Disposing of used lubricating oils

The disposal of used lubricating oils is regulated in the EU by the Waste Oil Directive[1] (as well as other waste directives). This Directive requires the Commission to obtain statistical data on the collection and disposal of used oil in the Member States. The Commission has recently published a report on these statistics[2] and is planning to issue a revised Waste Oil Directive.

Under current EU legislation, used engine oil is considered a hazardous waste and Member States must ensure safe collection and disposal. They can apply subsidies for this. The Waste Oil Directive gives a hierarchy of disposal options. The first priority is for regeneration, i.e. re-refining. After this, used oil may be used as fuel as long as this is under environmentally acceptable conditions. Finally, if these options cannot be used, it must be subject to safe destruction or disposal. In the following paragraphs we revisit the main conclusions from a previous CONCAWE study and compare some of the results with the EU data.

CONCAWE carried out a study in 1994/5 based on 1993 data. This study covered all lubricating oils in the whole of Western Europe, not just motor oils. It did not include other types of waste oils such as those recovered from effluent treatment systems. One of the problems with such studies is to determine which types of oil are included in the data, particularly when there is the potential for different types of oil being mixed at the collection facilities. The study looked at the market situation, used oil collection, disposal routes, re-refining technology, and re-refining economics. The full results are published in CONCAWE report no. 5/96.

The CONCAWE data is compared with those collected by the EU Commission as well as those from another study by Coopers & Lybrand (C&L) in Table 1. While there are differences between the three sets of data, and they cover different years, the results are all basically similar. The most important feature is that only about half of the potentially collectable waste oil is recorded as collected and, of this, only some 36 per cent is in fact re-refined.

Table 1
Results of the different studies compared (kt/a). Note that, for each study, only about half of the potentially collectable waste oil is recorded as collected and, of this, only some 36 per cent is in fact re-refined.

Comparison of results of CONCAWE, EU and C&L Studies (kt/a)

	CONCAWE *(1993)*	***EU*** *(1997)*	***C&L*** *(1995)*	***Average***	***Percent of average***		
Sold	5319	4892	5109	5107	100		
Potential waste oil	2624	2601	2448	2558	50	100	
Collected	1500	1915	1827	1747	34	68	100
Regenerated	645	607	658	637	12	25	38
Burnt	732	1274	1169	1058	21	41	62
Missing	1124	686	621	810	16	32	

[1] *Council Directive 75/439/EEC of 16 June 1975 as amended by Council Directive 87/101/EEC of 22 December 1986*

[2] *Report from the Commission to the Council and the European Parliament on the Implementation of Community Waste Legislation for the period 1995–97 (COM (1999) 752 final, 10 January 2000, p.43)*

It is important to realize that ‘used oil’ contains only about 70–80 per cent of actual oil. The type of oil is variable and probably a mixture of various grades. It also contains water (up to 10 per cent), unburned fuel (up to 10 per cent), metals (ca. 0.5 per cent), heavy ends, additives, and sulphur (up to 1 per cent). An important point is that used oil from gasoline engines is carcinogenic (because of PAH formation in the engines).

In the CONCAWE study a number of disposal routes were identified and the quantities of oil going to each route estimated. The results are given in Table 2. Burning in cement kilns uses the fuel value, organic contaminants are destroyed and the metals are locked in the cement. Burning in space heaters also uses the fuel value but is likely to cause local air pollution. Burning in hazardous waste incinerators should certainly control emissions and residues but may appear to use the energy content inefficiently. However, such incinerators usually require support fuel, and

Table 2
CONCAWE identified a number of disposal routes for used oil, and the quantities of oil going to each route were estimated.

Quantities of used lube-oil disposed of by various routes (CONCAWE study)

Disposal route	***kt/a***	***% of total***
Reclaiming industrial oils	165	11
Burning (cement kilns, space heaters, incinerators)	480	32
Re-processing to fuel (mild by removal of water and sediments; and severe by dewatering, flashing and vacuum distillation)	375	25
Re-refining (to new lubricating oil)	480	32
Total	1500	100

if the waste oil replaces this, then the energy content is used effectively. Burning after mild or severe re-processing can also have advantages but the degree of processing and the environmental effects depend very much on the type of combustion installation being considered.

The CONCAWE study looked at various re-refining methods. Some of these gave good product quality but it was considered that severe hydrotreatment is probably required to achieve adequate removal of carcinogenic components. The main problems identified with re-refining were that it is capital intensive, and probably not economic without subsidies. It is difficult to confirm a lack of carcinogenicity in the product and it is probably not possible to produce premium quality grades of lubricating oil, particularly low friction oils, from the typical mixed feed. There are also emissions from re-refining processes and residues have to be disposed of.

A number of Life Cycle Analyses (LCA) have been carried out by others. These are difficult to do, as the uncertainties are large in comparison with the differences between the options. Most have concluded that re-refining is ‘better’ than burning, usually on grounds of energy efficiency. The CONCAWE study did not claim to be a full Life Cycle Analysis but it did consider the environmental aspects of the various options. It attempted to consider the impact on the whole refining industry using the CONCAWE refinery model. This is a complicated question as, amongst other things, it depends on the sulphur balance in the future European oil market. Also, the differences between the re-refining and burning options were small compared with the uncertainties and there was no convincing way to model the replacement of coal as a fuel for cement kilns by used lubricating oil. CONCAWE (which represents both lubricating oil manufacturers and re-refining plant operators) concluded that none of the possible disposal options had a clear advantage and that the results might well differ from place to place depending on local circumstances and the quantities of used oil available for disposal.

Such an LCA should really also consider effects on the fuel economy of the vehicle using the oil. The difference in fuel consumption between a top-quality low friction oil and an 'ordinary' oil can be more than 5 per cent. Over 10 000 km a typical modern car uses ca. 1000 litres of gasoline and one fill of ca. 5 litres of engine oil of which perhaps 3 litres is recoverable oil. The possible difference in fuel use is 50 litres, which is much greater in energy conservation terms than any differences arising from different used oil disposal methods. CONCAWE's view is therefore that any incentives used to encourage re-refining should not include a compulsion to use re-refined oil in all new oils. There is no shortage of virgin base stocks for the manufacture of lubricants so that re-refining does not have an advantage from that point of view.

CONCAWE could not come to a clear choice on the 'best environmental option' for disposal of used oils and the optimum solution may vary with both place and time. The differences in energy requirements between the various disposal options are much less than the energy content of the used oil. The most important action is therefore to encourage the collection of used oil and select the disposal route that is most beneficial and environmentally acceptable in each specific case.