4. PRODUCTION, IMPORT, USE, AND DISPOSAL

4.1 PRODUCTION

Used mineral-based crankcase oil is a complex mixture of low and high molecular weight (C_{15}-C_{50}) aliphatic (paraffins, olefins, and acetylene hydrocarbons and their derivatives), aromatic, and naphthenic hydrocarbons, lubrication additives, sulfur, oxygen and nitrogen compounds, and metals. Aliphatic hydrocarbons contain a molecule with carbon atoms in simple or branched chains. Aromatic hydrocarbons are compounds with unsaturated carbons in six-membered rings and properties similar to benzene. Polycyclic aromatic hydrocarbons (PAHs) are complex organic compounds containing 3 or more aromatic rings. The chemical composition of new or used mineral-based crankcase oil varies widely and depends on the original crude oil and the processes used during refining.

Used mineral-based crankcase oil is produced when new mineral-based crankcase oil is subjected to high temperatures and high mechanical strains. The lubricating oil is altered by nitration, cracking of polymers, oxidation, and decomposition of organometallic compounds. Therefore, fuel (gasoline or diesel), water, metals, metal oxides, and other combustion products accumulate in the oil, resulting in used mineral-based crankcase oil (Vasquez-Duhalt 1989). Used mineral-based crankcase oil has been determined to be a source of lead exposure, but other sources like exhaust gas, gasoline, and gear oil can also contribute to lead exposure. Lead emissions are a direct result of lead added to fuel as an antiknock agent in order to increase fuel efficiency. However, because of stringent emissions controls in the late 1980s, atmospheric and human lead levels have dropped drastically with the introduction of unleaded gasoline and the reduction of lead levels in leaded gasoline (Sawyer 1993). Other factors such as the efficiency and type of engine the oil is lubricating, the gasoline combustion products, and the interval between oil changes and mileage driven also alter the chemical composition of used mineral-based crankcase oil.

The production of used mineral-based crankcase oil is expected to be equivalent to the sales of new mineral-based crankcase oil. An estimated 65-68% of the oil is recovered when engine oil is changed; the remaining motor oil is released into the environment while the engine is operating (Tanacredi 1977).

In 1972, EPA estimated that 500 million gallons of used mineral-based crankcase oil was produced in the United States. The American Petroleum Institute (API) estimated that 616 million gallons of used mineral-based crankcase oil were generated in 1974; 81% was collected by automotive shops, and the remaining oil was obtained when automobile owners changed their own oil at home. Production increased to 720 million gallons in 1975, and in 1980, more than 9 million tons were produced. In 1982, 1,350 million gallons of used mineral-based crankcase oil were produced in the United States (API 1974; Brinkman et al. 1982; Maugh 1976; Vasquez-Duhalt 1989; Weinstein 1974).

4.2 IMPORT/EXPORT

No information on the import or export of used mineral-based crankcase oil was located.

4.3 USE

Used mineral-based crankcase oil is burned as a supplemental fuel in industrial steam boilers, domestic oil burners, utility steam boilers, waste disposal incinerators, and rotary cement kilns. It is also used as a component in asphalt and as a dust suppressant on rural roads. Used mineral-based crankcase oil is also re-refined to make lubricating oils (EPA 1974b; NATO 1981; Tanacredi 1977; Weinstein 1974).

In 1974, 31.6-50% of used mineral-based crankcase oil (195-308 million gallons) was utilized as supplemental fuel; 11-16.7% (67-103 million gallons) was incorporated into asphalt for roads; 23.2% (143 million gallons) was used for road oiling; 3.3-9.2% (20-57 million gallons) was re-refined; and 23.0-30.0% (142-185 million gallons) was released into the environment (API 1974; EPA 1972; NATO 1981; Stehouwer 1980; Tanacredi 1977). In 1989, a total of 750 million liters (198 million gallons) of used mineral-based crankcase oil was used as road oil or incorporated into asphalt for roads (DOE 1989).

4.4 DISPOSAL

In 1974, automobile owners who changed their own oil disposed of 69 million gallons of used mineral-based crankcase oil directly onto the ground or into landfills, storm sewers, toilets, and sinks; 37 million gallons were returned to service stations for disposal. A national telephone survey of 4,805

U.S. households found that the disposal methods for the automobile owners who changed their own oil were as follows: oil poured onto the ground-40%; oil placed in trash to be collected-21%; oil taken to gas station or recycled-14%; miscellaneous uses-25% (i.e., used as a lubricant on machinery, stored, used as an insecticide). In rural areas, the most common way to dispose of oil was pouring onto gravel roads and driveways. A Wisconsin survey of automobile owners who changed their own oil found the following breakdown of disposal methods: oil dumped on property-33%; oil taken to service station-15%; oil taken to public dump-11%; oil dumped in storm sewer-11%; oil dumped in garbage can-10%; oil dumped in empty lot-3%; and other-17% (API 1974; Brinkman et al. 1982).

In a Wisconsin survey of service stations, the used mineral-based crankcase oil was disposed of in the following manner: re-refined to lubricating oil-33.8%; re-used as fuel oil-37.2%; re-used for road application-7.4%; reused on a farm-19.3%; dumped on the ground-2.1%; and not known-0.3% (API 1974).

The two main methods for recycling used mineral-based crankcase oil are burning as fuel and rerefining. Used mineral-based crankcase oil can easily be re-processed by settling and filtration to remove water and solids followed by blending with diesel fuel, coal, or residual oil; it can then be burned as a supplemental fuel. Used mineral-based crankcase oil may also be re-refined into a lubricant blending stock. In 1980, 11.4% of used mineral-based crankcase oil was re-refined. Both recycling methods have problems: high levels of metals are released into the atmosphere when used mineral-based crankcase oil is burned, and re-refining processes produce wastes that cause disposal problems. Additionally, the quality of re-refined motor oil is inferior to that of new motor oil because there is no way to assure batch-batch quality of the re-refined base stocks (Stehouwer 1980).