BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	R99-18
AMENDMENTS TO PERMITTING	)	(Rulemaking-Land)
FOR USED OIL MANAGEMENT AND	)	
USED OIL TRANSPORT	)	P.C. #19
	)	

NOTICE OF FILING

TO: Joel J. Sternstein, Esquire
Hearing Officer
Illinois Pollution Control Board
100 West Randolph Street
Suite 11-500
Chicago, Illinois 60601
(VIA U.S. Mail)

PERSONS ON ATTACHED SERVICE LIST
(Via U.S. Mail)

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Pollution Control Board the Comments of the National Oil Recyclers Association Before the Illinois Pollution Control Board Concerning Used Oil Regulations Docket R98-29; Docket R99-18, a copy of which is herewith served upon you.

Christopher Harris
General Counsel
National Oil Recyclers Association

DATE: September 24, 1999

National Oil Recyclers Association
1439 West Babcock
Bozeman, Montana 59715

PROOF OF SERVICE

I, the undersigned, certify that I have served the attached the Comments of the National Oil Recyclers Association Before the Illinois Pollution Control Board Concerning Used Oil Regulations Docket R98-29; Docket R99-18, upon:

Joel J. Sternstein, Esquire
Hearing Officer
Illinois Pollution Control Board
100 West Randolph Street
Suite 11-500
Chicago, Illinois 60601

by sending said documents Via U.S. Mail in Bozeman, Montana on or before 5:00 p.m. on September 24, 1999, and upon:

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by depositing said documents in the U.S. Mail in Bozeman, Montana on or before 5:00 p.m. on September 24, 1999.

Christopher Harris

Christopher Harris

SERVICE LIST (R99-018)

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Comments of the National Oil Recyclers Association Before the Illinois Pollution Control Board Concerning Used Oil Regulations

Docket R99-18
September 24, 1999

These comments supplement the testimony provided by the National Oil Recyclers Association ("NORA") on August 23, 1999 before the Illinois Pollution Control Board.

As the Board is aware, the National Oil Recyclers Association considers the proposal by the Illinois Environmental Protection Agency to be premature. This is because the Agency has failed to articulate the need for permit authority over used oil processing and storage facilities. Currently, such facilities are regulated by Part 739 (IEPA's regulations which mirror the federal used oil management standards found at 40 CFR Part 279). NORA contends that the current used oil management standards, promulgated by the U.S. Environmental Protection Agency in 1985 and 1992, constitute appropriate regulatory controls. Virtually every other state has adopted these standards with few, if any, changes. No other state which has adopted 40 CFR Part 279 has found it necessary to create a new set of controls in the form of permit authority over used oil processing and/or storage facilities.

When entities are subject to an existing regulatory regime, it is fair to ask an agency asking for additional authority, "What are the problems that exist that your existing authority cannot address?" When IEPA officials were asked that question at the August 23, 1999 hearing, there was no clear response, except that (1) permitted facilities are inspected more frequently than non-permitted facilities; and (2) the old used oil recycling operations had a lot of problems.

Neither answer is persuasive. First, IEPA, as it admitted, does not need permit authority to conduct inspections. If significant environmental problems were believed to exist at used oil processing and/or storage facilities in recent years, IEPA had a duty to conduct inspections. Had such inspections been

conducted *and* had such inspections revealed environmental problems, the Board would have a record upon which to evaluate a case for permit authority. Even if such a record had been placed before the Board (which it wasn't) it is worth asking why permit authority, as opposed to enforcement of existing regulations, is required. In any event, IEPA has not responded to this most basic question. (Significantly, in Illinois inspections of non-permitted facilities are often triggered by complaints or other information received by the agency. Apparently, the absence of an inspection record is because few, if any, complaints concerning oil processing facilities have been registered with IEPA.)

IEPA did cite several used oil related environmental problems that have occurred over a 12 year period. Many of these problems were found at re-refining facilities that were closed or abandoned more than ten years ago. NORA does not dispute or minimize the fact that sites with abandoned tanks and drums have resulted in serious contamination problems. The point is that these facilities never operated under the used oil management standards and consequently do not provide support for any assertion that the used oil management standards are inadequate as a set of regulatory controls.

Other examples of problems cited by IEPA relate to used oil generators. It is not immediately clear why generator-caused problems, such as used oil spills, would provide a reason to require processors to obtain permits. The few compliance issues attributed to currently operational processors do not appear to be outside the scope of the used oil management standards. Moreover, IEPA does not base its case on this small set of compliance issues.

It should also be emphasized that used oil processing operations are not exclusively regulated by the Part 739 used oil management standards. On the contrary, several other laws govern various aspects of used oil management. To provide a few examples: oil processors must possess and comply with a valid Spill Prevention Control and Countermeasure Plan ("SPCC Plan") as required by the federal Clean Water Act. Transportation of used oil is controlled by the Hazardous Materials Transportation Act. Used oil containing PCBs is governed by the Toxic Substances Control Act. Each of the requirements under these statutes is enforceable. In combination with the used oil management standards, these requirements form a comprehensive blanket of regulations covering every aspect of a used oil processor's operations.

It is significant that IEPA has not conducted any study of the economic effects of its proposal to impose permit requirements. As explained during the

hearing before the Board on August 23, 1999, costs imposed by regulation on an oil processor - but not on its competitor, the seller of virgin fuel oil - causes competitive burdens to be placed on the sale of used oil fuel. Some of those burdens can be absorbed by the used oil processor but at some point such regulations begin to undermine the oil recycler's capacity to compete. This is particularly true if the regulatory burdens adversely affect the ability of the oil processor to seller to burners. *See* attached description of used oil markets. NORA also contends that the Illinois Legislature, in adopting section 9 of the Illinois Waste Oil Recycling Act, intended to prevent the adoption of any regulatory requirement that discourages legitimate methods of used oil recycling.

One of the Legislature's principal concerns was the problem of widespread illegal dumping of used oil, particularly by Do It Yourself ("DIY") Oil Changers. NORA believes that improper disposal can be minimized through education and the availability of convenient DIY used oil tanks - provided there is a market for used oil fuel. However, if there is little or no demand for used oil fuel, and consequently no one is processing the used oil for sale, the problem will be how to handle massive quantities of unwanted used oil. In other words, undermining the market for used oil fuel - even if that result is caused by the best of environmental intentions - can create the unintended effect of widespread improper disposal.

Requiring permits for commercial storage of used oil fuel is a good example of the kind of burden on competition that the Legislature sought to avoid. As explained at the hearing, commercial petroleum storage tanks facilities will <u>not</u> undertake any effort to become permitted used oil storage facilities. The threat of regulatory entanglement is simply not worth the compensation received in rent. Yet, in periods of high volume sales of used oil fuel, such as the winter months, oil processors need the additional storage capacity provided by commercial tank storage facilities. Without such storage capacity, oil processors are forced to rely on their own storage capacity which is invariably insufficient to meet the demand of the winter season. Sellers of virgin oil, who are not subject to any such permit requirements, would gain an important and permanent competitive advantage as a result of this permit requirement.

Another issue directly related to the question of the economic impact of IEPA's proposal is the definition of special waste. IEPA at the August 23, 1999 hearing suggested that the definition could be flexible such that if a quantity of high bottom sediment and water ("BS&W") content of used oil fuel was under

contract to be sold as fuel, it would not be classified as a special waste - but would be so classified in the absence of such contracts. NORA appreciates IEPA's willingness to be flexible but foresees a host of regulatory problems attending this concept. For example, consider the situation where a processor has a quantity of high BS&W fuel that is under contract to be sold to a steel mill but the contract is cancelled and there is a 48 hour period before the processor finds another buyer. If this fuel is considered a special waste during this 48-hour period, what regulations or permit conditions are imposed during this time?

To avoid the unpredictable consequences of a flexible definition, NORA proposes that used oil fuel containing a BS&W content of 10 percent or more be classified as a "special waste." This classification would be applicable regardless of whether such fuel met the criteria of "specification used oil fuel." Although used oil containing 10 percent BS&W can be used a fuel or can be blended to produce a fuel and therefore has value as a product, NORA appreciates IEPA's concern that such material would not be handled as carefully as other used oil fuel products. Consequently, designating such material as a "special waste" will address the Agency's stated need to have permit authority over used oil that is less likely to be carefully managed. At the same time, a clear bright line will be created between used oil meeting the criteria for "special waste" and used oil that competes with virgin petroleum products. NORA's proposed regulatory language is as follows:

Part 808

Special waste Classification
Subpart A: General Provisions

Section 808.124 Special Waste Used Oil. Used oil that has been generated by a commercial source is classified as a nonhazardous special waste if it has not been certified as meeting U.S. Environmental Protection Agency criteria for specification used oil fuel under 40 CFR 279.11 or contains, by volume, 10 percent or more of bottom sediment and/or water. Special waste used oil shall not be stored, transported, treated, or otherwise managed except as allowed by a permit under 35 Ill. Admin. Code. 809.201

Finally, NORA also regards the entire permitting process, particularly the engineering studies and the permit negotiations with IEPA, to be a costly and time-consuming exercise. NORA members anticipate that for any given

processor or storage facility permit conditions would be imposed on a wide variety of "site specific" circumstances and that expensive "design criteria" would be substituted for the performance requirements set forth in Part 739. Moreover, any appeal of a facility's permit conditions to the Illinois Pollution Control Board can result in a significant expenditure of professional time (engineers and attorneys) on behalf of the used oil processor.

Conclusion

IEPA's proposal to obtain permit authority over used oil processing and storage facilities has not been justified. The existing regulatory controls have not been shown to be inadequate in any way. Nor has IEPA demonstrated that its proposal would not have significant adverse impacts on used oil processors in Illinois or the used oil fuel market. Compliance with section 9 of the Illinois Waste Oil Recycling Act requires government agencies to avoid such adverse impacts.

To facilitate a workable compromise solution, NORA proposes that used oil containing 10 percent or more of BS&W be regulated as a "special waste" - thereby creating a clear, bright line between valuable feedstock and fuel products and materials which are less valuable and could be managed with less care.

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Perspectives on Used Oil Markets in the United States

Christopher Harris

National Oil Recyclers Association

August 1999

Introduction

Whether used oil is a waste or a commodity was a crucial question in Washington, D.C. during the mid-1980s. By 1999, this question has long since been decisively answered. Used oil is a commodity – actually a variety of petroleum products that are traded in numerous recognized markets.

The essential fact about used oil is that having served its initial function as a lubricant, it has the opportunity to serve subsequent functions. Through re-refining it can once again become a lubricant – or through processing it can become a fuel. Since there are no subsidies for used oil recycling, whether used oil serves a subsequent function is entirely a question of whether there is demand for it. As discussed below, the history, strength and variety of well established markets for products made from used oil demonstrates the existence of this demand.

Background

Although oil recycling in the United States can be traced to the early part of this century, Congressional interest in used oil is relatively recent. Nearly two decades ago Congress enacted the Used Oil Recycling Act of 1980. Pub. L. 96-463, Oct. 15, 1980, 94 Stat. 2055. The legislative history of this statute makes clear that Congress believed that the "recycling of used oil will result in the conservation of a valuable energy resources as well as diminish the likelihood of posing a threat to public health and the environment if disposed of improperly." H.R. Rep. No 1415, 96th Cong., 2d Sess., 10 (1980). According to the Senate Environment and Public Works Committee, "the purpose [of the legislation] is to encourage safe reuse of used oil in the United States and to discourage improper burning or

disposal of used oil." S. Rep. No. 879, 96th Cong., 2d Sess. 1 (1980). The statute itself declares that "used oil is a valuable source of increasingly scarce energy and materials" and that "technology exists to re-refine, reprocess, reclaim and otherwise recycle used oil." 42 U.S.C. 6901a. Some states have enacted similar legislation designed to encourage proper recycling. For example, the Illinois Waste Oil Recovery Act declares that used oil "is a valuable natural resource, the conservation of which can benefit the people of Illinois." 815 ILCS 440/3(b). Further, the Illinois statute establishes the policy of "promot[ing] the use of recycled oil [and] reducing consumption of new oil by promoting increasing utilization of recycled oil." 815 ILCS 440/4(a),(c).

Other provisions of the federal statute directed EPA to provide technical and financial assistance to states to address "the economic and institutional impediments to the recycling of used oil." EPA was also required to conduct a comprehensive study - which it never completed - concerning the economics of the used oil industry and the energy savings attributable to recycling. *See* sections 5, 6, and 9 of the Used Oil Recycling Act of 1980, Pub. L. 96-463, section 2, Oct. 15, 1980, 94 Stat. 2055.

Frustrated by EPA's failure to take *any* regulatory action pursuant to the Used Oil Recycling Act, Congress passed sections 241 and 242 of the Hazardous and Solid Waste Amendments of 1984 ("HSWA"). 42 U.S.C. 6935. The purpose of these provisions was to prompt EPA to develop regulatory controls governing used oil recycling. However, Congress was mindful of the economic forces that form the foundation for a successful recycling system.

> [W]here protection of human health and the environment can be assured,...the [EPA] Administrator should make every effort not to discourage recycling of used oil. For example, if there are several alternative controls that would be environmentally acceptable, the Agency should allow those which would be least likely to discourage used oil recycling.

H.R. Rep. 1133, 98th Cong., 2d Sess. 114 (1984) *See also* H.R. Rep. 198 (Part 1) 98th Cong., 1st Sess., 64 (1983).

On November 19, 1986, after originally proposing to list used oil as a hazardous waste, EPA reversed course and decided not to. The Agency's decision was based on the realization that listing would discourage recycling activities which, in turn, "could cause an increased quantity of used oil to be disposed of in uncontrolled ways, causing harm, to the environment." 51 *Fed. Reg.* 41901 (November 19, 1986). A November 1986 report, cited by EPA,

estimated that listing recycled used oil as a hazardous waste could cause an additional 61 to 128 million gallons of used oil to be disposed of improperly. *See* Temple, Barker & Sloane, Inc., *Analysis of Possible Market Impacts Resulting From Stigmatizing Effect of Listing Recycled Oil* (Nov. 1986).

In 1992 EPA promulgated the long-awaited used oil management standards. These standards, codified at 40 CFR Part 279, combine the regulations governing burning of used oil fuel that were issued in 1985 with the requirements for managing used oil by transporters, recyclers and transfer facilities. Most states have adopted the Part 279 regulations with few, if any, substantive changes. In general, the Part 279 management standards form a regulatory framework that provides necessary tracking and operational controls without undermining the market for recycled oil products.

The 1985 regulations addressing used oil fuel created two categories of used oil fuel: specification and off-specification. 40 C.F.R. 279.11. Once specification fuel meets all of EPA's limits on arsenic, lead, cadmium, chromium, flash point and total halogens it is no longer subject to any regulatory control pursuant to RCRA. According to EPA, "[specification] used oil fuel poses no greater risk than virgin fuel oil and once it enters the commercial fuel market should not be regulated differently than virgin fuel oil." 50 *Fed. Reg.* 49189. Meeting the specification criteria has been significantly easier in the 1990s than in the 1980s because the phase-out of lead in gasoline resulted in a dramatic reduction of lead found in used oil.

Because used oil fuel that the processor certifies meets the specification criteria is not subject to Part 279 regulations, the demand for specification used oil fuel greatly exceeds the demand for "off-spec" fuel. Today, virtually all processors only produce specification used oil fuel which is sold to industrial burners such as asphalt ("hot mix") plants, steel mills, smelters, electric power utilities as well as cement, lime and phosphate kilns. The demand for used oil fuel is also generated by greenhouses, foundries, sand drying ovens and ships. In 1988, a Temple, Barker & Sloane study indicated that approximately 80 percent of the oil entering the used oil management system was burned as fuel. *Generation and Flow of Used Oil in the United States in 1988.* (Nov. 1988) at 8, n. 2. Today, as a result of increased regulation, more efficient collection and marketing efforts by processors and less demand for re-refined lubricants, that percentage is likely to substantially higher. Moreover, as a result of efforts by states and municipalities to encourage recycling of "Do It Yourself" ("DIY") used oil, more oil is entering the used oil management system rather than is being discarded.

ASTM Standards

To achieve greater recognition of the important role of used oil fuel in the industrial fuel market, the National Oil Recyclers Association ("NORA") proposed that the American Society for Testing and Materials ("ASTM") adopt a new specification that addresses certain criteria that are not encompassed by the Part 279 fuel standards. The ASTM standard, adopted in final form by ASTM in June 1999, covers four grades of fuel oil made in whole or in part from used lubricating or hydraulic oils. With the exception of flash point, the parameters for each grade encompass properties that are of interest to the buyers (the burners) rather than any governmental authority. The eight parameters are:

(1) viscosity;
(2) flash point;
(3) water and sediment;
(4) pour point;
(5) density;
(5) ash;
(6) sulfur;
(7) extracted pH; and
(8) BTUs (heating value)

The detailed requirements are set forth in Attachment A.

The four grades of reprocessed fuel oil ("RFO") are intended for use in oil burning industrial equipment – not residential heaters, small commercial boilers, or combustion engines. The ASTM description of the four grades is set forth below:

> *Grade RFO4* Primarily a blend of used lubrication oils and distillate or a reprocessed distillate product derived from used oil. It is intended for use in pressure atomizing industrial burners with no pre-heating. This grade of recycled fuel is used in many medium capacity industrial burners where ease of handling justifies the higher cost of the lighter used oil fuels.
>
> *Grade RFO5L* A straight (100%) used lubricating oil blend or a used lubricating oil and distillate blend fuel of intermediate viscosity, heavier than RFO4. It is intended for use both in pressure-atomizing industrial burners not requiring higher cost distillates and in burners equipped to atomize oils of higher viscosity with or without pre-heating. Its permissible viscosity

range allows it to be pumped and atomized at relatively low storage temperatures.

Grade RFO5H A straight (100%) used lubricating blend or a used lubricating oil and residual blend fuel, heavier than Grade RFO5L. It is intended for use in industrial burners equipped with devices at atomize oil of higher viscosity than domestic burners can handle. Preheating may be necessary in some types of equipment for burning and in colder climates for handling.

Grade RFO6 A high viscosity used lubricating oil and residual blend fuel, heavier than Grade RFO5H. It is intended for use in large industrial heaters and may require preheating in the storage tank to permit pumping. Additional pre-heating at the burner may be necessary to permit satisfactory atomization. The extra equipment and maintenance required to handle this fuel may preclude its use in small installations.

The ASTM standards for reprocessed fuels, in combination with a 1996 study conducted by Entropy, Inc., provide greater confidence to industrial burners that used oil fuel not only can achieve stringent quality standards but will also address concerns about air emissions. A key component of the Entropy Study involved emissions tests at two asphalt plants that evaluated the potential for release of heavy metals from virgin petroleum fuel and used oil fuel. According to the author of the study, "[t]he information from the study demonstrated that the combustion of used oil in asphalt plants equipped with baghouses in good working condition resulted in emission of lead below detection limits. In fact, the emissions of lead and other metals from the combustion of used oil at both test facilities did not differ significantly from the emissions associated with the combustion of number 2 virgin fuel at one of the test facilities." Entropy, Inc., *Quantification of Metals Emissions From Burning Used Oil Fuel,* July 1996, p. iv. *See* Attachment B.

Used Oil Markets in the United States

According to estimates by EPA, in 1960 there were more than 150 active re-refiners operating in the United States. These companies produced more than 300 million gallons of re-refined oil each year. 52 *Fed. Reg.* 38840 (Oct. 19, 1987). At that time there was a market for re-refined lubricants. With the advent of increasingly sophisticated additive packages, re-refining became significantly more expensive and less able to compete with virgin lubricants. Unfortunately, despite a substantial effort by the federal government to promote government

procurement of re-refined lubricants, the re-refining industry in the United States has all but collapsed. By the late 1990s used oil recycling means burning for energy recovery.

The markets for used oil fuel (also known as reprocessed fuel oil or "RFO") exist because used oil fuel is less expensive than virgin oil fuel even though the BTU content is comparable. It is worth noting that while virgin fuel oil and recycled fuel oil are direct competitors, oil fuel also competes with (and is a good substitute for) other forms of energy such as coal and natural gas. Consequently, the availability and demand for coal and natural gas has a direct impact on overall energy prices that, in turn, eventually affects used oil fuel prices.

Because used oil fuel and virgin products are direct competitors, prices for RFO are usually determined by reference to the posted price for the virgin fuel oil product for the nearest city where petroleum products are sold at wholesale prices. For example, in August 1997, the posted price for virgin distillate in Chicago was $55.13 per barrel. A nearby used oil processor set a price of $.36 a gallon for its competing RFO product. Price data for this used oil processor during the period from May 1991 to May 1999 shows that the RFO prices tracked virgin distillate prices and ranged from a high of $.42 a gallon in October 1992 to a low of $.30 a gallon in May 1999. A review by NORA of confidential price data from oil processors from all regions of the United States during the 1990s reveals remarkable similarity in their basic strategy for setting prices: use of the relevant posted price for the virgin oil product, discounts based on water and ash content, additional discounts based on high volume purchase orders or contracts, and upward adjustments for meeting other specifications requirements and charges for transportation.

As a general matter, the principal differences between any category of virgin oil fuel for industrial burners and its RFO counterpart are water content and ash. The higher the water and/or ash content of a used oil product, the lower the price. For burners whose boilers or furnaces can tolerate higher water and/or ash content, such as blast furnaces at steel mills, there is a substantial price advantage over virgin petroleum products. In September 1994, for example, one used oil processor in the mid-west (whose business in the recycled oil business dates from the early 1930s) established a base price of $.322 per gallon for two products: Blast Furnace Oil and Boiler Fuel and a discount formula based on the moisture (water) content of the fuel. The base price was pegged to the posted price for No. 6 virgin oil. A discount of $.11 was provided for fuel with less than 1 percent moisture content; a $.16 discount was provided

for fuel with less than 3 percent moisture content and a $.21 discount was provided for fuel with a moisture content of less than 5 percent.

While blast furnaces are more "tolerant" of water and ash content, the production process may be less tolerant of certain other chemical and physical properties. For example, the operators of a blast furnace for specialty steel products set certain restrictions on trace elements such as a maximum of 50 parts per million ("ppm") of cobalt, molybdenum, nickel, tin and vanadium.

Although the economics of the market dictate substantial price discounts for RFO, the used oil processor must, nonetheless, pay for all transportation and operating expenses incurred in producing the fuel and delivering it to the buyer and still attempt to make a profit. Obviously, for oil recyclers making a profit in an era of high energy prices is a much easier task than during a period of depressed prices. Two key factors are at work in the ability of the oil recycler to make a profit during periods of low energy prices: operating costs and supply. The principal variable in operating costs are those imposed by regulatory requirements; most other components of operating costs, such as labor and electricity, are relatively stable.

The costs of regulatory compliance relate to many of the federal and state environmental laws, principally the Resource Conservation and Recovery Act ("RCRA"), 42 U.S. 6901, *et seq.* These costs include testing of used oil at the points of collection from generators, receipt at the facility and prior to shipment as a RFO. Numerous regulatory compliance costs relate to the operation of the facility. These include: stormwater runoff compliance, air monitoring, secondary containment, shipment tracking and other recordkeeping, maintenance of spill prevention plans, security systems, compliance with wastewater discharge requirements, etc. At present, compliance costs constitute a major portion of the cost of operations but, are not an overwhelming expenditure. However, any significant increase in regulatory burdens, whether imposed directly or recyclers or on their customers, will dramatically decrease the capacity for oil processors to be profitable.

The second factor is the economics of supply. A processor does not normally have one or two suppliers of used oil. Rather, the processor has developed a collection system involving hundreds, if not thousands, of generators of used oil. Most of these customers generate automotive used oil because they are in the business of servicing cars and trucks. Others generate industrial oil as a result of machinery that requires continuous lubrication. Regardless of the source of the oil, the economic relationship between the customer and the collector is the same. When energy prices are high, used oil is

more valuable and the generator can command a substantial price. During the 1980s an east coast collector and oil processor developed a pricing formula that pegged the price paid to the generator to the price of virgin fuel oil, thereby creating certainty in the pricing structure. *See* Attachment C. When energy prices are significantly lower, collectors may be forced to charge generators for oil collection services.

The Impact of Regulation and Pricing on Collection of Do It Yourself Generated Used Oil

DIY generated used oil is generally the regarded as the "unwanted orphan" of the oil recycling industry - primarily because it is not a dependable source of supply for the used oil collector, either in terms of quantity or quality. The DIY used oil is generated not by a regular business customer of the used oil collector but by anonymous motorists who changes his own oil to avoid the expense of a commercial oil change. There is no assurance that the material left by the DIY oil changer is pure used oil. Although the reported number of incidents of DIY used oil that has been contaminated with hazardous waste is surprisingly small, the general aversion to this type of used oil remains significant. Yet because DIY used oil is the principal source of used oil pollution, most state governments - and thousands of local governments - have made this their top priority in the used oil arena. (A 1991 estimate by Clayton Environmental Consultants, an EPA contractor, indicated that 185 million gallons of used oil is illegally dumped each year. Most of this illegal disposal is attributable to DIY oil changers.) State and local governments' principal approach in encouraging proper recycling of DIY used oil is to provide numerous and convenient disposal tanks where the DIY oil changer can drop off the oil free of charge. While used oil collectors are often paid by the government to pick up the used oil, many others perform this service, without charge, as a civic responsibility.

For businesses that generate used oil (such as quick lubes and automobile dealers), a provision enacted by Congress in 1986 provides specific encouragement for the collection of DIY used oil. Section 114(c) of the Comprehensive Environmental Response Compensation and Liability Act ("CERCLA" or "Superfund") provides an exemption for all off-site Superfund liability involving used oil provided certain conditions are met. 42 U.S.C. 9614(c). To be eligible for this exemption, the used oil generator must (1) be a "service station dealer" i.e. a business that sells, services or repairs automobiles or light duty trucks (*See* 42 U.S.C. 9601(37)(A)); (2) comply with applicable management standards under RCRA for used oil generators; (3) not mix used oil

with hazardous waste; and (4) provide a collection tank for DIY-generated used oil.

In discussing section 114(c), the Conference Committee offered these observations on the used oil recycling system:

> While the pressures to recycle waste oil for energy conservation have eased recently, the pressures to safely manage such used oil and to prevent environmental pollution are ever growing. America's used oil recycling system handles approximately 57 percent of the more than one billion gallons of used oil generated each year. The balance of the used oil is disposed of improperly - into sewers, backyards, or into the trash which eventually winds up in municipal landfills.
>
> The current used oil recycling system in this country depends, in large measure, on volunteers. These include small business owners, such as service station dealers, who perform a community service by collecting used oil from do-it-yourself oil changers and delivering such used oil to recyclers. The volume of waste involved and the connection with the problem of properly managing household hazardous waste are just two examples of the factors that make the subject of this amendment unique.
>
> Used oil, when properly recycled and managed, is a valuable resource. However, a number of factors, such as lower prices for virgin oil and fear of liability under Superfund or the Solid Waste Disposal Act, have recently resulted in a reduced demand by commercial users of recycled oil. To the extent such a reduction in demand disrupts the entire chain of commerce in recycled oil and leaves numerous households with no safe outlet for the oil do-it-yourself automobile oil changers, the Federal government can and should, as a consumer, help rectify the problem

H.R. Rep. 962, 99th Cong., 2d Sess., 227-28 (1986). Accordingly, the Conference Committee recommended that the EPA Administrator use the purchasing power of the federal government, pursuant to section 6002(c)(2) of RCRA, to expand the demand for used oil fuel products. *Id.* at 228.

With EPA's promulgation of the used oil management standards in September 1992, the so-called "service station dealer's exemption" became operational. Encouraged by their trade associations, hundreds of thousands of

quick lubes, truck and automobile dealers, garages, and service station dealers are now providing used oil collection tanks (usually 250, 500 or 1000 gallon tanks) that are set aside for public use. The public is admonished not to mix used oil with any contaminants such as paints, inks, gasoline, kerosene, solvents, or other hazardous wastes. As long as the DIY used oil is relatively free of contamination and there remains a demand for used oil fuel, the system for collecting DIY used oil is expected to expand and strengthen. However, if the demand for used oil fuel declines, DIY used oil is the category of used oil that collectors are least likely to collect.

Conclusions

Used oil when processed into fuel competes with virgin petroleum products and other forms of energy such as coal. Used oil is less expensive than virgin petroleum products even though its heating value is virtually identical. In fact, the only reason there is a used oil fuel market is that used oil competes on the basis of comparable quality at a lower price.

The used oil market can be undermined whenever (1) regulatory controls are imposed on used oil (and not on virgin products) to such an extent that the costs of processing used oil significantly narrow the price difference between used oil fuel and virgin fuel products; (2) regulatory controls are imposed on the burners of used oil fuel; or (3) regulatory controls -- or the threat of liability -- convinces burners that the price advantage of used oil fuel is not worth the risk of regulatory or legal problems. When burners decide against using used oil fuel, the market shrinks. The gradual destruction of the used oil market in the United States should be a serious concern to policy-makers because the absence of appropriate recycling opportunities, such as burning for energy recovery, means that the used oil will ultimately be disposed of improperly.

Standard Specification for

Industrial Burner Fuels From Used Lubricating Oils[1]

1. Scope

1.1 This specification covers four grades of fuel oil made in whole or in part with hydrocarbon-based used or reprocessed lubricating oil or functional fluids, such as preservative and hydraulic fluids. The four grades of fuel are intended for use in various types of fuel-oil-burning industrial equipment under various climatic and operating conditions. These fuels are not intended for use in residential heaters, small commercial boilers, or combustion engines.

1.1.1 Grades RFO4, RFO5L, RFO5H and RFO6 are used lubricating oil blends, with or without distillate and/or residual fuel oil, of increasing viscosity and are intended for use in industrial burners equipped to handle these types of recycled fuels.

Note 1 – For information on the significance of the terminology and test methods used in this specification, see Appendix X1.

1.2 This specification is for use in contracts for the purchase of fuel oils derived from used lubricating oil and for the guidance of consumers of such fuels. This specification does not address the frequency with which any particular test must be run.

1.3 Nothing in this specification shall preclude observance of national or local regulations which can be more restrictive. In some jurisdictions, used oil is considered a hazardous waste and fuels from used oil are required to meet certain criteria before use as a fuel.

Note 2 – For U.S. federal requirements imposed on used oil generators, transporters and transfer facilities, reprocessors, marketers and burners, see 40 CFR 279[8].

Note 3 – The generation and dissipation of static electricity can create problems in the handling of distillate burner fuel oils. For more information on the subject, see Guide D 4865.

ATTACHMENT A

1.4 The values stated in SI units are to be regarded as standard; non-SI units, when given, are for information only.

2. Referenced Documents

ASTM Standards

D 56 Test Method for Flash Point by Tag Closed Tester[2]

D 93 Test Methods for Flash Point by Pensky-Martens Closed Cup Tester[2]

D 95 Test Method for Water in Petroleum Products and Bituminous Materials by Distillation[2]

D 96 Water & Sediment in Crude Oil by Centrifuge Method (Field Procedure)[2]

D 97 Test Method for Pour Point of Petroleum Products[2]

D 129 Test Method for Sulfur in Petroleum Products (General Bomb Method)[2]

D 240 Test Method for Heat of Combustion of Liquid Hydrocarbon Fuels by Bomb Calorimeter[2]

D 396 Standard Specification for Fuel Oils[2]

D 445 Test Method for Kinematic Viscosity of Transparent and Opaque Liquids (and the Calculation of Dynamic Viscosity)[2]

D 473 Test Method for Sediment in Crude Oils and Fuel Oils by the Extraction Method[2]

D 482 Test Method for Ash from Petroleum Products[2]

D 1266 Test Method for Sulfur in Petroleum Products (Lamp Method)[2]

D 1298 Practice for Density, Relative Density (Specific Gravity), or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method[2]

D 1552 Test Method for Sulfur in Petroleum Products (High-Temperature Method)[2]

D1796 Test Method for Determination of Water & Sediment in Fuel Oils by the Centrifuge Method (Laboratory Procedure)[2]

D 2622 Test Method for Sulfur in Petroleum Products by X-Ray Spectrometry[3]

D 2709 Test Method for Water and Sediment in Distillate Fuels by Centrifuge[3]

D 3245 Test Method for Pumpability of Industrial Fuel Oils[3]

D 3828 Test Methods for Flash Point by Small Scale Closed Tester[3]

D 4052 Test Method for Density and Relative Density of Liquids by Digital Density Meter[3]

D 4057 Practice for Manual Sampling of Petroleum and Petroleum Products[3]

D 4175 Terminology Relating to Petroleum, Petroleum Products, and Lubricants[3]

D 4177 Method for Automatic Sampling of Petroleum and Petroleum Products[3]

D 4294 Test Method for Sulfur in Petroleum Products by Energy-Dispersive X-Ray Fluorescence Spectrometry[3]

D 4377 Test Method for Water in Crude Oils (Karl Fisher) Titration[3]

D 4865 Guide for the Generation and Dissipation of Static Electricity in Petroleum Fuel Systems[4]

D 4868 Test Method for Estimation of Net and Gross Heat of Combustion of Burner and Diesel Fuels[4]

D 4980 Test Method for Screening of pH in Waste[5]

D 5185 Test Method for Determination of Additive Elements, Wear Metals and Contaminants in Used Lubricating Oils and Determination of Selected Elements in Base Oils by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP-AES)[4]

U.S. EPA Methods:

300.0 Determination of Inorganic Anions by Ion Chromatography[6]

9000 Determination of Water in Waste Materials by Karl fisher Titration[7]

9001 Determination of Water in Waste Lubricants by Quantitative Calcium Hydride Reaction[7]

9056 Determination of Inorganic Anions by Ion Chromatography[7]

Government Standards Referenced:

40CFR279 Standards for the Management of Used Oil[8]

3. Terminology

3.1 *Definitions*:

3.1.1 **burner fuel oil**, *n* – any petroleum liquid suitable for the generation of heat by combustion in a furnace or firebox as a vapour or a spray, or a combination of both.

DISCUSSION – Different grades are characterized primarily by viscosity ranges.

3.1.2 **reclaiming**, *n* – the use of cleaning methods during recycling primarily to remove insoluble contaminants, thus making the oil suitable for further use. The methods may include settling, heating, dehydration, filtration and centrifuging.

3.1.3 **recycling**, *n – in petroleum technology*, the acquisition of oil that has become unsuitable for its intended use, and processing it in order to regain useful materials.

3.1.4 **re-refining** *n* – the use of refining processes during recycling to produce high quality base stocks for lubricants or other petroleum products. Re-refining may include distillation, hydrotreating, and/or treatments employing acid, caustic, solvent, clay and/or other chemicals.

3.1.5 **used oil**, *n — in petroleum product recycling*, oil whose characteristics have changed since being originally manufactured, and which is suitable for recycling.

3.1.6 **waste oil**, *n — in petroleum technology*, oil having characteristics making it unsuitable either for further use or for economic recycling

3.2 For definitions of other terms used in this specification, refer to Terminology D4175.

3.3 *Definition of Terms Specific to this Standard:*

3.3.1 **reprocessing**, *n – in petroleum product recycling*, the preparation of used oil to be suitable as a fuel.

DISCUSSION – Reprocessing includes procedures such as settling, filtration, blending, distillation, or chemical treatment.

3.3.2 **industrial burner**, n – a device which produces heat for industrial use through the combustion of liquid hydrocarbon fuels.

DISCUSSION – Industrial burners are typically designed for one of two applications:

industrial furnaces – integral components of manufacturing processes that provide direct heating, for example in aggregate, cement, lime or phosphate kilns; coke ovens; or blast, smelting, melting, refining, or drying ovens.

industrial boilers – large indirect heating units which transfer thermal energy to water or other fluids or gases for use in heating in industrial settings and in manufacturing processes

4. Classification

There are four grades of industrial burner fuel containing recycled lubricating oils covered by this standard. These grades may or may not correlate directly with similar grades in other ASTM standards. The RFO designation identifies them as Reprocessed Fuel Oils. The usage descriptions of each grade may not describe all the uses, but are included as general information. The four grades are described as follows:

4.1 *Grade RFO4* – Primarily a blend of used lubricating oils and distillate or a reprocessed distillate product derived from used oil. It is intended for use in pressure atomizing industrial burners with no pre-heating. This grade of recycled oil fuel is used in many medium capacity industrial burners where ease of handling justifies the higher cost over the heavier used oil fuels.

4.2 *Grade RFO5L* – A straight (100%) used lubricating oil blend or a used lubricating oil and distillate blend fuel of intermediate viscosity heavier than RFO4. It is intended for use both in pressure-atomizing industrial burners not requiring higher cost distillates and in burners equipped to atomize oils of higher viscosity with or without pre-heating. Its permissible viscosity range allows it to be pumped and atomized at relatively low-storage temperatures.

4.3 *Grade RFO5H* – A straight (100%) used lubricating oil blend or a used lubricating oil and residual blend fuel, heavier than Grade RFO5L. It is intended for use in industrial burners equipped with devices that atomize oil of higher viscosity than domestic burners can handle. Preheating may be necessary in some types of equipment for burning and in colder climates for handling.

4.4 *Grade RFO6* – A high-viscosity used lubricating oil and residual blend fuel heavier than Grade RFO5H. It is intended for use in large industrial heaters and may require preheating in the storage tank to permit pumping. Additional preheating at the burner may be necessary to permit satisfactory atomization. The extra equipment and maintenance required to handle this fuel usually preclude its use in small installations.

5. General Requirements

5.1 The fuel oils specified herein shall contain a minimum of 25% (vol.) of used lubricating oil-derived products, the balance being a Specification D396 fuel oil or suitable refinery stocks.

5.2 The fuel oils shall be homogeneous fluids consisting primarily of hydrocarbons. Fuel oils containing residual components shall remain uniform in storage and shall not separate by gravity or aging into layers in normal operating conditions.

Note 4 – Prolonged storage or equipment down time may necessitate circulation of the fuel oil in-tank to prevent such separation.

5.3 The fuel oil shall not contain excessive amounts of organic and/or inorganic acids and shall be free of solid or fibrous matter that could cause system handling or maintenance problems. The buyer and seller should agree on any requirements for particle size.

Note 5 – The fuels defined by this standard are appropriate only for burners capable of handling and combusting fuels with potentially higher metals and ash content.

6. Detailed Requirements

6.1 Grade RFO4. The requirements for this type of fuel are presented in Table 1 and include fuels in the viscosity range below 5 mm^2 /sec (cSt) at 100°C according to ASTM D445.

6.2 Grade RFO5L. The requirements for this type of fuel are presented in Table 1 and include fuels in the viscosity range 5.0 to 8.9 mm^2 /sec (cSt) at 100°C according to ASTM D445.

6.3 Grade RFO5H. The requirements for this type of fuel are presented in Table 1 and include fuels in the viscosity range 9.0 to 14.9mm^2 /sec (cSt) at 100°C according to ASTM D445.

6.4 Grade RFO6. The requirements for this type of fuel are presented in Table 1 and include fuels in the viscosity range 15.0 to 50.0mm^2 /sec (cSt) at 100°C according to ASTM D445.

Note 6 – In the U.S., fuel must also meet USEPA on-specification parameters for recycled used oil fuels as defined under 40CFR Part 279.11.

6.5 The properties listed in this specification are those of greatest significance in obtaining acceptable performance of the burner. Only referee test methods are shown in Table 1. (See Section 7 for alternate test methods and Appendix X1. for significance of test requirements).

6.6 A representative sample shall be obtained for testing: Practices D4057, D4177, or other comparable sampling standards should be followed. In case of dispute, D 4057 shall be the referee practice. A minimum sample size of about 1 litre (1 US qt) is recommended.

6.7 Testing frequency and any modifications of limiting requirements to meet special operating conditions shall be agreed upon by both the buyer and the seller.

Note 7 – It is possible that one or more of the parameters listed in Table 1 may be used as an indicator of when more extensive testing is required.

Table 1 – Detailed Requirements for Industrial Burner Fuels From Used Lubricating Oils

PROPERTIES	Method[E]	PROPOSED LIMITS[G]			
		RFO4	RFO5L	RFO5H	RFO6
PHYSICAL:					
Viscosity @ 100 °C mm2/sec [A]	D445				
minimum	---	---	5.0	9.0	15.0
maximum	---	<5.0	8.9	14.9	50.0
Flash Point, °C (°F), min.	D93	38 (100)	55 (130)	55 (130)	60 (140)
Water & Sediment[B], % vol. max.	D95 & D473	2.0	3.0	3.0	3.0
Pour Point, °C (°F), max.	D97	-6 (21)	NA	NA	NA
Density, Kg/m^3 @ 15°C [C]	D1298	Report	NA	NA	NA
CHEMICAL:					
Ash, % mass, max.	D482	0.7	0.8	0.8	Report
Sulphur, % mass [F]	D129	Report	Report	Report	Report
Extracted pH, min.	D4980	4.0	4.0	4.0	4.0
PERFORMANCE:					
Gross Heating Value, Mj/kg (BTU/US gal[D]), min	D240	40.0 (130,000)	41.5 (135,000)	41.5 (135,000)	43.0 (140,000)

[A] 1 cSt = 1 mm^2/sec

[B] Solids content should not exceed 1.0 % for RFO4 & 5; 2.0 % for RFO 6; Filtration may be required to obtain appropriate particle size for use

[C] Density in kg/L at 15°C multiplied by 1000 = Kg/m^3

[D] Assumes 7.5 lb/US gal

[E] See Section 7 for details and additional methods

[F] Local jurisdictions may limit the sulphur content in burner fuels

[G] Units given in parenthesis are for informational purposes only

7. Test Methods

7.1 The requirements enumerated in this specification shall be determined in accordance with the following ASTM methods except as noted:

7.1.1 Viscosity – Test Method D 445. For quality control, a Brookfield rotary viscometer (D2983) may be used. In case of dispute, D445 shall be used as the referee method.

7.1.2 Flash Point – Test Method D 93, except where other methods are prescribed by law. For all grades, Test Method D 3828 may be used as an alternative method with the same limits. For RFO4 fuel oils, Test Method D 56 may be used as an alternate with the same limits, provided the flash point is below 93°C and the viscosity is below 5.5 mm^2/s at 40°C. This test method will give slightly lower values. In case of dispute, Test Method D 93 shall be used as the referee method.

7.1.3 Water and Sediment – Test Method D 95 for water and Test Method D 473 for sediment. A density of 1.0 kg/L shall be used for Test Method D 95. Test Methods D 96 for water and sediment, D 1796 for water and sediment, D 4377 for water, EPA SW-846 Method 9000 for water, and EPA SW-846 Method 9001 for water may be used as alternate test methods with the same limits. For RFO4 fuel oils, Test Method D 2709 may be used as an alternate with the same limits, provided the viscosity is in the range of 1.0 to 4.1 mm^2/sec (1.0 to 4.1 cSt) at 40°C and the density is in the range of 0.870 to 0.900 kg/L at 15°C. In case of dispute, Test Methods D95 and D 473 shall be the referee methods.

7.1.4 Pour Point – Test Method D 97.

7.1.5 Density – Practice D 1298. Test Method D 4052 may be used as an alternate with the same limits. In case of dispute, Practice D 1298 shall be the referee method.

7.1.6 Ash – Test Method D 482.

7.1.7 Sulfur – Test Method D 129. Test Methods D 1266, D 1552, D 2622, D 4294, D5185, EPA 300.0, and SW-846 Method 9056 may also be used for all grades with the same limits. For Grade RFO4 fuels having a sulphur content below 0.4% (mass), Test Method D 1266 may be used as an alternate with the same limits. In case of dispute, Test Method D 129 shall be the referee method.

7.1.8 Extracted pH – Test Method D 4980.

7.1.9 Heating Value (Heat of Combustion) – Test Method D 240. Method D 4868, a calculation method, may be used as an alternate, with the same limits, where precise heat determinations are not critical. In case of dispute, Method D 240 shall be the referee method.

8. Keywords

8.1 burner fuels; fuel oils; furnace oils; petroleum and petroleum products; specifications, used oils.

APPENDIX

(Nonmandatory Information)

X1. SIGNIFICANCE OF ASTM SPECIFICATION FOR INDUSTRIAL BURNER FUELS FROM USED LUBRICATING OILS

X1.1 Scope

X1.1.1 This specification divides fuel oils into grades based upon kinematic viscosity. It places limiting values on the properties of the oils in each grade believed to be of the greatest significance in determining the performance characteristics of the fuel oils in the types of burners in which they are most commonly used. The type of burner for which a fuel oil is suitable depends largely on the fuel's viscosity.

X1.2 Significance Of Test Methods

X1.2.1 Physical Properties

X1.2.1.1 Viscosity – The measure of a fluid's resistance to flow. In fuel oil it is highly significant; it indicates both the relative ease with which the oil will flow or can be pumped, and the case of atomization. Viscosity is particularly important for the heavier grades which may require appropriate preheating facilities to permit the product to be pumped to the burner and for good atomization.

X1.2.1.2 Flash Point – The flash point of a fuel oil is an indication of the maximum temperature at which it can be stored and handled without serious fire hazard. The minimum permissible flash point is usually regulated by national or local laws and is based on accepted practice in handling and use.

X1.2.1.3 Water and Sediment – Appreciable amounts of water and sediment in a fuel oil tend to cause fouling of fuel-handling facilities and to give trouble in burner mechanisms. Sediment may accumulate in storage tanks and on filter screens or burner

parts, resulting in obstruction to flow of oil from the tank to the burner. Water in distillate fuel can cause corrosion of tanks and equipment, and water in residual fuel may cause emulsions. The presence of water in a burner fuel can also cause "spattering" in a burner flame, and lead to damage of burner nozzles (erosion or "explosive" damage) due to the rapid expansion of water in water vapour at a hot nozzle tip. Excessive water in burner fuel could lead to "flame out" or extinguishing the flame.

X1.2.1.4 Pour Point – An indication of the lowest temperature at which a fuel oil can be stored and still be capable of flowing under very low forces. The pour point is prescribed in accordance with the conditions of storage and use. Higher pour point fuels are permissible where heated storage and adequate piping facilities are provided. An increase in pour point can occur when residual fuel oils are subjected to cyclic temperature variations that can occur in the course of storage or when the fuel is preheated and returned to storage tanks. To predict these properties, Test Method D 3245 may be required.

X1.2.1.5 Density – Density alone is of little significance as an indication of the burning characteristics of fuel oil. However, when used in conjunction with other properties, it is of value in mass-volume relationships and in calculating the specific energy (heating value per unit mass) of an oil. Higher density burner fuels may indicate higher aromatics content, which may result in more soot or carbonaceous deposits if combustion temperatures are not hot enough for complete combustion.

X1.2.2 Chemical Properties

X1.2.2.1 Ash - The amount of noncombustible material in an oil. Ash-forming materials may be present in fuel oil in two forms, solid particles and /or oil- or water-soluble metallic compounds. The solid particles are, for the most part, the same material that is designated as sediment in the water and sediment test. Depending upon their size, these particles can contribute to wear of burner pumps and valves, and decrease fuel efficiency. The soluble metallic compounds have little or no effect on wear or plugging, but they can contain elements that produce corrosion and deposits on boiler heating surfaces. Excessive amounts of ash also may cause violation of national or local air emission regulations.

X1.2.2.2 Sulfur – A knowledge of the sulfur content of fuel oil can be useful for special applications in connection with heat treatment, nonferrous metal, glass, and ceramic furnaces or to meet national or local legislation or regulations.

X1.2.2.3 pH – An indication of potentially hazardous levels of acidity or alkalinity.

X1.2.3 Performance Properties

X1.2.3.1 Heat of Combustion - A knowledge of the heat of combustion is useful in determining the thermal efficiency of equipment for producing either power or heat. This in turn may determine the economic value of the fuel.

X1.3 Viscosity Conversions

X1.3.1 This standard specifies limiting values of kinematic viscosity at 100°C for the fuel oil categories contained in Table 1. In some cases kinematic viscosity may be measured or quoted at other temperatures or in other units, and Table A.1, below, gives approximate relationships. The data should be used with caution, firstly since the precision of measurements at temperatures other than 100°C may differ, and secondly because the variability of composition of these fuels may cause variations in viscosity-temperature relationships.

Table A.1 – Viscosities estimated from those measured at 100°C

	Estimated Viscosity at Temperature:			
Kinematic Viscosity, mm^2/sec	Kinematic Viscosity, mm^2/sec		Saybolt Universal Seconds	Saybolt Furol Seconds
100°C	40°C	50°C	100°F	122°F
5.0	24	17	125	--
9.0	58	40	290	21
15.0	170	100	900	48
50.0	1350	640	7400	300

FOOTNOTES

Footnote [1] This specification is under the jurisdiction of ASTM Committee D-2 on Petroleum Products and Lubricants and is the direct responsibility of Subcommittee D02.P on Recycled Petroleum Products.

Current edition approved XXXX.

Footnote [2] Annual Book of ASTM Standards, Vol. 05.01.

Footnote [3] Annual Book of ASTM Standards, Vol. 05.02.

Footnote [4] Annual Book of ASTM Standards, Vol. 05.03.

Footnote [5] Annual Book of ASTM Standards, Vol. 11.04.

Footnote [6] U. S. EPA – 600/4-79-020, "Methods for Chemical Analysis of Water and Wastes"

Footnote [7] U. S. EPA – SW-846, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"

Footnote [8] National Archives and Records Administration, Code of Federal Regulations, Volume 40.

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STATIONARY SOURCE SAMPLING REPORT

REFERENCE NO. 14505C

VOLUME 1

EMISSIONS TESTING FOR:

Particulate

Arsenic

Barium

Cadmium

Chromium

Hexavalent Chromium

Lead

Zinc

PERFORMED FOR: USED OIL RECYCLING COALITION

JULY 1995

ATTACHMENT B

EXECUTIVE SUMMARY

The Used Oil Recycling Coalition (UORC) contracted with Entropy, Inc. to evaluate metals emissions from used oil combustion. The primary objective of the study was to compile accurate data on emissions of lead for combustion sources utilizing used oil as a fuel. The secondary objective was to compile accurate emissions data for other metals including barium, cadmium, chromium, arsenic, and zinc.

The project was divided into two phases. In Phase I, Entropy, Inc. conducted a comprehensive literature search to determine if there were significant gaps in the available technical information regarding the emissions of metals from the combustion of used oil. In addition, an emissions inventory for used oil combustion sources was compiled to evaluate the emission quantities of each source category. Portions of the conclusions and recommendations for Entropy's Phase I report (dated April 27, 1994) are excerpted below.

In Phase II of the project, Entropy, Inc. conducted emissions test programs at two asphalt plants that combust used oil. Testing at one of the plants also involved the combustion of virgin oil. Asphalt plants were chosen for emissions testing because they are the single largest category of sources that burn used oil, and they consume approximately 43 percent of the total used oil collected and used as fuel in the United States.

The information from the study demonstrates that the combustion of used oil in asphalt plants equipped with baghouses in good working condition resulted in emissions of lead below detection limits. In fact, the emissions of lead and other metals from the combustion of used oil at both test facilities did not differ significantly from the emissions associated with the combustion of number 2 virgin oil at one of the test facilities.

Phase I Conclusions:

1. Due to significant reductions in the concentrations of some of the metals in used oils, most of the metals emission test data obtained prior to 1985 is not representative of present-day emissions.
2. Due to the lead-in-gasoline phase-down requirements, lead levels in automotive used oil after processing have decreased substantially. Average levels are now in the range of 40 ppm, well below the pre-1985 levels of 200 to 1000 ppm.
3. Barium levels in used oil have decreased substantially due to changes in the composition of additive packages used for lubricating oils. Average levels in automotive used oils are now in the range of 10 ppm.
4. A large fraction of the metals contained in used oil fuel stays within the combustion chamber and is not emitted into the effluent stream. The metals are trapped as deposits on combustion chamber walls and heat exchange surfaces. For industrial boilers, commercial boilers, space heaters, and other small combustion sources, the quantities retained as permanent deposits are probably 50 percent of the total quantity of metals entering with the fuel.

5. A significant fraction of the metals contained in used oil fuel for industrial furnaces is captured by the product streams processed in the furnaces. These metals are trapped as permanent solid deposits in the surfaces of the product materials and are not emitted to the atmosphere. For cement kilns and asphalt plant rotary dryers, metal capture by-product materials can range from 20 percent to 90 percent.

6. Metal-containing particles formed due to vaporization in the combustion chamber and nucleation during gas stream cooling are primarily in the submicron size range. Multicyclone collectors are ineffective for this particle size range. The collection efficiencies for the types of wet scrubbers, electrostatic precipitators, and fabric filters employed on used oil combustion sources range from approximately 50 percent to greater than 99 percent.

7. Asphalt plants are the largest single category of sources burning used oil. They consume approximately 43 percent of the total used oil collected and used as fuel in the United States, and there are indications that the consumption rates are increasing. Metals removal in baghouse-controlled plants is very high. There is considerable uncertainty regarding the capability of wet scrubber controlled plants to collect metals-containing particles efficiently.

8. Utility boilers are an important consumer of used oil. More data are needed regarding the types of boilers that burn used oil, the types of fuels co-fired with used oil, the types of air pollution control systems on these boilers, and the used oil firing practices. There are no previously conducted air emissions studies on utility boilers regarding the potential metals emissions attributable to the burning of used oil.

9. Industrial boilers used for space heating and steam generation are important because of the quantities of used oil consumed and the limited air pollution control system capability. Emissions data are needed to evaluate the metals retention as deposits in the boilers and to evaluate the fractions removed as part of bottom ash or flyash streams. There are no relevant, up-to-date data concerning metals emissions from industrial boilers.

10. Space heaters are an important category due to the quantities of used oil burned and the lack of air pollution control systems. There is very little relevant, up-to-date emissions data. However, a study being coordinated by the State of Vermont is likely to provide valuable data. (See Volume 1, Appendix A of this report).

11. The NORA survey data indicates that small commercial boilers, apartment house boilers, and school boilers (collectively termed "residential/commercial" boilers) receive a relatively small fraction of the overall used oil generated in the United States.

12. Cement kilns and other types of industrial processes do not appear to be significant sources of metals emissions due to high particulate collection efficiencies and to metal capture in the product streams.

Phase I Recommendations:

1. An emission test program should be conducted to characterize emissions from three types of used oil combustion sources: (1) asphalt plants, (2) utility boilers, and (3) industrial boilers. The tests should include analyses of the used oil fuel and the accumulation of metals on heat exchange surfaces and refractory within the boilers. The scope of the tests should include lead, barium, cadmium, chromium, arsenic, and zinc.
2. Air pollution emission data obtained as part of the State of Vermont study of space heaters should be requested as soon as it is available to further evaluate the environmental aspects of used oil combustion in space heaters. (See Volume 1, Appendix A of this report).

Phase II:

Pursuant to the Phase I recommendations, extensive efforts were made to locate suitable combustion sources from all three recommended categories, but no suitable utility or industrial boilers were identified as test subjects. No utility boilers were identified that co-burned used oil with virgin oil. Although many utility boilers co-burn used oil with coal, these burners were determined not to be appropriate test subjects because the used oil generally constitutes a small constituent of the fuel load and because of the difficulties inherent in differentiating the very slight impact of metals associated with the combustion of used oil from the metals associated with the combustion of coal. A small number of potential industrial boiler candidates were identified and contacted. Ultimately, however, none would allow the testing to be performed. Thus, Phase II testing was limited to two asphalt plants.

Stack testing was conducted at two asphalt plants, designated as Facility A and B throughout this report, to determine the emissions of lead, barium, cadmium, chromium (hexavalent and total), arsenic, and zinc. At Facility A, tests were conducted during the combustion of virgin number 2 fuel oil (designated as Condition I) as well as used oil, which is referred to by the asphalt plants as number 4 recycled oil (designated as Condition II). At Facility B, tests were conducted during the combustion of number 4 recycled oil.

Comparison of the emissions from the different fuels fully supports the contention that metals removal in baghouse-controlled plants is very high. At Facility A, lead content of the recycled oil was 50 times higher than that of the virgin oil, yet emissions remained at or below the detection limit with corresponding removal efficiencies greater than 99.98 percent. A comparison of the average percent removal efficiencies for each metal under each of the test conditions is presented in the following table.

Metals Removal Efficiency - Average of Three Test Runs

Arsenic	Barium	Cadmium	Chromium	Lead	Zinc
Facility A Virgin Number 2 Fuel Oil					
> 98.63	> 92.06	> 97.86	> 96.07	> 95.33	> 70.49
Facility A Recycled Number 4 Fuel Oil					
> 98.70	98.72	> 99.42	99.05	> 99.98	99.97
Facility B Recycled Number 4 Fuel Oil					
> 98.03	96.59	> 98.56	98.74	> 99.95	99.96

At Facility B, lead content in the recycled oil was slightly lower than that in the recycled oil at Facility A, and removal efficiencies remained high - greater than 99.95 percent. At both facilities, removal efficiencies of the other metals tested were similarly high.

The information from the study indicates that the combustion of used oil in asphalt plants equipped with baghouses in good working condition resulted in low levels of emissions of lead and other metals at or below detection limits. In fact, the emissions of lead and other metals from the combustion of used oil at these facilities did not differ significantly from the emissions associated with the combustion of number 2 virgin fuel oil at Facility A. The mass balance calculations indicate overall removal efficiencies of 96.05 percent to 99.98 percent of the metals tested. Thus, the study demonstrates that the combustion of used oil in these types of asphalt plants is a good option for resource recovery.