Analysis of Disposal Methods for Do-It-Yourselfer Used Oil Filters

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This report fulfills the requirement of 1999 Minnesota Session Laws, Ch 231, section 201, *Analysis of Used Oil Filter Disposal Methods.*

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EXECUTIVE SUMMARY

Background

The Minnesota Pollution Control Agency (MPCA) and the Minnesota Office of Environmental Assistance (MOEA), in cooperation with many industry stakeholders, have analyzed the technical feasibility of various methods of disposing of and recycling do-it-yourselfer (DIY) used motor oil filters, as required in Laws of 1999, Ch. 231, Sec. 201.

Approximately 4 to 7.5 million passenger vehicle oil filters are used each year in Minnesota. The MOEA estimates that 840,000 to 1,400,000 of these are disposed of in the trash each year. This represents 280 to 467 tons of used oil filters (approximately 3,000 passenger car oil filters weigh one ton). Used oil filters can contain two to eight ounces of oil after they are removed. This amounts to an additional 13,000 to 88,000 gallons of used motor oil being disposed of in MSW in the state.

I. Environmental Impacts of Oil Filters

A. Impacts to water and soil

One of the more difficult issues affecting water and soil contamination from used oil filters is that the residual oil from the filter is not spilled in large quantities in one location. Microbial action and time help to break down the oil in contaminated soils so that certain contaminants do not have a detrimental impact. The impact of used oil can vary depending upon soil type, level of soil moisture/saturation, oil concentration, frequency between "dumpings," compaction and slope (run-off potential), and the type and concentration of heavy metals in the oil.

Soil contamination from mismanaged used oil found in filters may occur throughout Minnesota in small, localized doses. The degree of contamination depends upon (among other things) where and how much of the used oil is dumped. Due to the differing amounts and the distribution methods of improperly managed used oil, identification and cleanup of DIY used oil-contaminated soils becomes extremely difficult.

II. Disposal in Landfills

The addition of DIY used oil filters to the solid waste stream would not significantly increase the amount of solid waste going to the MSW landfills. Given that the proposed additional disposal associated with filters is as a percentage very small, leachate quality would not be affected in any significant way. As a result, there would be little increase in costs associated with leachate disposal.

III. Incineration

DIY oil filters in the MSW stream at municipal waste combustors (MWCs) represent an insignificant impact on the waste stream itself, the environment, or as a loss of resources (that is, the loss of steel as ash rather than being recycled). Used oil filters are noncombustible (but have some small heat value from the oil and paper filters in them). Because they are steel, they can be recovered from a waste or ash processing stream by magnetic separation. Therefore, putting used oil filters in MSW at MWCs means that the oil filters may be recycled.

IV. Collection Methods

There are basically three collection methods that can be used to collect DIY used oil filters: (1) curbside collection, (2) retail site drop-off and (3) drop-off at public collection sites. While curbside collection of DIY used oil filters may offer the greatest convenience to the consumer, it adds special handling requirements for trash collectors. It may be inconvenient, messy and ineffective from the collectors' point of view if proper materials, training and consumer education do not accompany the implementation of the curbside service.

The central element of a drop-off collection site is a container placed in a publicly accessible location, such as a solid waste transfer station, retail auto parts store, service station, quick lube facility or recycling center for used oil and used oil filters. One disadvantage of drop-off locations is the continual problem of abandoned solid and hazardous wastes. Solutions to this problem range from posting information that it is against the law to leave these wastes at the site to putting up fencing or installing surveillance cameras to monitor the activity of the site when no one is present.

Annual Recycling Impacts

Recycling one ton of oil filters annually:

- saves 10 cubic yards of landfill space;
- produces approximately 1,700 pounds of high-quality steel;
- produces approximately 300 pounds of paper filter media that, when burned as a fuel source, produce approximately 16,000 British thermal units (BTUs) per pound.

Using these figures, recycling all of the DIY used oil and oil filters would save 2,800 to 4,670 cubic yards of landfill space, provide 238 to 397 tons of high-carbon steel and reduce the depletion of natural resources.

Conclusions

A decisive consideration relative to the feasibility of disposal alternatives is: What overall level of effort is appropriate for DIY used oil filter disposal? This is a question of where to direct state resources, or more specifically, a question of how to prioritize resource use when faced with much competition for resources.

The MPCA's established major programs — along with many significant smaller programs — have achieved widespread and recognized successes in protecting and improving the quality of Minnesota's environment. As it supports these ongoing programs, the agency faces new, emerging and unanticipated demands on its resources. Moreover, in addition to environmental quality, the citizens of Minnesota are strongly committed to a broad range of other quality-of-life issues that require and compete for resources.

Recognizing these resource constraints and considering the environmental impact, the MPCA concludes:

- Resource recovery and saving landfill space are important factors in the entire waste-management system.
- Due to the Waste Management Act "hierarchy of disposal," the reuse of steel and the energy recovery from the oil in used oil filters are important.
- Adequate recycling is available once filters are collected.
- Resources are not currently available to household hazardous waste collection sites to collect more DIY used oil filters.
- The environmental risk for landfill or incineration disposal of DIY used oil filters is not substantial.

Recommendations

Minnesota Statutes 325E.112, subdivision 1, states:

> (a) "Motor oil and motor oil filter manufacturers and retailers shall seek to provide by May 31, 2001:
>
> (1) access to at least one non-governmental site for collection of used motor oil and filters from the public within a five-mile radius of any resident in the seven-county metropolitan area; and
>
> (2) access to at least one non-governmental site for collection of used motor oil and used motor oil filters from the public within a city or town with a population of greater than 1,500 outside the seven-county metropolitan area. The commissioner of the pollution control agency shall determine by June 30, 2001, whether these goals have been met."

- The MPCA will evaluate the work of the retailers and manufacturers in identifying DIY collection sites and determine if they have reached compliance with state law as soon as such information is made available. At this time, the preliminary data looks favorable and staff is hopeful that industry will meet their obligations;
- Retailers/Manufacturers will update the collection site list annually to MPCA/OEA;
- Keep the DIY used oil filter ban from landfilling;
- Continue MPCA/OEA auto waste education efforts at current levels;
- Give first priority in used oil filter education to discouraging disposal in or on land or in water bodies;
- Continue to focus efforts on the collection system problems;
- Maintain the voluntary product stewardship activities with automotive industry retailers and associations to:
  - Continue education efforts with their members;
  - Continue to encourage their members to take back DIY filters for free;
  - Provide appropriate lists of collectors/recyclers for the 800 clean up helpline; and
  - Provide public service announcements;
- Explore emerging, environmentally friendly oil filter design alternatives with automotive and filter manufacturers, ECOS, and EPA (this will be done by OEA staff); and
- Maintain the $250 refund program for DIY collectors, as an incentive to collect.

Analysis of Disposal Methods for Do-it-yourselfer Used Oil Filters

I. Problem Statement

Used oil and filters are prohibited from being placed in or on the land o in the solid waste. As a result, this essentially leaves recycling as the only legal option. Collection systems and recycling for business sources are good. However, convenient collection for do-it-yourselfers (DIYers) who change the oil in their vehicles is less established, especially in some areas outside the Twin Cities metro area.

II. Background/History

During the 1990s, different levels of regulations were enacted regarding the management of used DIY oil and filters. Currently, Minn. Statute 115A.916 says that Minnesota citizens who change their own motor oil may not knowingly place used motor oil or used motor oil filters in the solid waste. As of October 1995, Minn. Rules 7045 describes the options for DIYers to properly manage their used oil and filters.

In 1995, the MPCA and OEA were successful in getting controversial legislation passed requiring retailers who sell more than 1,000 filters a year to provide free collection at their sites or to contract with another collector nearby. After several years of strenuous opposition from retailers and many modifications to the legislation, as it *now* stands, Minn. Statutes 325E.112 states that:

> "motor oil and motor oil filter manufacturers and retailers shall seek to provide by May 31, 2001 access to at least one non-governmental site for collection of used motor oil and used motor oil filters from the public within a five-mile radius of any resident in the seven-county metropolitan area; and access to at least one non-governmental site for collection of used motor oil and used motor oil filters from the public within a city or town with a population of greater than 1,500 outside the seven-county metropolitan area.
>
> The commissioner of the pollution control agency shall determine by June 30, 2001, whether these goals have been met. If the commissioner of the pollution control agency determines that motor oil and motor oil filter manufacturers and retailers have not met the goals by May 31, 2001, then beginning July 1, 2001, all retailers that sell at an individual location more than 1,000 motor oil filters per calendar year at retail for off-site installation must provide for collection of used motor oil and used motor oil filters from the public."

The following reports have been written regarding many aspects for used DIY oil and filter disposal:

Do-It-Yourselfer Used Motor Oil Management in Minnesota (MPCA, August 1993)
Used Oil and Used Oil Filter Report (OEA, January 1996)
Do-It-Yourselfer Used Oil and Filter Recycling (MPCA and OEA, January 1999)
1999 Used Motor Oil and Oil Filter Study (OEA, January 2000)

As part of the ongoing negotiations, in 1999 the Legislature required the MPCA and the MOEA to work with industry on a study of alternative methods of disposing of and recycling used filters. The OEA commissioned a survey of DIYers, which provided data on disposal methods, recycling habits and barriers to recycling. We also looked at the environmental impacts of the filters, which primarily lie in the used oil they contain. We explored their impacts on water and soil and the impacts of collection, disposal and recycling.

III. Environmental Impacts

A. Test Results

Approximately 35 used oil filters were randomly collected from household hazardous waste collection sites throughout Minnesota. The paper filters were tested at random. The inside of each container was lightly rinsed to collect oil residue as part of the sample. The lab noted that there was a lot of liquid oil residue in each filter. This is common with DIY oil filters because DIYers do not drain or crush the filters before disposing of them. Educating DIYers to drain the filters before disposal would help decrease the amount of oil that remains in each filter.

Low levels of volatiles, especially acetone, were present in the oil residue sample. This was a surprise to the analyst, and the origin of the acetone is not known. Some benzene, ethyl benzene, xylene and toluene were present also, but these were expected. Low levels of semivolatiles, such as naphthalene (which came from a petroleum source), were also found. Tentatively identified compounds (TICs), mostly of a petroleum nature, were found. In general, the TIC report was in line with what would be expected when oil is analyzed. No polychlorinated biphenyls (PCBs) or pesticides were found in the sample. Except for the amounts of acetone and lead, the other results were typical with what is expected in a petroleum-based compound.

A total metals analysis was run on the paper media, with lead having an elevated concentration in one sample of 149 parts per million (ppm). For this sample, that is the maximum amount of lead present. However, this will vary with random samples. We can only speculate about a few possible sources of the lead, which may include gasoline burning in the oil, lead solder, and amount of lead in gasoline additives. From our limited set of samples, the lead appeared not to leach because the TCLP (Toxicity Characteristic Leaching Procedure (TCLP) levels were 0.9 ppm and 0.5 ppm.

B. Impacts of Disposal

When examining the environmental impacts of DIY used oil filters, the main concern is the residual amount of oil that remains in the filters even after they are "hot drained" (the dome of the filter is punctured to remove the vacuum of the anti-back drain valve and placed with the opening down in a collection container for 12 hours).

A properly drained used oil filter contains two to eight ounces of used oil. Using data from the MOEA 1999 DIY Survey and the Filter Manufacturers Council, it is estimated that 13,125 to 88,085 gallons of used oil are contained in mismanaged DIY filters.

1. Impact to water

According to the EPA, one gallon of improperly managed used oil can contaminate 1 million gallons of water. With this rate in mind, we have attempted to quantify the impact to water:

- Used oil contained in improperly managed oil filters in Minnesota = 13,000 to 88,000 gallons/year.
- 1 gallon used oil improperly managed = 1 million gallons contaminated water

A facility in Minnesota that provides a water-purification service to customers with oil-contaminated water quoted the following price for treatment of contaminated water. It costs $2 per gallon to separate and clean water that has been contaminated with drain oil. This rate is definitely a worst-case scenario, but its point should be taken well: cleaning up contaminated water can be expensive. If we put the time and resources that are necessary into dealing with better management of used oil filters up front, rather than dealing with the problem as an afterthought, the overall costs will be much less.

1. Impact to soil

One of the more difficult issues affecting soil contamination from used oil filters in this scenario, is that the residual oil from the filters is not spilled in large quantities in one location. If the DIY filters are drained into the soil, the overall concentration per filter may be minimal. But if this behavior is continued in one area, over time the contamination will increase. Microbial action over time helps to break down the oil in contaminated soils so that certain contaminants do not have a detrimental impact. Oil filters drained on the ground (for example, in one spot in a DIYer's backyard, where the person disposes of the used oil filters each time he/she changes oil), could pose a problem in a number of ways, but it is difficult to quantify due to the number of variables involved. For example, the potential impact of used oil can vary depending upon the factors described in the following chart:

Factor	Potential Impacts
Soil type	Some soil types are more porous than others. In some cases, the oil would not seep into the soil at any great rate but would instead run off to another location. Other times, all the oil would be absorbed by the soil and little run-off would occur.
Level of moisture/saturation	A high water table could pose more of a problem because discarded used oil could more easily seep into it.
Oil concentration	The higher the concentration of used oil, the higher the likelihood of soil or water contamination. If a site is constantly being "dumped on," the higher the likelihood that the site would pose a threat to water and vegetation.
Frequency between "dumpings"	More frequent dumping overloads the capacity of microbes to break down the soil.
Compaction (run-off potential)	Compact soils can increase the rate of oil run-off.
Slope (run-off potential)	Run-off potential can increase dramatically in soils with high slopes.
Heavy metals in oil (type and concentration)	Concentrations of certain heavy metals (*e.g.*, lead, cadmium, etc.) can build up to high levels in soils.

This list details some of the possible conditions that need to be considered when estimating the impacts of improperly managed used oil on soils. Lack of appropriate research, however, along with the large list of variable factors, make it difficult to determine any specific cost that could be attached to proper management of used oil.

Other research has been conducted by various institutions on the impact of oil spills to soil, water, vegetation and wildlife. Unfortunately, most of the available oil research focuses on such topics as tanker spills, leaking storage tanks and spills from pipelines. From this research, methods have been developed that can clean up oil-contaminated soils. For example, large areas of soil that are contaminated with oil can be cleaned up successfully through techniques like bioremediation. Bioremediation uses composting techniques to aerate the soil and allow microbial action to break down the oil to a tolerable level. Unfortunately, this form of cleanup would not be applicable to the situation surrounding used oil. Improper management of used oil, though significant in total oil volume, does not occur in one site. Soil contamination from mismanaged used oil occurs throughout the state in small, localized doses, and the degree of contamination depends (among other things) upon where and how much of the used oil is dumped. Due to the differeing amounts and distribution methods of improperly managed used oil, cleanup of used-oil-contaminated soils becomes virtually impossible.

1. Disposal in MSW Landfills

According to Minn. Statute 115A.916, a person may not knowingly place motor oil or motor oil filters in solid waste or a solid-waste-management facility. This requirement makes it illegal for a private individual to place a used oil filter in his or her garbage. There are many different types of landfills permitted including: demolition, industrial, mixed municipal and waste combustor ash

land disposal facilities. These facilities are currently prohibited from taking a waste containing free liquids and used oil. See Minn. Rules 7035.2535.

The 1988 Solid Waste Rules and Subtitle D of the Resource and Conservation and Recovery Act (RCRA) require MSW landfills to have a liner consisting of either four feet of clay or two feet of clay overlain by a geomembrane. This requirement anticipated that the liner material would need to be resistant to chemical attack. Thus, there is, with increased used filter landfilling, no need for additional liner protection. The same rules, referenced above, require a landfill owner/operator to collect and treat the leachate. Landfill owners/operators have several options to treat the leachate. First, they may haul the leachate for treatment at a wastewater-treatment plant. Typically, a plant will set influent guidelines based on receiving stream standards. Given that the proposed additional disposal associated with filters is a very small percentage, leachate quality will not be affected in any significant way. As a result, there will be little increased cost associated with leachate disposal.

The liners at MSW facilities have not been designed to completely contain landfill leachate. The MPCA believes that to require complete leachate containment would place an unnecessary cost burden on facility owners and operators. A small amount of leachate is expected to be released to the ground water over time. The solid waste rules were developed to take liner leakage into account. Facilities are required to establish compliance boundaries that may be no more than 200 feet from the waste fill. It is at the compliance boundary where conformance with ground water quality standards is determined. Therefore, this 200-foot buffer should provide adequate opportunity for chemical and biological attenuation to occur should leachate leak from a liner. With current liner design requirements, the addition of used oil filters to the waste stream should not have an adverse effect on ground water.

2. Disposal at Solid Waste Incinerators (Air)

DIY used oil filters in the MSW stream at MWCs represent an insignificant impact on the waste stream itself, the environment, or as a loss of resources (that is, the loss of steel as ash rather than being recycled).

Minnesota relies on 10 MWCs to process MSW before the waste is landfilled. In 1998, these MWCs processed about 1.4 million tons of MSW.[1]

Waste combustors process MSW to reduce the volume of waste requiring landfilling, while at the same time extracting and converting the energy contained in the waste stream itself. All MWCs in Minnesota generate hot water, steam for processing, or electricity from the heat created when solid waste is burned.

About 20% of MSW that is processed is noncombustible and must be disposed of as ash. This resulted in MWCs having generated 280,000 tons of ash in 1998 (20% of 1.4 million tons of

[1] According to Minnesota Office of Environmental Assistance, about 40% of all waste generated in Minnesota is recycled. Of the remaining waste, half is landfilled and the other half incinerated. Ref. MOEA, 2000.

MSW). The total may be slightly higher, due to the use of additional chemicals to treat flue gases to meet air-pollution-control requirements

MWCs in Minnesota burn MSW in two forms: (1) as unprocessed waste or (2) as refuse-derived fuel. The term "unprocessed waste" means that there is no further physical processing at the MWC before the waste is burned. These facilities take waste as garbage haulers deliver it, relying on community recycling and hazardous-waste-management programs to separate specific waste streams prior to combustion.

"Refuse-derived fuel" results from physically processing mixed MSW. Depending on the equipment used, refuse-derived fuel processing facilities process waste delivered by garbage haulers to eliminate non-combustibles in the waste, and reduces the size of waste components through shredding or other mechanical means.

Used oil filters are "non-combustible" (but have some small heat value from the oil and filter media in them). Because they are steel, they can be recovered from a waste or ash processing stream by magnetic separation. The following table describes the capacity of facilities in the MSW combustion system in Minnesota, and their ability to separate steel from their waste/residual streams for recycling.

Facility	**Capacity (tons per day or tons per year)**	**V. Fuel Type**	**Preprocessing/ separation at the plant**	**Postprocessing**
Hennepin Energy Resource Corporation (Minneapolis)	1,212 tpd 365, 000 tpy	Unprocessed MSW		Magnetic separation of metal from ash
Great River Energy (Elk River, combustor)	1,400 tpd	Refuse-derived fuel from NRG Elk River, sometimes NRG Newport	Metals separation prior to combusting RDF. Metals sold to scrap	
NSP Wilmarth (Mankato, combustor)	720 tpd	Refuse-derived fuel from NRG Newport	None	
NSP Red Wing (Red Wing, combustor)	720 tpd	Refuse-derived fuel from NRG Newport	Metals separation prior to combusting RDF from NRG.	
NRG Elk River (RDF production plant)	964,181 tpy		Ferrous separation project now under way; scrap metals to North Star Steel	
NRG Newport (RDF production plant)			Magentic separator after hammermill. Recovers 60 tpd, about 1,000 tons per month of ferrous.	
Olmsted Co.	200 tpd	Unprocessed MSW		
Polk County	37 tpd		Materials recovery facility at MWC facility; recovered metals resold to materials market	Metal removal from ash
Pope Douglas	49 tpd	Unprocessed MSW		
City of Fergus Falls	40 tpd	Unprocessed MSW		
City of Red Wing	40 tpd	Unprocessed MSW		

With incineration, there are often concerns about specific fractions of the waste stream contributing toxic metals to ash or to air emissions.

Minnesota's 3.8 million light-duty vehicles generate approximately 4.2 million DIY filters. The combined weight of all the filters (residual oil and filter) is about 1080 tons, representing about 0.1% of the amount of MSW processed at MWCs each year.

To investigate whether used oil filters contributed to lead or cadmium emissions at MWCs, the operators at the Olmsted Waste to Energy Facility collected used gasoline and diesel oil filters and had the filters analyzed for their lead and cadmium content. When burned, the metals that are contained in solders that would melt at furnace temperatures and the metals in paints and the oil itself could contribute to metals that are environmentally mobile in air emissions and in ash. Total lead concentrations were less than 10 ppm, and total cadmium concentrations were less than 5 ppm (reference 1)

From the information in the MPCA's 1999 report on lead in the environment, it can be calculated that the mass of lead contained in both the ash and air emissions is about 632,000 pounds per year (reference 2). This quantity represents in part the presence of some DIY filters, because there is no active enforcement at the household level of the statutory ban on filters in the MSW stream. However, if one assumes that by putting all DIY filters in the MSW stream is an incremental addition of metals to the MSW stream, the 4.2 million filters are contributing 21 additional pounds of lead, essentially an insignificant amount compared to the total lead in MSW. The same comparison (and conclusion) can be made for cadmium, at a concentration of 5 ppm.

In addition, putting used oil filters in MSW at MWCs still means the oil filters will be recycled. Most MWCs have installed magnets in their ash-handling systems so they can sell recovered ferrous metal to the secondary steel markets. For example, one small MWC in Minnesota installed a materials-recovery facility in front of the waste combustion units to recover saleable recyclables, one of them being ferrous metal. Thus, used oil filters still are potentially recoverable for recycling through processing at MWCs.

References:
1. Interpoll, *Laboratory Report #6716* for Minnesota Resource Recovery Association. October 23, 1992.
2. MPCA, *Report on Lead in the Environment*, January 1999, pp. 65, 67.

A. Summary of Environmental Impacts

DIY used oil filter disposal does not represent an emergency or the risk of an emergency. That is, if it is not immediately addressed, it will not result in significant widespread environmental damage or human health risk.

Based on MPCA evaluations, the volume of oil and associated pollutants in incinerated filters, relative to the overall volume of incinerated wastes, is so small as to be undetectable. Therefore, it neither increases nor decreases the environmental impacts associated with incineration. The

volume of oil in landfilled MSW represents a somewhat more significant problem relative to the risk of leakage, but here again the scale is remarkably small relative to the overall volume of wastes. The environmental impact of oil leaking from filters that are disposed of directly to the environment is more difficult to assess. Although motor oil is degradable in the environment, depending on the location and circumstances of discharge, it may have considerable impact, particularly on water quality. Of the three characteristic DIY used oil filter improper disposal methods, disposal to the environment would seem to have the highest potential for environmental damage and represent a relative priority consideration.

DIY-used-oil-filter-related emissions do not result in the exposure of, or the risk of exposure of, ecological systems or individuals to persistent bioaccumulative toxic pollutants, given the trace amounts of these pollutants in used motor oil (*i.e.*, below Toxicity Characteristic Leaching Procedure levels, except for lead).

VI. IV. DIY Oil Filter Mismanagement Estimates

To develop an accurate estimate of the number of DIY filters that are entering the solid waste system in the state, the MPCA and MOEA used two models to create estimates of mismanaged DIY filters. The first method used data collected in a 1999 MOEA statewide telephone survey and the second method used information submitted by the Filter Manufacturers Council on the amount of light duty filters sold in Minnesota.

According to the telephone survey done in December 1999, 32% of vehicle owners change their own oil at least once a year. Using this information and the Minnesota Department of Public Safety's data on registered vehicles in the state, the following estimates were developed.

Assuming that for every five quarts of oil (the average amount of oil used in an oil change) one oil filter is generated, approximately 4 million passenger filters are generated per year. Using the 1999 survey data that states that 35% of the filters generated by DIYs are disposed of in the trash, 1.4 million filters per year-end up in Minnesota's waste stream. Used oil filters can contain two to eight ounces of undrained oil after they are removed. This amounts to an additional 22,000 to 88,000 gallons of used motor oil being disposed of in the MSW stream in the state.

Using estimates provided by the Filter Manufacturers Council of 7.5 million passenger filters sold in Minnesota for 1999 and the same DIY generation data; 840,000 million filters containing 13,000 to 52,500 gallons of used motor oil are mismanaged in the state

Annually, **840,000 to 1.4 million used oil filters** are not being properly managed in Minnesota.

This represents 280 to 467 tons of used oil filters being disposed of in the MSW stream (approximately 3,000 passenger car oil filters = one ton).

VII. Recycling

A. Waste-Management Hierarchy

In 1980, the Minnesota Legislature passed the Waste Management Act (Minn. Stat. 115A). It states: "The waste management goal of the state is to foster an integrated waste management system in a manner appropriate to the characteristics of the waste stream and thereby protect the state's land, air, water, and other natural resources and the public health. The following waste-management practices are in order of preference:

(1) waste reduction and reuse;
(2) waste recycling;
(3) composting of yard waste and food waste;
(4) resource recovery through MSW composting or incineration;
(5) land disposal which produces no measurable methane gas or which involves the retrieval of methane gas as a fuel for the production of energy to be used on-site or for sale; and
(6) land disposal which produces measurable methane and which does not involve the retrieval of methane gas as a fuel for the production of energy to be used on-site or for sale."

As one can see the management of DIY used filters through separation and recovery of the steel, oil soaked media and liquid oil is in compliance with the states goals for waste management and fully supported by the Waste Management Act.

B. Benefits of Recycling Used Oil Filters

Recycling one ton of oil filters:

- saves 10 cubic yards of landfill space.
- produces approximately 1,700 pounds of high-quality steel.
- produces approximately 300 pounds of paper filter media. Oil filter media, when burned, yields approximately 16,000 British thermal units (Btus) per pound.
- Used oil as a fuel source is approximately 18,000 Btus/gallon.

Using these figures, proper management for all of the DIY used oil and oil filters would save 2,800 to 4,670 cubic yards of landfill space, provide 238 to 397 tons of high-carbon steel, and reduce the depletion of natural resources.

C. Factors Controlling Oil Recovery

Under EPA regulations, oil filters must be punched and hot drained to be exempt from hazardous waste designation. Puncturing of the dome and of used oil filters can significantly increase the amount of oil recovered. While puncturing of the dome end recovers much more oil than not puncturing, a significant portion of the oil is still trapped inside the filter. A market-weighted average of oil filters treated according to the EPA-recommended gravity hot draining (with dome puncturing) procedure reveals that 40% of the weight of a used oil filter is oil. The recovery of oil, from light-duty oil filters that are equipped with antisiphon valves, is enhanced by puncturing

the dome end during gravity hot draining. However, with respect to households disposing of their used oil filters, most DIYs do not properly drain their oil filters.

The heavy-duty filter contains approximately 23% of its original amount of oil after a 12-hour gravity hot drain regardless of the status of its dome end. The recovery of oil from heavy-duty filters that lack an antisiphon valve is not enhanced by puncturing of the dome end during gravity hot draining. The effect of puncturing of the filter dome end on oil recovery during draining is dependent upon the design of the filter.

In 25 draining tests that were conducted with both light-duty and heavy-duty oil filters, no significant draining was observed after the first hour, even when some of the filters were allowed to drain for 128 days. In the three filters that drained for 128 days, only a 5% decrease in the filter weight was observed. Little draining occurs after the first hour, showing that the EPA-mandated 12-hour drain is much longer than needed to effectively gravity drain.

Significant oil drainage from test filters was noticed when the filters were upset from their inverted position on the horizontal grate. The slightest tilt resulted in immediate draining of additional oil even though the filters had been draining for 12 or more hours. To investigate the impact of orientation during draining, 30 light-duty filters were drained at different angles. As expected, dome-punched filters resulted in larger oil recoveries than their unpunched counterparts. For example, the 30° filter drains only 33% of it is original oil in the unpunched condition, but drains nearly 67% of its original oil in the punched condition. The best oil recovery was found for dome-punched filter drained at angles of 30° and 180° from vertical. The unequal hydrostatic force on the antisiphon valve is thought to be responsible for the increased drainage. Draining the punched filter at 180° removed nearly 65% of its original oil content. The EPA gravity hot draining mandate allows for puncturing of either the dome end or the antisiphon valve.

These data lead to an important conclusion concerning draining as an acceptable method of removing oil to allow for landfilling of oil filters according to EPA requirements. The regulations are not specific as to the orientation of the oil filters during hot draining. Therefore, if an oil filter is removed from a vehicle and hot drained (either punched or unpunched) in any orientation other than the two most effective orientations (30° and 180°), considerable oil will remain in the filter that will most likely leak from the filter because of the changes in orientation when the filter is placed in the dumpster, being transported or while it is resting in its eventual position in the landfill. Based on these data, as much as 30% of the oil contained in the oil filter could eventually drain out into the uncontrolled environment. Observations of oil filters arriving in drums at oil filter recyclers supports this conclusion because there is always considerable oil in the bottom of the oil filter containers, whether the oil filters had been hot drained, punched and drained, or even crushed and drained. Therefore, for the best oil recovery and to minimize the amount of oil leakage during transport and final disposal, it is recommended that each filter be punctured on the dome end immediately upon removal from the vehicle, inverted to drain through the punched hole, and drained for 12 hours. This is critical only for oil filters that will be landfilled. Recycled oil filters will utilize recovery techniques that will allow recovery of the oil regardless of how much oil remains in the filter after the filter is removed from the automobile.

(Reprinted with changes from *Filter Recycling Issues —- Recycling versus Landfilling*, by permission of Kent D. Peaslee, University or Missouri-Rolla. Paper presented at the 1999 National Oil Recyclers Association Annual Conference).

VIII. D. DIY Used Oil Filter Collection Methods

There are basically three collection methods that can be used to collect DIY used oil filters: curbside collection, retail site drop-off or drop off at public collection sites. While the retail collection site and public collection site methods both involve the DIY bringing his or her used oil filters to a collection site, the circumstances surrounding the actual trip to the location are quite different.

1. Curbside collection

According to the American Petroleum Institute, 11 states have some form of curbside oil collection. It is not clear whether all of these programs also collect used oil filters.

Most curbside programs have a common structure. Residents are asked to place their used oil and oil filters at the curb on collection days in a tightly sealed, non-breakable container, such as a plastic milk jug for the oil and a coffee can with a lid for the oil filter. A hauler then collects the oil and filters during the regular garbage or recycling route. The used oil is either dumped into an on-board collection tank and the filters deposited into a leakproof drum or other container and then they are hauled to a centralized location for emptying and collection by a used oil and oil filter processor.

While curbside collection of DIY used oil filters may offer the greatest convenience to the consumer, it does add special handling requirements for the trash collector. It may be inconvenient, messy and ineffective from the collector's point of view if proper materials, training and consumer education do not accompany the implementation of the curbside service.

2. Drop-off collection

The central element of a drop-off used oil and oil filter collection site is a vessel placed in a publicly accessible location, such as a solid waste transfer station, auto parts retail store, a service station, quick lube facility or recycling center for used oil and used oil filters. The site may or may not be staffed by an attendant. The used oil is poured into the collection tank and the used oil filters are placed into a collection vessel, such as a metal or plastic drum. When full, the collection vessels are emptied by a hauler who operates either on an on-call or a "milk-route" basis. The oil and oil filters are then consolidated for centralized processing and recycling by a used oil and oil filter processor.

One disadvantage of drop-off locations is the continual problem of abandoned wastes. People often leave their used oil, oil filters and other automotive wastes at collection sites when the containers are full, the access to the site is closed, or after hours. This represents a concern to many operating these types of sites. Solutions range from posting information that is it against the law to leave your waste at the site to putting up surveillance cameras to monitor activity at the site

when no one is present. Another possible barrier for collection sites, including government collection centers, is related to the cost of disposal, lack of resources and collection space.

E. Recycling Costs for Used Oil Filters

When the costs of recycling used oil and oil filters are broken down, collection and transportation compromise most of the cost. The cost of transporting and collecting used oil and oil filters typically are 70-85% of the management cost. Costs for recycling used oil filters range from $.15 to $.87, depending on location and collection methods. Most DIYs who bring their used oil filters to a collection site currently pay a recycling fee that varies from $0.50 to $2.00 per filter.

One possible way to reduce the cost of recycling used oil filters would be to establish centralized processing locations throughout the state. Reducing collection frequency also reduces costs substantially. Using the generation numbers outlined previously, the total cost to recycle all of the used oil filters statewide would range from $126,000 to $1,200,000, depending on frequency of pickup, location and collection and storage methods.

F. Structural Change in the Design of Oil-Filtering Systems

The disposable canister filter that is almost without exception in use on light duty vehicles could be redesigned by providing either a housing for the filter membrane that is integrated into the engine block, or a re-usable canister. This approach could be developed through ECOS in conjunction with the EPA. At least one major manufacturer, General Motors, is already manufacturing a new generation of engines with a casing for the filter membrane. At least one major filter manufacturer, Fram/Honeywell, has developed an after market re-usable canister system. This re-design approach effectively eliminates the problems associated with the disposable canister.

VI. Conclusions

A decisive consideration relative to the feasibility of disposal alternatives is: What overall level of effort is appropriate for DIY used oil filter disposal? This is a question of where to direct state resources, or more specifically, a question of how to prioritize resource use when faced with much competition for resources.

The MPCA's established major programs — along with many significant smaller programs — have achieved widespread and recognized successes in protecting and improving the quality of Minnesota's environment. As it supports these ongoing programs, the agency faces new, emerging and unanticipated demands on its resources. Moreover, in addition to environmental quality, the citizens of Minnesota are strongly committed to a broad range of other quality-of-life issues that require and compete for resources.

Recognizing these resource constraints and considering the environmental impact, the MPCA concludes:

- Resource recovery and saving landfill space are important factors in the entire waste-management system.
- Due to the Waste Management Act "hierarchy of disposal," the reuse of steel and the energy recovery from the oil in used oil filters are important.
- Adequate recycling is available once filters are collected.
- Resources are not currently available to household hazardous waste collection sites to collect more DIY used oil filters.
- The environmental risk for landfill or incineration disposal of DIY used oil filters is not substantial.

VII. Recommendations

Minnesota Statutes 325E.112, subdivision 1, states:

> (a) "Motor oil and motor oil filter manufacturers and retailers shall seek to provide by May 31, 2001:
>
> (1) access to at least one non-governmental site for collection of used motor oil and filters from the public within a five-mile radius of any resident in the seven-county metropolitan area; and
>
> (2) access to at least one non-governmental site for collection of used motor oil and used motor oil filters from the public within a city or town with a population of greater than 1,500 outside the seven-county metropolitan area. The commissioner of the pollution control agency shall determine by June 30, 2001, whether these goals have been met."

- The MPCA will evaluate the work of the retailers and manufacturers in identifying DIY collection sites and determine if they have reached compliance with state law as soon as such information is made available. At this time, the preliminary data looks favorable and staff is hopeful that industry will meet their obligations;
- Retailers/Manufacturers will update the collection site list annually to MPCA/OEA;
- Keep the DIY used oil filter ban from landfilling;
- Continue MPCA/OEA auto waste education efforts at current levels;
- Give first priority in used oil filter education to discouraging disposal in or on land or in water bodies;
- Continue to focus efforts on the collection system problems;
- Maintain the voluntary product stewardship activities with automotive industry retailers and associations to:
  - Continue education efforts with their members;
  - Continue to encourage their members to take back DIY filters for free;
  - Provide appropriate lists of collectors/recyclers for the 800 clean up helpline; and
  - Provide public service announcements;
- Explore emerging, environmentally friendly oil filter design alternatives with automotive and filter manufacturers, ECOS, and EPA (this will be done by OEA staff); and
- Maintain the $250 refund program for DIY collectors, as an incentive to collect.