hg vapor	PCBs bind to organic matter in lf	fibers in air	fuel explosive	emits alpha need to ingest	Pb and Hg CRT glass Hg switches
hazard level	LOW	LOW if land HIGH if burn	LOW	HIGH	LOW if land MED. if burn	LOW if land MED. if burn	HIGH friable LOW if not	LOW empty HIGH if not	LOW	LOW if land MED. if burn
Regulatory limitations	no	no	statutory limit 1 gallon dry to landfill	no - many collection days	household no Universal Waste	household no Universal Waste	2 landfills or only asbestos contractors	no	no	not yet
Management costs are acceptable	yes/no .10 per to $85/drum	yes/no $800/drum	yes/no $100/drum	yes very costly	yes/no	yes expensive	yes for friable costly	no	simply don't deal with them	yes in future costly - will need fees to drive it
Perception of a problem (often by district)	important only where collected now	public want it incinerator districts care	some districts	public cares uniformly	public unaware	public unaware	public undecided	not an issue	some districts care a lot some districts unaware	public unsure its like a white good
Future prospects for the waste	slow increase in #s	total #s up % Hg down	total amount increasing	If banned constant #s at collections	Hg content down but total #s up	PCB #s down DOHP down total # steady	total amounts decreasing	total amounts increasing	total amounts increasing	total amounts increasing greatly

Table 1 Special Waste Hazardous Constituents and Consequences from Disposal

WASTE TYPE	HAZARDOUS COMPONENTS	RELEASED TO	ROUTES OF EXPOSURE	POTENTIAL IMPACTS
waste oil	petroleum lead*	water, air, soil water, air, soil	water, air water, air	local, regional local, regional
waste oil filters	petroleum lead*	water, air, soil water, soil	water, air water	local, regional local
auto batteries	lead sulfuric acid	water, soil water, air, soil	water water, air	local local
household batteries	lead nickel cadmium mercury* zinc	water, soil water, soil water, soil water, air, soil water, soil	water water water water, air, foods water	local local local local, regional, global local
waste paints	petroleum, lead* barium* cadmium* chromium* mercury* zinc	water, air, soil water, soil water, soil water, soil water, air, soil water, air, soil water, soil	water, air water water water water, air water, air, foods water	local, regional local local local local, regional local, regional, global local
white goods	CFCs petroleum PCBs*	air water, air, soil water, soil	air water, air water	global local, regional local
tires	zinc	water, soil	water	local
consumer electronics	lead cadmium zinc mercury	water, soil water, soil water, soil water, air, soil	water water water water, air, foods	local local local local, regional, global
HHW/ pesticides	flammable liquids corrosives poisons	water, air, soil water, soil water, air, soil	water, air water water, air	local, regional local local, regional
fluorescent lamps & ballasts	mercury, cadmium* PCBs*	water, air, soil water, soil water, soil	water, air, foods water water	local, regional, global local local
thermostats & switches	mercury	water, air, soil	water, air, foods	local, regional, global

* denotes hazardous constituents found in older waste products

Table 2 Availability of Special Waste Management Options

WASTE	MANAGEMENT OPTION	AVAILABILITY
waste oil	re-refining fuel blending small w.o. burners	- state-wide through commercial vendors - fairly costly - state-wide local collection/commercial vendors - low cost - state-wide # sites unknown - usually no cost
waste oil filters	recycling as scrap SW landfill	- mainly Chittenden SWD - state-wide in trash
auto batteries	lead recycling	- state-wide retailers/scrap yards/recycling centers
rechargeable batteries	recycling disposal as HW	- state-wide RBRC merchants for Ni-Cd/local HHW collection - state-wide local HHW collections (ultimately recycled)
dry cell batteries	SW landfill disposal as HW	- state-wide in trash - waste districts using incineration (mainly SW/WSWMD)
oil base paints	paint swapping recycle dispose as HW	- mainly Chittenden SWD and NEKSWMD - none - state-wide local HHW collections (HW fuel blending)
water base paints	paint swapping recycle dispose as HW	- mainly Chittenden SWD and NEKSWMD - none - state-wide local HHW collections (HW fuel blending)
white goods	recycle as scrap	- state-wide retailers/scrap yards/recycling centers Freon removal charges
tires	tire shredders tire derived fuel	- state-wide retailers/scrap yards/recycling centers - charges - state-wide retailers/scrap yards/recycling centers - charges
HHW	SW landfill dispose as HW	- state-wide in trash/labeled mercury-added products banned - state-wide local HHW collections
pesticides	SW landfill dispose as HW	- state-wide in trash - state-wide local HHW collections (ultimately incinerated)
fluorescent lamps & ballasts	SW landfill recycle dispose as HW	- state-wide in trash/labeled mercury-added products banned - mainly Chittenden, Addison, Windham SW districts - state-wide local HHW collections (ballasts)
thermostats	SW landfill recycle dispose as HW	- state-wide in trash/labeled mercury-added products banned - universal waste (national collection program) - state-wide local HHW collections (ultimately recycled)
consumer electronics	SW landfill recycle dispose as HW	- state-wide in trash/labeled mercury-added products banned - limited retailer upgrades/non-profit exchanges - none

Appendix I

How Solid Wastes are Described

Since 1986 the United States Environmental Protection Agency (EPA) has prepared and annually updated its report: *Characterization of Municipal Solid Waste in the United States.*[1] This publication provides national information on waste composition and waste management practices. It also makes distinctions between the materials and the products found in the municipal waste stream. Because this national data is so widely used, including in this report, it is important to understand how the data is developed by the EPA.

Generally, there are two principal ways to characterize waste. The first is a source-specific approach where individual components of the waste stream are sampled, sorted, and weighed. While the method is useful for defining a local waste stream, atypical circumstances encountered during sampling or errors in the sample would be greatly magnified if extrapolated to describe the nation's entire waste stream. The second method, which is used by the EPA in its waste characterization report, is a "material flows methodology." EPA's Office of Solid Waste and its predecessors in the Public Health Service sponsored research in the 1960s and early 1970s to develop this model. The methodology is based on production data (by weight) for the materials and products in the waste stream, with adjustments for imports, exports, and product lifetimes. Apparent discrepancies in data often emerge from one edition of the report to the next because the EPA continually updates its MSW characterization database with revised estimates from various industry associations and other federal agencies.

For the purposes of the EPA report, MSW consists of both materials and products. For example, of the approximately 208 million tons of MSW generated in the United states during 1995, the proportions of various materials in MSW were:

paper and paperboard (39.2%),	wood (7.1%)
yard trimmings (14.3%),	food wastes (6.7%)
plastics (9.1%)	glass (6.2%)
metals (7.6%)	rubber, leather, textiles, etc (9.8%)

However, looking only at the types of materials in the waste stream may not be entirely useful. Each material category (except for food wastes and yard trimmings) can also be thought of as is being made up of items representing many different products. The products to be found in MSW can also be grouped into three main categories which make up about three-quarters of the solid waste stream:

(1) durable goods, such as appliances (15%),
(2) nondurable goods, such as newspapers (27%)
(3) containers and packaging (35%).

These product categories generally contain significant amounts of each type of MSW material, with some exceptions. The durable goods category contains almost no paper and paperboard. The nondurable goods category includes only small amounts of metals and essentially no glass or wood. The containers and packaging category includes only very small amounts of rubber, leather, and textiles.

Appendix II

Municipal Solid Waste Planning in Vermont

Without Solid Waste Implementation Plans

	Population
Athens	321
Buel's Gore	6
Canaan	1151
Concord	1143
Fairfax	2720
Fairlee	914
Grand Isle	1821
Granville	312
Kirby	304
Lemington	115
Londonderry	1446
Newbury	2047
Norton	168
Rochester	1171
Searsburg	90
Somerset	2
Stockbridge	675
Stratton	138
Sutton	925
Topsham	997
Underhill	2798
Wardsboro	663
Weston	493
Windham	257
Winhall	489

With Solid Waste Implementation Plans

	Population
Albany	792
Barton	2985
Bristol	3927
Brownington	774
Burke	1423
Charleston	860
Corinth	1292
Coventry	856
Derby	4616
Franklin	1166
Georgia	3869
Glover	786
Greensboro	763
Hartford	9389
Highgate	3286
Irasburg	903
Jay	405
Lowell	669
Newport City	4707
Newport Town	1507
North Hero	541
Salisbury	1141
St. Albans Town	5467
St. Johnsbury	7741
Swanton	5798
Troy	1609
Westfield	465

Towns With Solid Waste District or Coordinated Solid Waste Implementation Plans*

Addison County Solid Waste Management District

Addison	ACSWMD	1228
Bridport	ACSWMD	1197
Cornwall	ACSWMD	1115
Ferrisburg	ACSWMD	2440
Goshen	ACSWMD	245
Leicester	ACSWMD	938
Lincoln	ACSWMD	1023
Middlebury	ACSWMD	8564
Monkton	ACSWMD	1577
New Haven	ACSWMD	1412
Orwell	ACSWMD	1214
Panton	ACSWMD	665
Ripton	ACSWMD	554
Shoreham	ACSWMD	1174
Starksboro	ACSWMD	1633
Vergennes	ACSWMD	2737
Waltham	ACSWMD	480
Weybridge	ACSWMD	782
Whiting	ACSWMD	425

Bennington County Regional Planning Commission *

Arlington	BRPC	2263
Bennington	BRPC	16186
Dorset	BRPC	2029
Glastenbury	BRPC	7
Landgrove	BRPC	158
Manchester	BRPC	3779
Peru	BRPC	359
Pownal	BRPC	3376
Rupert	BRPC	678
Sandgate	BRPC	299
Shaftsbury	BRPC	3421
Stamford	BRPC	785
Sunderland	BRPC	881
Woodford	BRPC	372

Central Vermont Solid Waste Management District

Barre City	CVSWMD	9536
Barre Town	CVSWMD	7543
Berlin	CVSWMD	2618
Bradford	CVSWMD	2576
Cabot	CVSWMD	1109
Calais	CVSWMD	1593
Chelsea	CVSWMD	1201
East Montpelier	CVSWMD	2272
Hardwick	CVSWMD	2994
Marshfield	CVSWMD	1530
Middlesex	CVSWMD	1538
Montpelier	CVSWMD	8392
Northfield	CVSWMD	5758
Orange	CVSWMD	965
Plainfield	CVSWMD	1301
Roxbury	CVSWMD	595
Tunbridge	CVSWMD	1134
Walden	CVSWMD	755
Washington	CVSWMD	1003
Williamstown	CVSWMD	2811
Woodbury	CVSWMD	834
Strafford	CVSWMD GUVSWMD	875

Chittenden Solid Waste District

Bolton	CSWD	1148
Burlington	CSWD	40259
Charlotte	CSWD	3457
Colchester	CSWD	16420
Essex	CSWD	9270
Essex Junction	CSWD	8647
Hinesburg	CSWD	4012
Huntington	CSWD	1664
Jericho	CSWD	4595
Milton	CSWD	8916
Richmond	CSWD	4030
Shelburne	CSWD	6457
South Burlington	CSWD	14080
St. George	CSWD	809
Westford	CSWD	1891
Williston	CSWD	5967
Winooski	CSWD	6753

Greater Upper Valley Solid Waste Management District

Strafford	CVSWMD GUVSWMD	875
Bridgewater	GUVSWMD	884
Hartland	GUVSWMD	3076
Norwich	GUVSWMD	3138
Pomfert	GUVSWMD	903
Sharon	GUVSWMD	1195
Thetford	GUVSWMD	2537
Vershire	GUVSWMD	623
West Fairlae	GUVSWMD	657
Woodstock	GUVSWMD	3285

Lamoille Regional Solid Waste Management District

Belvidere	LRSWMD	234
Cambridge	LRSWMD	2978
Craftsbury	LRSWMD	1156
Eden	LRSWMD	950
Elmore	LRSWMD	691
Hyde Park	LRSWMD	2428
Johnson	LRSWMD	3136
Morristown	LRSWMD	5131
Stowe	LRSWMD	3858
Waterville	LRSWMD	585
Wolcott	LRSWMD	1316
Worcester	LRSWMD	907

Northeast Kingdom Waste Management District

Averill	NEKWMD	7
Avery's Gore	NEKWMD	0
Barnet	NEKWMD	1432
Bloomfield	NEKWMD	277
Brighton	NEKWMD	1400
Brunswick	NEKWMD	111
Danville	NEKWMD	1990
East Haven	NEKWMD	272
Ferdinand	NEKWMD	24
Granby	NEKWMD	91
Groton	NEKWMD	931
Guildhall	NEKWMD	315
Holland	NEKWMD	470
Lewis	NEKWMD	0
Lunenburg	NEKWMD	1230
Lyndon	NEKWMD	5454
Maidstone	NEKWMD	144
Morgan	NEKWMD	535
Newark	NEKWMD	355
Peacham	NEKWMD	647
Ryegate	NEKWMD	1079
Sheffield	NEKWMD	610
Stannard	NEKWMD	174
Victory	NEKWMD	52
Warner's Grant	NEKWMD	0
Warren Gore	NEKWMD	1
Waterford	NEKWMD	755
Westmore	NEKWMD	330
Wheelock	NEKWMD	520

Rutland County Solid Waste District		
Brandon	RCSWD	4166
Castleton	RCSWD	4309
Clarendon	RCSWD	2891
Danby	RCSWD	1212
Hubbardton	RCSWD	627
Ira	RCSWD	446
Mendon	RCSWD	987
Mount Tabor	RCSWD	214
Pittsfield	RCSWD	374
Pittsford	RCSWD	374
Poultney	RCSWD	3404
Proctor	RCSWD	1888
Rutland City	RCSWD	18059
Sherburne	RCSWD	756
Wallingford	RCSWD	2218
Wells	RCSWD	942
West Rutland	RCSWD	2505

Rutland Joint Municipal Survey Committee/ Solid Waste Alternative Committee *		
Benson	JMSC	871
Chittenden	JMSC	1108
Fair Haven	JMSC	2887
Middletown Springs	JMSC	709
Mount Holly	JMSC	1069
Pawlet	JMSC	1352
Rutland Town	JMSC	3987
Shrewsbury	JMSC	1131
Sudbury	JMSC	518
Tinmouth	JMSC	476
West Haven	JMSC	277

Northwest Vermont Solid Waste Management District		
Alburg	NWVSWMD	1472
Bakersfield	NWVSWMD	1059
Berkshire	NWVSWMD	1268
Enosburg	NWVSWMD	2503
Fairfield	NWVSWMD	1888
Fletcher	NWVSWMD	1034
Isle LaMotte	NWVSWMD	474
Montgomery	NWVSWMD	827
Richford	NWVSWMD	2219
Sheldon	NWVSWMD	1888
South Hero	NWVSWMD	1511
St. Albans City	NWVSWMD	7596

Waterbury/Mad River Solid Waste Alliance *		
Duxbury	W/MRSWA	1053
Fayston	W/MRSWA	1024
Moretown	W/MRSWA	1507
Waitsfield	W/MRSWA	1505
Warren	W/MRSWA	1317
Waterbury	W/MRSWA	4639

Randolph, Brookfield and Braintree *		
Braintree	RANDOLPH	1233
Brookfield	RANDOLPH	1171
Randolph	RANDOLPH	4716

White River Alliance *		
Barnard	WRA	856
Bethel	WRA	1869
Hancock	WRA	372
Royalton	WRA	2336

Southern Windsor/Windham County Solid Waste Management District		
Andover	SW/WCSWMD	381
Baltimore	SW/WCSWMD	189
Cavendish	SW/WCSWMD	1280
Chester	SW/WCSWMD	2808
Grafton	SW/WCSWMD	647
Ludlow	SW/WCSWMD	2495
Plymouth	SW/WCSWMD	451
Reading	SW/WCSWMD	629
Rockingham	SW/WCSWMD	5571
Springfield	SW/WCSWMD	9330
Weathersfield	SW/WCSWMD	2672
West Windsor	SW/WCSWMD	950
Westminster	SW/WCSWMD	3136
Windsor	SW/WCSWMD	3869

Windham Solid Waste Management District		
Brattleboro	WSWMD	12322
Brookline	WSWMD	417
Dover	WSWMD	1014
Dummerston	WSWMD	1886
Guilford	WSWMD	1930
Halifax	WSWMD	586
Jamaica	WSWMD	760
Marlboro	WSWMD	1032
Newfane	WSWMD	1586
Putney	WSWMD	2610
Readsboro	WSWMD	775
Townshend	WSWMD	1070
Vernon	WSWMD	1887
Whitingham	WSWMD	1182
Wilmington	WSWMD	2023

Appendix III

Availability of Local Special Waste Management Options

TOWN	SW District	Used oil	Oil filters	Auto Batts	Recharg batts	Dry cell batts	Oil paint	Latex paint	White goods	Tires	HHW	Pesticides	Mercury lamps	PCB ballasts	Thermostats
Addison	ACSWMD	D		D	D	D	D		D	D	D	D	D	D	D
Albany		P		P	M		M	M	M	M	M	M			
Alburg	NWVSWMD	D			D		D	D	D	D	D	D			
Andover	SW/WCSWMD	D		D	D	D	D		D	D	D	D			
Arlington	BRPC	D		P	D		D	D	P	P	D	D			
Athens															
Averill	NEKWMD	D		D	D		D	D	D		D	D			
Avery's Gore	NEKWMD	D		D	D		D	D	D		D	D			
Bakersfield	NWVSWMD	D			D		D	D	D	D	D	D			
Baltimore	SW/WCSWMD	D		D	D	D	D		D	D	D	D			
Barnard	WRA	M	M	M	D		D		M	M	D	D			
Barnet	NEKWMD	D		D	D		D	D	D		D	D			
Barre City	CVSWMD	D			D,P		D			P	D	D	D	D	D
Barre Town	CVSWMD	D			D,P		D				D	D	D	D	D
Barton		P		P	M		M	M	M	M	M	M			
Belvidere	LRSWMD	D			D		D			D	D	D			
Bennington	BRPC	D		P	D,P		D	D	P	P	D	D			
Benson	JMSC	D			D		D				D	D			
Berkshire	NWVSWMD	D			D		D	D	D	D	D	D			
Berlin	CVSWMD	D,P			D,P		D			P	D	D	D	D	D
Bethel	WRA	D	D	D	D	D	D		D	D	D	D			
Bloomfield	NEKWMD	D		D	D		D	D	D		D	D			
Bolton	CSWD	D	D	D	D		D	D	D	D	D	D	D	D	D
Bradford	CVSWMD	D			D,P		D				D	D	D	D	D
Braintree	RANDOLPH	D		D	D		D	D	D	D	D	D			
Brandon	RCSWD	M		M	M		D	D	M	M	D	D			
Brattleboro	WSWMD	D	D	D	P		D		D	D	D	D			
Bridgewater	GUVSWMD	D,C		D	D,C		D,C		D	D	D,C	D,C	D,C	D,C	D,C
Bridport	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Brighton	NEKWMD	D		D	D		D	D	D		D	D			

TOWN	SW District	Used oil	Oil filters	Auto Batts	Recharg batts	Dry cell batts	Oil paint	Latex paint	White goods	Tires	HHW	Pesticides	Mercury lamps	PCB ballasts	Thermostats
Bristol		M		M	M		M		M	M	M	M			
Brookfield	RANDOLPH	D		D	D		D	D	D	D	D	D			
Brookline	WSWMD	D	D	D	D		D		D	D	D	D			
Brownington		P		P	M		M	M	M	M	M	M			
Brunswick	NEKWMD	D		D	D		D	D	D		D	D			
Buel's Gore															
Burke		P		P	M		M	M	M	P	M	M			
Burlington	CSWD	D	D	D	D,P		D	D	D,P	D	D	D	D	D	D
Cabot	CVSWMD	D			D		D				D	D	D	D	D
Calais	CVSWMD	D			D		D				D	D	D	D	D
Cambridge	LRSWMD	D			D		D		D	D	D	D			
Canaan		M						M	M						
Castleton	RCSWD	M		M	D,P		D	D	M	M	D	D			
Cavendish	SW/WCSWMD	D		D	D	D	D		D	D	D	D			
Charleston		P		P	M		M	M	M	M	M	M			
Charlotte	CSWD	D	D	D	D		D	D	D	D	D	D	D	D	D
Chelsea	CVSWMD	D			D		D		P		D	D	D	D	D
Chester	SW/WCSWMD	M		M	M	M	D		M	M	D	D			
Chittenden	JMSC	D			D		D		M	M	D	D			
Clarendon	RCSWD	D			D		D	D	M		D	D			
Colchester	CSWD	D	D	D	D,P		D	D	D	D	D	D	D	D	D
Concord															
Corinth		P		P					P	P					
Cornwall	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Coventry		M		M	M		M	M	M	M	M	M			
Craftsbury	LRSWMD	D		D	D		D		D	D	D	D			
Danby	RCSWD	D			D		D	D			D	D			
Danville	NEKWMD	D		D	D		D	D	D		D	D			
Derby		M		M	M		M	M	M	M	M	M			
Dorset	BRPC	D		P	D,P		D	D	P	P	D	D			
Dover	WSWMD	D	D	D	D		D		D	D	D	D			
Dummerston	WSWMD	D	D	D	D		D		D	D	D	D			
Duxbury	W/MRSWA	D		P	D		D		P	P	D	D			
East Haven	NEKWMD	D		D	D		D	D	D		D	D			
East Montpelier	CVSWMD	D,P	P		D		D				D	D	D	D	D
Eden	LRSWMD	D		D	D		D		D	D	D	D			
Elmore	LRSWMD	D		D	D		D		D	D	D	D			

TOWN	SW District	Used oil	Oil filters	Auto Batts	Recharg batts	Dry cell batts	Oil paint	Latex paint	White goods	Tires	HHW	Pesticides	Mercury lamps	PCB ballasts	Thermostats
Enosburg	NWVSWMD	D			D,P		D	D	D	D	D	D			
Essex	CSWD	D	D	D	D,P		D	D	D	D	D	D	D	D	D
Essex Junction	CSWD	D	D	D	D,P		D	D	D	D	D	D	D	D	D
Fair Haven	JMSC	D			D		D		M	M	D	D			
Fairfax															
Fairfield	NWVSWMD	D			D		D	D	D	D	D	D			
Fairlee	WRA														
Fayston	W/MRSWA	D		P	D		D		P	P	D	D			
Ferdinand	NEKWMD	D		D	D		D	D	D		D	D			
Ferrisburg	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Fletcher	NWVSWMD	D			D		D	D	D	D	D	D			
Franklin		M		M	M	M	M	M	M	M	M	M			
Georgia		P		P	M		M	M	M	M	M	M			
Glastenbury	BRPC	D		P	D		D	D	P	P	D	D			
Glover		P		M	M		M	M	M	M	M	M			
Goshen	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Grafton	SW/WCSWMD	D		D	D	D	D		D	D	D	D			
Granby	NEKWMD	D		D	D		D	D	D		D	D			
Grand Isle															
Granville	WRA														
Greensboro		P		P	M		M	M	M	P	M	M			
Groton	NEKWMD	D		D	D		D	D	D		D	D			
Guildhall	NEKWMD	D		D	D		D	D	D		D	D			
Guilford	WSWMD	D	D	D	D		D		D	D	D	D			
Halifax	WSWMD	D	D	D	D		D		D	D	D	D			
Hancock	WRA	D	D	D	D	D	D		D	D	D	D			
Hardwick	CVSWMD	D			D		D		P		D	D	D	D	D
Hartford		M		M	M,C,P		M,C		M	M	M,C	M,C	M,C	M,C	M,C
Hartland	GUVSWMD	D,C		D	D,C		D,C		D	D	D,C	D,C	D,C	D,C	D,C
Highgate		M		M	M		M	M	M	M	M	M			
Hinesburg	CSWD	D	D	D	D		D	D	D	D	D	D	D	D	D
Holland	NEKWMD	D		D	D		D	D	D		D	D			
Hubbardton	RCSWD	D			D		D	D			D	D			
Huntington	CSWD	D	D	D	D		D	D	D	D	D	D	D	D	D
Hyde Park	LRSWMD	D		D	D		D		D	D	D	D			
Ira	RCSWD	D			D		D	D			D	D			
Irasburg		P		P	M		M	M	M	M	M	M			

TOWN	SW District	Used oil	Oil filters	Auto Batts	Recharg batts	Dry cell batts	Oil paint	Latex paint	White goods	Tires	HHW	Pesticides	Mercury lamps	PCB ballasts	Thermostats
Isle LaMotte	NWVSWMD	D			D		D	D	D	D	D	D			
Jamaica	WSWMD	D	D	D	D		D		D	D	D	D			
Jay		P		P	M		M	M	M	M	M	M			
Jericho	CSWD	D	D	D	D		D	D	D	D	D	D	D	D	D
Johnson	LRSWMD	D		D	D		D		D	D	D	D			
Kirby															
Landgrove	BRPC	D		P	D		D	D	P	P	D	D			
Leicester	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Lemington															
Lewis	NEKWMD	D		D	D		D	D	D		D	D			
Lincoln	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Londonderry					P				M	M					
Lowell		P		P	M		M	M	M	M	M	M			
Ludlow	SW/WCSWMD	D		M	M	M	D		M	M	D	D			
Lunenburg	NEKWMD	D		D	D		D	D	D		D	D			
Lyndon	NEKWMD	D		D	D		D	D	D		D	D			
Maidstone	NEKWMD	D		D	D		D	D	D		D	D			
Manchester	BRPC	M		P	D,P		D	D	M,P	M,P	D	D			
Marlboro	WSWMD	D	D	D	D		D		D	D	D	D			
Marshfield	CVSWMD	D			D		D				D	D	D	D	D
Mendon	RCSWD	D			D		D	D			D	D			
Middlebury	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Middlesex	CVSWMD	D			D		D		P		D	D	D	D	D
Middletown Springs	JMSC	D			D		D		M		D	D			
Milton	CSWD	D	D	D	D,P		D	D	D	D	D	D	D	D	D
Monkton	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Montgomery	NWVSWMD	D			D		D	D	D	D	D	D			
Montpelier	CVSWMD	D,P			D		D	P	P	P	D	D	D	D	D
Moretown	W/MRSWA	D		P	D		D		P	P	D	D			
Morgan	NEKWMD	D		D	D		D	D	D		D	D			
Morristown	LRSWMD	D,P		D	D,P		D		D,P	D	D	D			
Mount Holly	JMSC	D			D		D		M	M	D	D			
Mount Tabor	RCSWD	D			D		D	D			D	D			
New Haven	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Newark	NEKWMD	D		D	D		D	D	D		D	D			
Newbury										M					
Newfane	WSWMD	D	D	D	D		D		D	D	D	D			

TOWN	SW District	Used oil	Oil filters	Auto Batts	Recharg batts	Dry cell batts	Oil paint	Latex paint	White goods	Tires	HHW	Pesticides	Mercury lamps	PCB ballasts	Thermostats
Newport City		P		P	M,P		M	M	M	M	M	M			
Newport Town		P		P	M		M	M	M	M	M	M			
North Hero		M		P	M		M	M	M	M	M	M			
Northfield	CVSWMD	D			D,P		D				D	D	D	D	D
Norton															
Norwich	GUVSWMD	D,C		D	D,C,P		D,C		D	D	D,C	D,C	D,C	D,C	D,C
Orange	CVSWMD	D			D		D				D	D	D	D	D
Orwell	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Panton	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Pawlet	JMSC	D			D		D		M	M	D	D			
Peacham	NEKWMD	D		D	D		D	D	D		D	D			
Peru	BRPC	D		P	D		D	D	P	P	D	D			
Pittsfield	RCSWD	D			D		D	D			D	D			
Pittsford	RCSWD	M		M	D		D	D		D	D	D			
Plainfield	CVSWMD	D			D		D				D	D	D	D	D
Plymouth	SW/WCSWMD	D		D	D	D	D		D	D	D	D			
Pomfert	GUVSWMD	D,C		D	D,C		D,C		D	D	D,C	D,C	D,C	D,C	D,C
Poultney	RCSWD	M		M	D		D	D	M	M	D	D			
Pownal	BRPC	D		M,P	D		D	D	M,P	M,P	D	D			
Proctor	RCSWD	D			D		D	D	M		D	D			
Putney	WSWMD	D	D	D	D		D		D	D	D	D			
Randolph	RANDOLPH	D		D	D		D	D	D	D	D	D			
Reading	SW/WCSWMD	D		D	D	D	D		D	D	D	D			
Readsboro	WSWMD	D	D	D	D		D		D	D	D	D			
Richford	NWVSWMD	D			D		D	D	D	D	D	D			
Richmond	CSWD	D	D	D	D		D	D	D	D	D	D	D	D	D
Ripton	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Rochester	WRA				P										
Rockingham	SW/WCSWMD	D		M	M	M	D		M	M	D	D			
Roxbury	CVSWMD	D			D		D				D	D	D	D	D
Royalton	WRA	D	D	D	D	D	D		D	D	D	D			
Rupert	BRPC	D		M,P	D		D	D	P	P	D	D			
Rutland City	RCSWD	M,P		M,P	D,P		D	D	M,P	M,P	D	D			
Rutland Town	JMSC	D			D,P		D			M	D	D			
Ryegate	NEKWMD	D		D	D		D	D	D		D	D			
Salisbury		M,P		M	M		M	M	M	M	M	M		M	
Sandgate	BRPC	D		P	D		D	D	P	P	D	D			

TOWN	SW District	Used oil	Oil filters	Auto Batts	Recharg batts	Dry cell batts	Oil paint	Latex paint	White goods	Tires	HHW	Pesticides	Mercury lamps	PCB ballasts	Thermostats
Searsburg															
Shaftsbury	BRPC	D		P	D		D	D	M,P	M,P	D	D			
Sharon	GUVSWMD	D,C		D	D,C		D,C		D	D	D,C	D,C	D,C	D,C	D,C
Sheffield	NEKWMD	D		D	D		D	D	D		D	D			
Shelburne	CSWD	D	D	D	D		D	D	D	D	D	D	D	D	D
Sheldon	NWVSWMD	D			D		D	D	D	D	D	D			
Sherburne	RCSWD	D			D		D	D	M		D	D			
Shoreham	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Shrewsbury	JMSC	D			D		D		M	M	D	D			
Somerset															
South Burlington	CSWD	D	D	D	D,P		D	D	D	D	D	D	D	D	D
South Hero	NWVSWMD	D			D		D	D	D	D	D	D			
Springfield	SW/WCSWMD	D		D	D,P	D	D		D	D	D	D			
St. Albans City	NWVSWMD	D,P			D,P		D	D	D	D	D	D			
St. Albans Town		M		M	M		M	M	M	M	M	M			
St. George	CSWD	D	D	D	D		D	D	D	D	D	D	D	D	D
St. Johnsbury					P				M	M					
Stamford	BRPC	D		M,P	D	M	D	D	M,P	M,P	D	D			
Stannard	NEKWMD	D		D	D		D	D	D		D	D			
Starksboro	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Stockbridge	WRA														
Stowe	LRSWMD	D,P		D	D		D		D	D	D	D			
Strafford	CVSWMD GUVSWMD	D,C		D	D,C		D,C		D	D	D,C	D,C	D,C	D,C	D,C
Stratton									M	M					
Sudbury	JMSC	D			D		D				D	D			
Sunderland	BRPC	M		M	D		D	D	M,P	M,P	D	D			
Sutton															
Swanton		M		M	M,P		M	M	M	M	M	M			
Thetford	GUVSWMD	D,C		D	D,C		D,C		D	D	D,C	D,C	D,C	D,C	D,C
Tinmouth	JMSC	D			D		D		M	M	D	D			
Topsham															
Townshend	WSWMD	D	D	D	D		D		D	D	D	D			
Troy		P		P	M		M	M	M	M	M	M			
Tunbridge	CVSWMD	D			D		D				D	D	D	D	D
Underhill					M		M				M	M			
Vergennes	ACSWMD	D		D	D,P		D		D	D	D	D	D	D	D
Vernon	WSWMD	D	D	D	D		D		D	D	D	D			

TOWN	SW District	Used oil	Oil filters	Auto Batts	Recharg batts	Dry cell batts	Oil paint	Latex paint	White goods	Tires	HHW	Pesticides	Mercury lamps	PCB ballasts	Thermostats
Vershire	GUVSWMD	D,C		D	D,C		D,C		D,M	D	D,C	D,C	D,C	D,C	D,C
Victory	NEKWMD	D		D	D		D	D	D		D	D			
Waitsfield	W/MRSWA	D		P	D,P		D		P	P	D	D			
Walden	CVSWMD	D			D		D				D	D	D	D	D
Wallingford	RCSWD	M		M	D		D	D	M	M	D	D			
Waltham	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Wardsboro									M	M					
Warner's Grant	NEKWMD	D		D	D		D	D	D		D	D			
Warren	W/MRSWA	D		P	D		D		P	P	D	D			
Warren Gore	NEKWMD	D		D	D		D	D	D		D	D			
Washington	CVSWMD	D			D		D				D	D	D	D	D
Waterbury	W/MRSWA	D		P	D,P		D		P	P	D	D			
Waterford	NEKWMD	D		D	D		D	D	D		D	D			
Waterville	LRSWMD	D		D	D		D		D	D	D	D			
Weathersfield	SW/WCSWMD	M		M	M	M	D		M	M	D	D			
Wells	RCSWD	M			D		D	D	M	M	D	D			
West Fairlee	GUVSWMD	D,C		D	D,C		D,C		D	D	D,C	D,C	D,C	D,C	D,C
West Haven	JMSC	D			D		D		M	M	D	D			
West Rutland	RCSWD	M		M	D		D	D			D	D			
West Windsor	SW/WCSWMD	D		D	D	D	D		D	D	D	D			
Westfield		P		P	M		M	M	M	M	M	M			
Westford	CSWD	D	D	D	D		D	D	D	D	D	D	D	D	D
Westminster	SW/WCSWMD	D		D	D	D	D		D	D	D	D			
Westmore	NEKWMD	D		D	D		D	D	D		D	D			
Weston															
Weybridge	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Wheelock	NEKWMD	D		D	D		D	D	D		D	D			
Whiting	ACSWMD	D		D	D		D		D	D	D	D	D	D	D
Whitingham	WSWMD	D	D	D	D		D		D	D	D	D			
Williamstown	CVSWMD	D			D,P		D				D	D	D	D	D
Williston	CSWD	D	D	D	D,P		D	D	D	D	D	D	D	D	D
Wilmington	WSWMD	D	D	D	D,P		D		D	D	D	D			
Windham															
Windsor	SW/WCSWMD	D		M	M	M	D		M	M	D	D			
Winhall									M	M					
Winooski	CSWD	D	D	D	D		D	D	D	D	D	D	D	D	D
Wolcott	LRSWMD	D		D	D		D		D	D	D	D			

TOWN	SW District	Used oil	Oil filters	Auto Batts	Recharg batts	Dry cell batts	Oil paint	Latex paint	White goods	Tires	HHW	Pesticides	Mercury lamps	PCB ballasts	Thermostats
Woodbury	CVSWMD	D			D		D				D	D	D	D	D
Woodford	BRPC	D		M	D		D	D	P	P	D	D			
Woodstock	GUVSWMD	D,C		D	D,C,P		D,C		D	D	D,C	D,C	D,C	D,C	D,C
Worcester	LRSWMD	D		D	D		D		D	D	D	D			

Abbreviations:

C	Non-profit community group provides collection
D	Solid waste district or Alliance of towns provides collection
M	Town or city provides collection
P	Private business provides collection

ACSWMD	Addison County Solid Waste Management District
BRPC	Bennington Regional Planning Commission
CSWD	Chittenden Solid Waste District
CVSWMD	Central Vermont Solid Waste Management District
GUVSWMD	Greater Upper Valley Solid Waste Management District
JMSC	Joint Municipal Survey Committee (Rutland)
LRSWMD	Lamoille Regional Solid Waste Management District
NEKWMD	Northeast Kingdom Waste Management District
NWVSWMD	Northwest Vermont Solid Waste Management District
RCSWD	Rutland County Solid Waste District
SW/WCSWMD	Southern Windsor/Windham County Solid Waste Management District
W/MRSWA	Waterbury/Mad River Solid Waste Alliance
WRA	White River Alliance
WSWMD	Windham Solid Waste Management District

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