



Government of Saint Lucia

Strategy on the Management of Used Oil

*PREPARED BY
SAINT LUCIA SOLID WASTE MANAGEMENT AUTHORITY*

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ACRONYMS

CDB	Caribbean Development Bank
CEHI	Caribbean Environmental Health Institute
CPI	Corrugated Plate Interceptor
EIA	Environmental Impact Assessment
EMA	Environmental Management Authority
EPA	Environmental Protection Agency
ESDU	Environment and Sustainable Development Unit
GEF	Global Environmental Facility Fund
HEM	n-Hexane Extractable Material
IBRD	International Bank for Reconstruction and Development
IMO	International Maritime Organisation
ISO	International Organisation of Standardisation
LOT	Load on Top
MARPOL	International Convention for the Pollution from Ships
NGO	Non Governmental Organization
NP	National Petroleum Marketing Company Limited
NRMU	Natural Resources Management Unit
OECS	Organisation of Eastern Caribbean States
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
TAC	Technical Advisory Committee
TAN	Total Acid Number
TBN	Total Base Number
TPH	Total Petroleum Hydrocarbons
TTS	Trinidad and Tobago Standard

1.0 BACKGROUND

1.0.1 *Used Oil Strategy*

Saint Lucia imports a large volume of oil and oil products every year. These products are essential for the proper maintenance of vehicles, equipment, ships and power generation. During the maintenance of these equipment used oils are generated. In addition to the used waste oil generated from these activities Saint Lucia also accept used oil from cruise ships. In light of the potential negative environmental and health impact which can arise from the improper management of used oil it was recognising that there was a need to institute a proper management system.

Further the Government of Saint Lucia adopted a Policy for the Management of Shore and Ship Generated Waste in 2000. This policy stipulates that the Saint Lucia Solid Waste Management Authority works with waste oil generators and the importers/distributors to facilitate the development of management systems to address this waste stream.

The Authority through assistance received by GPEC International and CIDA devised an industrial hazardous waste management plan for used oil. This study was quite comprehensive in scope and sought to devise a plan which took local issues into consideration. Further it recommends an incremental approach to implementation of this strategy and clearly defines the issues to be considered in ensuring that the plan assist Saint Lucia in meeting its commitment to international conventions particularly Basel.

Additionally at a Regional Roundtable on the implementation of the OECS Solid Waste Management project, held in Grenada in September 2001, the OECS Member States participating in the Project identified the management of Used Oil as an issue requiring particular attention. It was therefore decided that the Management of Used Oil would be included among the areas of Technical Assistance to be addressed through the Regional Component. Since then a regional waste oil strategy document has been provided for the six OECS Countries which participated in the OECS Shore and Ship Generated Waste Management Project. The study makes broad recommendation which serves as a basis for each island to develop a country - specific strategy.

2.0 USED OIL IN SAINT LUCIA

2.1 *Sources of Used Oil*

Saint Lucia is primarily an importer of oil and used oil is generated from a number of sources in the island. **In general, there are four sources of Used Oil:**

- Electricity Generating Stations,
- < Land Vehicles,
- < Factories, and
- Ships and Watercraft.

In addition a number of processors who burn used oil as a supplementary fuel accept it from cruise ships. This has proven to be the major source of oil to these companies. The concern however is that most of the used oil generated on island is being disposed indiscriminately resulting in contamination of land, waterways and the marine environment while at the same time we are receiving used oil from abroad to burn as a supplementary fuel.

2.1.1 Electricity Generating Stations

- The Saint Lucia Electricity Services Limited has instituted a waste oil management plan and has expressed their intention to responsibly dispose of their waste oil, and has taken positive action to achieve this.**

The Saint Lucia Electricity Services Ltd is the largest single-point producer of used oil in Saint Lucia. Historically, the disposal of used oil from these facilities had proved to be very problematic, and there are many anecdotes about improper disposal (crude dumping) of used oil from power stations. However, in recent times this situation has improved significantly. The Saint Lucia Electricity Services Limited have instituted the necessary mechanism for the collection of the used oil and makes this oil available to the entities who uses this oil as supplementary fuel. These include a rum distillery, a linen washing operation and a brick factory operator.

2.1.2 Land Vehicles

- Collectively, the operators of land vehicles constitute a large producer of used oil. However, the sources are dispersed throughout the country.**

Used Oil from the servicing of cars, trucks, buses, etc. constitutes a large fraction of the used oil produced in the Saint Lucia, but the actual sources are dispersed throughout the country. This makes management more difficult than in the case of electricity generating stations, where significant volumes of used oil are produced at single locations.

The scale of operations also varies, ranging from service depots (operated by vehicle agents, Service Stations and large contractors) to roadside mechanics and at-home oil changes. Several of the larger garage operators have acknowledged the need for proper disposal of used oil, but only a few seem to have instituted a suitable method of collecting and making it available to the used oil processors. In contrast, it was reported that most of the roadside mechanics and persons who serviced their own vehicles tend to dump the used oil rather than bring it back to collection centres, even though there was no charge at the collection centres. In general there is limited awareness at this level of the need for proper used oil disposal.

The Saint Lucia Solid Waste Management Authority has interfaced with a number of these generators as well as the insurance council of Saint Lucia to ensure that the Authorized Garages institute a waste oil management plan and that the roadside garages improve used oil management on their premise. There have been varying levels of success however it can be stated that these generators have expressed and displayed a general willingness to

participate in any initiative geared at improved waste oil management.

2.1.3 Factories

- Factories represent both a source of waste oil and a potential disposal option.**

In Saint Lucia there exist three major factories who utilise Used Oil as a supplementary fuel. The management of two of these factories have indicated that this used oil have assisted significantly in reducing their cost of operations and that they are prepared In this context, to work with the Authority in its attempts to improve the recovery of used oil generated island wide. They have made attempts in the past to work with generators to improve recovery through the institution of a more effective collection system. However there is need to build upon this model and thereby increase the proportion of used oil generated on the island which is recovered.

2.1.4 Ships and Watercraft

- Saint Lucia receives used oil from large vessels, for use as supplementary fuel**

This category of Used Oil producers can be conveniently sub-divided into two groups:

- larger vessels and cruise ships which ply between islands, and
- smaller vessels which operate largely within the waters of a single country.

Saint Lucia also receives used oil from larger vessels, and this is utilized as a supplementary fuel. The Ministry of Planning, Development, Environment and Housing estimates that just over 1,000 m³ per year is currently received from ships.

Smaller vessels are normally serviced at marinas or ports, and are generators of a significant volume of waste oil. In the case of the Rodney Bay Marina they now collect used oil for return to the companies who process used oil as a supplementary fuel. This model has been successful in ensuring that users of their facility do not dump the oil into the marine environment. One key driver in this effort is that improperly disposed used oil will dirty the same pleasure craft from which the oil originated. There is a need to ensure that all Marinas and Marine Management Areas institute a collection system for waste oil generated.

2.2 Volume of Used Oil

- The estimated volume of Used Oil produced in the year 2001 was above 460 M³**

The volume of Used Oil produced in the country is an important parameter in recommending a disposal strategy, as treatment and disposal systems may become inefficient or ineffective at very low volumes or at volumes exceeding their design capacity. This section provides estimates of the used oil volume produced per year in Saint Lucia based on oil import statistics. In light of the fact that the country is a non oil-producer, the lubricating oil import statistics represent all such oil used in the countries. Table 1 lists volumes obtained from the Department of Statistics.

TABLE 1: LUBRICATING OIL IMPORTS

YEAR OF STATISTICS	LUBRICATING OIL IMPORTS			ESTIMATED ANNUAL USED OIL FOR DISPOSAL (m ³) 1 st 10 Years
	as reported		m ³	
1999	425,671	l	426	276
2000	548,994	kg	615	400
2001	541,719	l	542	352

Not all imported lube oil can be collected for disposal. A small amount adheres to the containers, while some spills are inevitable during filling and emptying. In addition, some of the lube oil will be evaporated or burned in the engines they are used to lubricate. It is estimated that between 75 to 90 percentage of new lube oil can eventually be collected for disposal. It is therefore reasonable to assume that the recovery rate will begin at or about 40 percent to about 80 percent when the used oil collection system matures.

However, to be conservative in estimating sizes of facilities and costs, a value of 60% was used for this assignment. This is because it is believed that it would take at least 10 years to achieve an 80% collection rate.

2.3 Current Disposal Practices

- There is presently great variability in disposal methods for Used Oil in Saint Lucia.

Generators of Used Oil adopt various mechanisms to manage oil generated from their activities. This includes:

- < Used oil as a Supplementary Fuel,
- < Minor Uses,
- < Crude Dumping.

2.3.1 *Use as Supplementary Fuel*

- Used Oil as a supplementary fuel appears to have some potential in boilers, furnaces and kilns, but not in generators nor engines.**

In Saint Lucia, Used Oil is used to fuel boilers at a linen factory and a distillery, and to fuel a kiln at a clay products factory. The distillery presently burns approximately 666 m³ of Used Oil per year, most of which is obtained from ships visiting the island. The linen factory uses approximately 440 m³ of Used Oil per year, roughly half is obtained from the power company and half from ships.

The environmental effects of burning Used Oil have not been studied in Saint Lucia however it has been recognized that Used Oil tends to result in a smokier emission from the burners, and concern have been expressed on the effects of these emissions on the population downwind of the chimney (and particularly on asthma sufferers). On the other hand, the emission of the products of the combustion of additives in the oil does not appear to have been considered in any systematic way. It is therefore important for a mechanism to be instituted to study the impact of both acute and chronic exposure to such emissions as well as determination of the operational criteria for entities that utilise used oil as a supplementary fuel.

- There are a host of minor uses of Used Oil in Saint Lucia, but some should be discontinued.**

2.3.2 *Minor Uses*

A host of minor uses of Used Oil have been identified in Saint Lucia these include:

- Wood Preservative (painted on posts, etc),
- Mosquito Suppressant (applied to stagnant water in drains, etc),
- Vermin Suppressant (applied to outhouses and plywood houses),
- Treatment of Livestock for Parasite Control,
- Lubricating Moulds and Formwork for Concrete Units,
- < Marking of Sport Fields.

However, all of these uses will not consume the full volume of Used Oil produced in Saint Lucia annually. Additionally, the health and environmental consequences of these various uses suggest that they should be discontinued. For example, the application of Used Oil on water bodies to control mosquitoes is an unacceptable practice (both from the environmental and the public health standpoint). Used Oil contains poly-nuclear aromatic hydrocarbons (PAHs), some of which are suspected carcinogens. Used Oil is also likely to contain low levels of benzene, another suspected carcinogen.

2.3.3 *Crude Dumping*

- Used Oil disposal can be described as an invisible problem in Saint Lucia.**

The crude dumping of Used Oil is a problem which is very prevalent in Saint Lucia. The implication is of its negative impact on health and the environment cannot be underscored. It is very common in the vicinity of roadside garages and may also be seen in the drains in the vicinity of authorized garages. These are several issues associated with this practice which includes:

- Pollution of Surface Waters (streams, rivers and the sea);
- Fish Kills and other effects on Marine Life;
- Soil Contamination, Beach Contamination and Contamination of Seabed and Riverbed Sediments; and
- Ground Water Contamination.

Notwithstanding the problems listed above, the view of environmental activists is that Used Oil is an invisible problem in Saint Lucia. Specifically, the general public appears to recognize improper disposal of Used Oil by large operators, but not by small operators nor by the public itself. As a result, the same persons who would complain about the oil-stained condition of drains outside a power station (for example) would think nothing of similar staining of the drain adjacent to their roadside mechanic.

2.4 **Role of the Oil Companies**

- Several international oil companies have espoused a “cradle to grave” philosophy for their products.**

The two main companies involved in the supply of oil to Saint Lucia are Shell Caribbean & Central America and Texaco Eastern Caribbean Limited. These are international Agencies and their corporate position is **articulated** below.

The “cradle to grave” concept is one where a manufacturer retains an interest (somesay a responsibility) for his products throughout its useful life, and until it is safely disposed. An important element of this philosophy is the design of products to enhance reuse, recycling or resource recovery.

These companies have indicated that they strongly believe in the “cradle to grave” philosophy. Shell Caribbean & Central America have indicted that they are in the process of developing a management plan for Used Oil in each of the OECS countries. This is in support of their “cradle to grave” philosophy.

Texaco (Eastern Caribbean) Limited has indicated that they have a Product Stewardship Program which requires that Used Oil be recycled into a base oil, which is either engine or hydraulic oil or recycled into bunker fuel which is then burned in ships. This program seeks to keep Used Oil out of the waste stream thereby effectively conserving energy.

These initiatives though beneficial come or will come at a significant cost to the user. Additionally Used Oil is a resource as a supplementary fuel if managed properly and these initiatives of the suppliers are geared primarily at large generators. The reality is that these large generators are already organised and have been targeted by the companies who utilise the Used Oil as a supplementary fuel. Therefore from an economic perspective there exists a greater benefit for the country to utilise the oil as a supplementary fuel. However, the necessary safeguards and standards must be instituted to ensure that public health and the environment are not compromised.

2.5 Role of users of used oil as a supplementary fuel

In Saint Lucia currently there exist three companies which utilize used oil as a supplementary fuel. These companies have indicated that a commitment to work alongside the relevant agencies to ensure that an environmentally sound management system is implemented for used oil.

They have agreed that they will institute a collection system to manage the used oil. What is critical however is a need to ensure that the waste oil collected at the various points is collected in a timely manner.

The companies which utilize waste oil as a supplementary fuel have also recognised the need to ensure that the issue of air pollution must be given increased focus in the future. To this end they have agreed to work alongside the Authority and the Ministry of Environment, Sustainable Development Unit to review their technology and institute necessary improvements to ensure that health and environment is not compromised by air pollution.

The waste oil companies will ensure that oil is transported and stored in accordance with guidelines established and must ensure that their operations do not compromise the environment. In order to ensure that these requirements are met these companies require competent and well trained staff, to this end an initial training program will be instituted by these companies in collaboration with the Ministry of Environment and the Saint Lucia Solid Waste Management Authority. It will be a request that all new staff is trained and refreshers' program held for all existing staff at least once every two years.

3.0 REGULATORY FRAMEWORK

3.1 International Treaties

The St. George's Declaration addresses hazardous waste, while both the Basel Convention and the MARPOL Convention address Used Oil specifically. These three are discussed below.

3.1.1 *St. George's Declaration*

The States of the OECS that are signatory to the St. George's Declaration of the Principles for Environmental Sustainability in the OECS, are persuaded that the effective management of environmental resources at local, national, regional and international levels is an essential component of sustainable social and economic development. The Member States of the OECS are committed to implementing the inter-related principles contained in the St. George's Declaration. The relevant components of these Principles are as follows:

Principle 3: Improve on Legal and Institutional Frameworks, includes a statement where each Member State agrees to incorporate or embody, where appropriate, the polluter pays principle in laws and principles, and in economic instruments.

Principle 10: Prevent and Control Pollution and Manage Waste, states that each Member State agree to:

- (a) Adopt and implement appropriate measures to adequately manage solid and liquid waste, including hazardous waste, and atmospheric pollutants;
- (b) Adopt individually or jointly, appropriate measures to prevent, reduce and control pollution arising from, among other things, the trans-boundary movement of radioactive, toxic or other hazardous substances;
- (c) Develop and implement measures, including among other measures the identification, adoption and enforcement of effluent and emission standards and guidelines, to prevent, reduce and control pollution, and degradation of the environment from pollution;
- (d) Develop and implement strategies to regularly monitor and report on pollution levels.

Principle 14: Recognize Relationships between Trade and Environment, states that each Member State agrees (among other things) to:

- (a) Adopt measures that prevent importation of products that that have been banned or whose use has been otherwise curtailed in other countries because of the negative impact of those products on the environment or human health;
- (b) Adopt measures aimed at ensuring the prices of commodities and raw materials reflect the direct and indirect social and environmental costs of their extraction,

production, transport, marketing and where appropriate, ultimate disposal as far as is practicably feasible after the requisite investigations.

3.1.2 Basel Convention

The Convention on the Control of Trans-boundary Movements of Hazardous Wastes and their Disposal (Basel Convention) is an important global agreement to which Saint Lucia and other OECS territories are contracting parties.

The Basel Convention takes as a basic principle the need to reduce both the generation of hazardous wastes and their trans-boundary movement to a minimum. The Convention states that all countries have the right to ban the import of hazardous waste.

The exporting country has a duty to ensure that all wastes, whether for recovery or disposal can be dealt with in an environmentally sound manner. That country also has a duty to arrange for the return of wastes failing to go to an appropriate treatment or disposal plant.

The Basel Convention permits parties to it to agree bi-lateral agreements for trade in hazardous waste and prohibits such arrangements with others. Hazardous wastes which are to be exported must be packaged, labelled and transported in accordance with recognised international standards.

It should also be noted that wastes which are derived from the normal operations of a ship, the discharge of which is covered by another international instrument, are excluded from the scope of the Basel Convention.

The Basel Convention requires that the disposal of hazardous waste does not result in the development of another hazardous waste stream.

Used Oil is considered hazardous under the Basel Convention since it is listed under Annex I: Categories of Wastes to be controlled. The waste streams applicable to this study are:

- < Y-8 Waste mineral oils unfit for their originally intended use; and
- < Y-9 Waste oils/water, hydrocarbons/water mixtures, emulsions

3.1.3 MARPOL Convention

The International Convention for the Prevention of Pollution from Ships 1973 (MARPOL Convention) is the main international convention which addresses prevention of pollution of the marine environment by ships from operational or accidental causes. The MARPOL Convention was adopted following the 1973 international conference on marine pollution held under the International Maritime Organization. Included were articles dealing with oil, chemical, sewage and other pollution from ships. It was not ratified because many countries found it was too difficult to implement. A further conference in 1978 agreed a protocol (MARPOL 73/78) have now been ratified by Saint Lucia.

Annex I: Prevention of Pollution by Oil, of the MARPOL Convention states that operational

discharges of oil from tankers are allowed only when all of the following conditions are met:

1. the total quantity of oil which a tanker may discharge in any ballast voyage whilst under way must not exceed 1/15,000 of the total cargo carrying capacity of the vessel;
2. the rate at which oil may be discharged must not exceed 60 litres per mile traveled by the ship; and
3. no discharge of any oil whatsoever must be made from the cargo spaces of a tanker within 50 miles of the nearest land.

An oil record book is required, to record the movement of cargo oil and its residues from loading to discharging on a tank-to-tank basis.

In addition, in the 1973 Convention, the maximum quantity of oil permitted to be discharged on a ballast voyage of new oil tankers was reduced from 1/15,000 of the cargo capacity to 1/30,000 of the amount of cargo carried. These criteria applied equally both to persistent (black) and non-persistent (white) oils.

A new and important feature of the 1973 Convention was the concept of "special areas" which are considered to be so vulnerable to pollution by oil that oil discharges within them have been completely prohibited, with minor and well-defined exceptions. The 1973 Convention identified a number of areas, but not the Caribbean Sea.

All oil-carrying ships are required to be capable of retaining oily wastes on board through the "load on top" system or for discharge to shore reception facilities. This involves the fitting of appropriate equipment, including an oil-discharge monitoring and control system, oily-water separating equipment and a filtering system, slop tanks, sludge tanks, piping and pumping arrangements.

3.2 National Laws

3.2.1 Uniform Legislation

Saint Lucia is in the process of enacting Solid Waste Management Legislation based on a common model developed for countries who participated in the OECS Solid and Ship Generated Waste Management Project. These include:

- The **draft** Waste Management Act of Saint Lucia (2003), and
- The **draft** Marine Pollution Act of Saint Lucia (2003).

The salient features of these pieces of legislation related to Used Oil are discussed below.

3.2.1.1 *Hazardous Waste Classification*

- Used Oil is classified as a hazardous waste under the Marine Pollution legislation.**

The Marine Pollution legislation contains a Schedule on the classification of hazardous waste, based on the Basel Convention. Upon the enactment of this legislation waste oil will be classified as a hazardous waste, both in terms of its properties and with regard to the additives used.

3.2.1.2 *Waste Oil Management Scheme*

- Wherever practical, waste should be minimized, recycled, recovered, reclaimed or reused.**

The legislation requires that Saint Lucia prepare a waste inventory, and subsequently a National Waste Management Strategy. This strategy must include “*an implementation programme outlining mechanisms, programmes, policies and strategies that are to be established to ensure that waste management is carried out in such a manner so as not to adversely impact on human health or the environment*”. The Strategy must address infrastructure requirements, and should include the concepts of waste minimization, recycling, recovery, reclamation and reuse. Simply put, these concepts seek to consider waste as a potential resource wherever possible.

- A Used Oil management scheme must be prepared in consultation with importers and distributors. In this report, this scheme is termed a National Used Oil Strategy.**

Part of the Strategy is a scheme for the establishment of a Used Oil management system that provides for the environmentally secure management of Used Oil in Saint Lucia. This scheme is to be developed in consultation with importers and distributors of oil

3.2.1.3 *Waste Oil Treatment and Disposal Facilities*

- The environmental impacts of waste transport, treatment and disposal facilities must be considered before approval is granted.**

The legislation sets up regulatory systems for the collection, treatment and disposal of waste, through the issue of licenses and permits. In this context, an Environmental Impact Assessment pre-evaluation is required before any waste management facility is established. This requirement applies “*whether or not the facility is solely for the purpose of waste management or partly to serve the purpose of waste management among a number of other purposes*”. This wording suggests that the use of waste oil as a supplementary fuel will also require an Environmental Impact Assessment Pre-evaluation.

Following the pre-evaluation, the applicant will be advised either that:

- a comprehensive Environmental Impact Assessment (EIA) is required, or that
- no further information is required.

Under the draft legislation, operators of industrial, commercial or institutional establishments are required to make their own arrangements for waste management, and must ensure that their wastes do not present a risk to human health, safety or the environment. Such an operator may either deliver the waste to an independent facility for treatment and disposal, or may construct and operate an on-site waste management facility. Such an on-site waste management facility requires approval by the Minister, but is expressly exempted from the requirement for Environmental Impact Assessment Pre-evaluation. Where local facilities are not available for the managing of hazardous waste, the operator must arrange for export to appropriate facilities.

In addition to the foregoing, under the draft legislation, the operators of existing or new garages, premises selling motor oil or petroleum products and Service Stations will be required to provide facilities and equipment for dealing with Used Oil. These on-site facilities will be limited to collection systems which will make this oil available to entities which burn used oil as a supplementary level. This is because of the relatively small quantities of Used Oil which will be generated at any one premise.

3.2.1.4 *Importation of Waste*

Waste importation is prohibited, with specific exceptions.

In the context of waste treatment and disposal facilities, it is important to note that the legislation includes a prohibition on the importation of waste. The exceptions are:

- certain ship-generated waste in accordance with the MARPOL Convention
- waste from aircraft where the waste was produced within 24 hours prior to landing; and
- material other than hazardous waste which is imported for any manufacturing process.

This prohibition precludes the construction of Used Oil treatment and disposal facilities to serve several OECS Countries, and also precludes the importation of waste to improve the operating efficiencies of particular in-country facilities.

3.2.1.5 *Incentives*

Under the uniform legislation, the Minister responsible for finance is empowered to make regulations to provide for the establishment of fiscal incentives and other inducements required to implement the National Waste Management Strategy. Because the Used Oil management system forms part of the overall Waste Management Strategy, such incentives may also be provided for Used Oil collection, treatment and disposal.

3.2.1.6 *Monitoring*

The uniform legislation envisages monitoring of waste collection treatment and disposal facilities. Two monitoring methods are discussed. If monitoring is done by an independent third party, the results must be provided both to the regulatory agency and to the owner of the facility. In addition, the regulatory agencies are empowered to undertake their own monitoring. In the draft legislation the regulatory agencies are the Ministry of Physical Development, Environmental and Housing and the Ministry of Health.

4.0 **PROPERTIES OF USED OIL**

Data obtained from the Statistics Department reveals that three types of used oil are imported into the island. During the course of this study, three types of Used Oil were identified:

- Used Lubricating Oils,
- Used Hydraulic Oils, and
- Used Specialty Oils.

The properties of these oils (both new and used) are discussed in this section. Special focus is placed on the properties that influence the type of treatment and disposal and the health and environmental consequences of disposal in each case.

4.1 **Lubricating Oils**

Lubricating oil is used to reduce wear and tear on machinery, and regular changes are therefore required. As a result, used lubricating oils comprise the greatest proportion of all Used Oils which are produced in Saint Lucia.

The additives which are blended into the various lubricants by manufacturers include the following:

- < Detergents,
- < Dispersants,
- < Thickeners,
- < Pour Point Depressants,
- < Antioxidants,
- < Friction Modifiers,

- < Anti-wear,
- < Corrosion and Rust Inhibitors, and
- < Antifoams.

Many of the additive compounds contain metals, are stable and do not readily degenerate. Hazardous constituents include barium, zinc, lead and aromatic organics. Zinc and phosphorus are anti-wear elements and help reduce friction and wear. Calcium, barium and magnesium are the detergents and dispersants. They effectively pick up wear and contaminant particles as they flow through the system, and then carry the particles off to the filter for removal from the engine.

4.1.1 Contaminants in Used Oil

The concentration of contaminants in Used Oil varies based on the original formulation of the oil and the machinery in which it was used. Test data for Used Oil from the West Indies was not available, but Zayed and Taweel (1994) and the British Petroleum website quoted typical concentrations of sulphur and metals in used automobile lubricating oil (in comparison to typical values in new oils), based on research in North America. This information is summarized in Table 2. Zayed and Taweel (1994) also listed organic compounds in Used Oil, at typical concentrations as shown in Table 3.

TABLE 2: SULPHUR AND METAL CONTAMINANTS IN USED OIL

Sources: Zayed and Taweel,1994 and BP website

Parameter	Used Automotive Lubricating Oil		Used Oil from Saint Lucia	New Automotive Lubricating Oil
	BP website	Zayed and Taweel	courtesy Saint Lucia Distillers Limited	Zayed and Taweel
Sulphur (wt %)		0.43		2.15
Arsenic (ppm)		5	0.35	0.5
Barium (ppm)		48		3
Cadmium (ppm)		3	0.06	0.5
Calcium (ppm)	1,500	1,850		48
Chromium (ppm)		7	0.05	3
Copper (ppm)		177		1
Iron (ppm)	330	1,025		120
Lead (ppm)		240*	1.65	3
Magnesium (ppm)		559		14
Phosphorus	550	1,250		-

(ppm)				
Silver (ppm)		1		0.3
Tin (ppm)		58		-
Zinc (ppm)	590	480		1

* this lead value is chosen from a range of 1983 data reported by Franklin Associates Ltd. (1985); the range is from 0 to 3,700 ppm (median of 150 ppm)

TABLE 3: SELECTED ORGANIC COMPOUNDS IN USED OIL

Source: Zayed and Taweel, 1994

Volatile Organic Contaminants	Concentration ($\mu\text{g/g}$)
1,1,1-Trichloroethane	800
Trichloroethylene	3,000
Tetrachloroethylene	110
Benzene	75
Toluene	2,800
Semi-volatile Organic Contaminants	Concentration ($\mu\text{g/g}$)
Phenol	11
2,4,6-Trichlorophenol	40
N-Nitrosodiphenylamine	116
Naphthalene	440
Phenanthrene/Anthracene	150
Pyrene	62
Benzo(a)pyrene	<10
Pesticide: 4,4-DDE	94
PCB (Arochlor)	34

The concentration of Polychlorinated biphenyls (PCBs) indicated above is fairly high and some degree of suspicion exists regarding this contaminant. PCBs are not naturally occurring compounds. They are very uncommon in Used Oil, unless it contains transformer oil or cooling oils. Even then, it would be found in Used Oil from certain countries since PCBs have been banned in most countries.

Similarly chlorinated organic compounds are not usually found in Used Oil, unless solvents have been mixed with the oil. This may occur if degreasers were mixed with oil slops. Chlorinated organics are also not naturally occurring compounds and are not a combustion product. The concentration provided in the table is therefore higher than expected.

4.2 Hydraulic Oils

Hydraulic oils are used to transmit forces in hydraulic equipment such as truck hoists, backhoes, forklifts, etc. Such oils are not changed as frequently as lubricating oils, so the volume of used hydraulic oil for disposal is relatively small. It should be noted that anti-wear and detergent additives are included in hydraulic oils, and these include the following metals:

TABLE 4: ANTI-WEAR AND DETERGENT ADDITIVES IN OIL

Element	Target Concentration in Hydraulic Oil (ppm)
Zinc	329.7
Phosphate	264.6
Sulphur	499.8
Calcium	30

4.3 Specialty Oils

The most prevalent specialty oil used in Saint Lucia is transformer oil, but small volumes of cutting oil may also be used in machine shops. Transformer oils are not changed regularly, so the volume of Used Oil for disposal is very small. For old transformers (manufactured prior to 1975), the possibility of PCBs in the transformer oil must be recognized. For this reason, it is prudent to exclude transformer oil from recycling, reuse or treatment efforts unless they have been tested to confirm that they are PCB-free. The major generators of transformer oil is the Saint Lucia Electricity Service Company. They have recognized the risk associated with these oils and have instituted mechanisms to ensure that the oil from this operation does not get treated as used oil for supplementary fuel. It is important however to ensure that this issue is recognized at oil collection points and among generators to prevent its occurrence.

5.0 MANAGEMENT OPTIONS

5.1 Disposal Options

In developing this strategy, five disposal options were initially considered:

- i. Return to Refinery,
- ii. Use as Supplementary Fuel,
- iii. Bioremediation,
- iv. Incineration, and
- v. Disposal at a Landfill.

The last three options were not pursued for the following reasons:

- The environmental and health concerns related to incineration of Used Oil are very similar to those associated with its use as a supplementary fuel. However, incineration does not recover any value from the Used Oil. Therefore, use as a supplementary fuel was considered to be preferable to incineration.
- Historically, disposal of Used Oil at landfills has resulted in significant environmental problems, most related to the migration of the oil from the landfill to surface or ground water bodies (see Section 2.3.5). While technology exists for “fixing” the oil before disposal, this is costly and does not recover any value from the Used Oil. Therefore,

other disposal methods were considered to be preferable.

- Bio remediation requires a large investment in equipment and land. Additionally it does not recover any value from the used oil which is a potential resources

This chapter begins with a discussion of Used Oil collection, and continues by providing information on the first two disposal options above. In each case, the approach is briefly described and operational, environmental and financial issues are discussed. The penultimate section compares the two disposal methods, and the final section makes concrete recommendations on the National used oil strategy.

5.2 Collection of Used Oil

5.2.1 *Description*



An effective in-country Used Oil collection system is a key component of the National Action Plan.

The collection of Used Oil is an integral part of any management strategy, and **there is** already some experience in Saint Lucia. Some larger single producers of Used Oil (power companies, commercial garages, etc) have already set up collection systems at their facilities. However what is required is the institution of a collection system for Used Oil from smaller producers

Collection systems will consist of up to two basic components:

- i. receiving facility close to the point of Used Oil generation,
- ii. transfer to a facility which utilizes used oil as a supplementary fuel.

Receiving facilities may be as simple as strategically placed 55-gallon drums, or may be more elaborate purpose-built tanks. In the draft waste management legislation, the operators of existing or new garages, premises selling motor oil or petroleum products, and Service Stations will be required to provide facilities and equipment for dealing with Used Oil. However in order to facilitate the development of this system special purpose-built containers have been procured for deployment at large generation point as well as at selected centers islandwide which will serve as collection points for small generators.

The Used Oil collected at the receiving facilities will be periodically collected by the users and transported to their establishments where it will be utilized as a supplementary fuel.

The contents of these containers will be pumped into a tanker truck for transport. In light of the limited volume of oil generated on island, it makes economic sense for the waste oil generators to devise a mechanism for the joint utilization of one truck.

5.2.2 Operational Issues



A significant public education campaign will be required to ensure the success of Used Oil collection in Saint Lucia.

The most significant operational issues related to Used Oil collection are:

- recognition of the need to collect Used Oil, and
- the need to avoid mixing other liquids in with the Used Oil.

In Saint Lucia a significant public education campaign will be required on both issues. As noted above there is a varying degree of sensitivity to the Used Oil disposal problem among generators. Many of the larger producers of Used Oil have recognized the problem and have instituted measures to manage it. In contrast, Used Oil disposal appears to be an invisible problem to many of the smaller producers and to the general public. This manifests itself in the fact that the return of Used Oil by the public to receiving locations is not very effective, even when there is no charge for the service. This suggests that a significant effort will be required to sensitize the public to this problem, and to obtain their cooperation in ensuring that the collection system functions effectively.

The second issue relates to the need to avoid placing other waste liquids into the Used Oil containers. Certain liquids can render the Used Oil unacceptable for use as a supplementary fuel. It will therefore be necessary to sensitize all producers of Used Oil to these potential problems, so that they will understand the need to avoid them. To this end a joint PR program by the SLSWMA/Supplier and users of used oil as a supplementary should be instituted. The SLSWMA as the entity with the legal mandate to devise a PR program on hazardous waste management will be required to take a lead role in this initiative.

5.2.3 *Environmental Issues*

The primary environmental concern related to Used Oil collection is the prevention of spills in handling and transportation. This can be achieved by a range of design and operating features including:

- Secondary containment around waste oil storage containers
- Availability of absorbent material for spill response at the locations where used oil is managed and also on transport vehicles
- Properly sealed trucks or tanker trucks for transport of Used Oil
- Established of licensing regime for the transportation of used oil.

5.2.4 *Policy and Regulatory Issues*

The uniform waste management legislation contains two provisions which are highly relevant to the collection of Used Oil in Saint Lucia:

- The national waste oil management scheme must be developed in consultation with the importers and distributors of lubricants.

- New servicing facilities must provide a collection tank for Used Oil

5.2.5 Financial Issues

Cost information on three capital cost items is presented below:

- i. Receiving Facilities,
- ii. Vacuum Trucks, and
- iii. Air quality monitoring facilities.

5.2.5.1 Receiving Facilities

The uniform legislation places the responsibility for providing these facilities on the operators of garages, premises selling motor oil or petroleum products and Service Stations. The actual cost will vary depending on the size and type of each individual facility. However the Saint Lucia Solid Waste Management Authority has already procured 40 waste oil storage containers for deployment islandwide to facilitate this collection system.

5.2.5.2 Vacuum Trucks

Given the relatively small annual volume of Used Oil that will be produced in Saint Lucia, it is likely that a single vacuum truck will suffice for the transport of Used Oil from the collection centres. The estimated cost of a vacuum truck (not including local taxes) is between \$US 60,000.00 to \$US 100,000.00. Second hand equipment may also be available at much lower costs (between \$US 10,000.00 to \$US 15,000.00). Dialogue with the companies who utilize used oil as a supplementary fuel indicated that one such truck exist on island and its importation was facilitated through incentives received by the GOSL in the form of duty free concession. They were also asked to dialogue on a mechanism through which they could share the use of the oil collected in the used oil storage containers through the use of the single truck. This will ensure that the island does not invest in excess capacity thus ensuring that the system is implemented at minimal cost to the stakeholders.

5.2.5.3 Air Quality Monitoring Equipment

As noted earlier there are concerns with respect to the monitoring of the quality of emissions emanating from facilities which utilize used oil as a supplementary fuel. As obtains today these companies import a large proportion of the oil which they burn from cruise ship whilst a significant proportion of the used oil generated on island is inadequately managed resulting in pollution which compromises health and the environment. It is therefore in the national interest to institute a system which will facilitate better utilization of the Used Oil generated on island.

Equipment currently being utilized to burn the used oil should be assessed to ascertain the extent to which it addresses environmental concerns and a plan of action be devised with clear timeframes to institute necessary improvement. The onus should be on the owners of these facilities to prove that their operations address the necessary environmental concerns. This issue has been brought to the attention of these persons who have articulated that it is an issue that they are prepared to address in tandem with the Sustainable Development and

Environment unit of the Ministry of Planning and the SLSWMA.

It will therefore be necessary for the relevant parties to discuss this concern and institute the required measures to ensure that this issue is adequately addressed. At which time the required monitoring equipment will be determined as well as a monitoring agency and regime devised.

5.2 Return to Refinery

- Returning Used Oil to a refinery harmonizes with the uniform waste management legislation, which encourages the recycling of waste products.**

The basic concept in this disposal option is that a significant portion of the Used Oil can be converted back into a useable hydrocarbon product.

5.3.1 *Approaches to Refining*

Three general approaches may be used:

- i. Reconditioning,
- ii. Slipstreaming, and
- iii. Re-refining.

5.3.1.1 *Reconditioning*

In reconditioning, the Used Oil is not restored to its original condition but simply prepared for a less demanding use. Consequently, the utility of the Used Oil is reduced after each reconditioning, and eventually the oil will reach a point where it cannot be used in any lubricating application. At that point, it is simply a waste which must be disposed utilizing another disposal method.

Reconditioning commonly requires fairly sophisticated equipment, which makes it uneconomical for situations where the volumes of Used Oil are small. In Saint Lucia reconditioning is unlikely to be viable for the reasons given above.

5.3.1.2 *Slipstreaming*

Slipstreaming involves the introduction of Used Oil into the crude feed of an oil refinery. The primary benefit of this method is that it is virtually independent of the quality of the Used Oil. Slipstreaming can be repeated indefinitely with little waste, and the method reduces crude oil demand by the volume of the recycled product. Used Oil delivered to the refinery sloop tank is slipstreamed. Clearly, though, this method depends on the availability of a refinery to accept the Used Oil. In Saint Lucia this will require transportation overseas to a refinery which comes at a considerable cost.

5.3.1.3 Re-Refining

Re-refining involves the treatment of Used Oil to remove impurities so that it can be used as base stock for new lubricating oil. This approach differs from slipstreaming in that it only produces lubricating oils and no other petroleum products. It differs from reconditioning in that it restores the Used Oil to its original condition and use. Like slipstreaming, re-refining extends the life of the oil resource indefinitely and thus conserves resources. In addition, the process is relatively insensitive to Used Oil quality, and hence requires little or no pre-treatment.

In general, in the Caribbean, Used Oil is not accepted directly by the refinery, but rather by a contractor who pre-treats the Used Oil before it is combined with other feedstock. This is done first by removing contaminants (mainly water and grit) from the Used Oil.

5.3.2 Operational Issues

The primary operational issues related to this option are:

- willingness of a refinery to accept the Used Oil,
- the need to avoid mixing other liquid wastes in with the Used Oil,
- water content of the Used Oil,
- the logistics of shipping the lube back to a refinery, and
- the cost of shipping and treatment of this material.

The other issue as discussed earlier is the fact that a potential resource of a supplementary fuel will be shipped out at an additional cost to the country.

5.3.2.1 Receiving Refinery

It has been confirmed that two refineries in the Caribbean Region presently accept Used Oil for refining:

- i. The Petroleum Refinery in Trinidad, and
- ii. The Refinery in St. Croix.

5.3.2.2 Water Content

During the discussions with waste oil users in Saint Lucia, SLSWMA received information of isolated instances of high water content in the Used Oil, especially at facilities which use common drainage systems for rain water and Used Oil. In one instance, water content as high as half the oil/water mixture was reported. Clearly, this has implications for the cost of shipping.

One practical approach to solving this problem is to remove free water at the central holding tank. Because the waste oil will be held in this tank over a significant period of time (several weeks or more between shipments), free water will migrate to the bottom of the tank and the oil will float over it. This will permit a simple gravity

draining of the water just before the Used Oil is transferred to the ship.

The simplest method of operation is to manually crack a low-level valve and allow the water to drain out. The discharge should be continuously observed, and the valve closed when a significant oil fraction is observed in the discharge. This method is used in some on-shore oilfield operations in Trinidad. This method requires that the free water be routed through an oil-water separator prior to discharge to surface drains, rivers or streams.

A number of the oil companies in the region already return Used Oil to refineries in vessels, which bring bulk petroleum-based fuels and lubricants to the various islands. Used Oil is often transported in the slop tanks of the vessels, so as to avoid contaminating the product compartments.

This method of shipping has a significant effect on cost as it significantly reduces the volume of used oil which can be transported. In addition, the method has implications for the reliance of governments on external organizations. The oil tankers which bring fuel and lubricants to Saint Lucia are owned by (or work for) the international oil companies. Therefore, if the Saint Lucia Used Oil Strategy relies on these tankers to return Used Oil to the refineries, it will also rely on the policies of these external organizations.

5.3.3 *Environmental Issues*

As with the collection of Used Oil, the environmental issues related to the return of Used Oil to a refinery center around the possibility of spills (in this case, spills at sea). The normal spill control features on oil tankers and commercial cargo vessels will serve to reduce the possibility of spills, and the normal oil spill response mechanisms will be brought into play in the event of a spill. If free water is drained from the collection tanks, though, there is also an issue of the quality (oil content) of that water. There exist no local standards in Saint Lucia for oil content in wastewater, but the Trinidad & Tobago Standard for Waste Water from Industry (TTS 547:1998) stipulates limits of 10 mg/l for discharges to inland surface waters, and a limit of 15 mg/l for discharges to coastal near shore waters. This limit is based on n-hexane extractable material (HEM). The Jamaican National Trade Effluent Standard (1995) stipulates a limit of 10 mg/L of Oil and Grease in Waste Water.

5.3.4 *Policy and Regulatory Issues*

Returning Used Oil to a refinery conforms with the intent of the uniform legislation, which encourages resource recovery. However, it has been noted that in the case of refining the resource recovery actually takes place outside of Saint Lucia. However, this approach also relies on the policies of the oil companies and the receiving countries. In the case of slip-streaming, the use of the slop tanks of tankers to return the Used Oil relies on the willingness of the oil companies to undertake this activity. Should the policies of these companies

change, this method of returning the Used Oil will no longer be available. Similarly, the countries in which the refineries are located must continue to accept Used Oil. Trinidad & Tobago's policy in this regard is somewhat ambiguous, and regulations may soon be written that will preclude the importation of hazardous waste (which includes Used Oil. If this occurs, then the refinery in Trinidad will no longer be available as a recipient of Used Oil.

5.3.5 Financial Issues

The financial issues related to return to the refinery are:

- Cost of Shipping,
- Cost of Acceptance at the Refinery, and
- Cost of Treating Free Water Drain-off.

5.3.5.1 Cost of Shipping

At the present time, shipment of Used Oil in tankers does not bear a direct cost. The tankers must return to the refineries after delivering their cargo of fuel or lubricants, so the Used Oil is simply taken aboard for the return leg. In the case of commercial shipping, commercial cargo rates would apply. This varies depending on the port of origin and the destination port. However, Oil Mop has quoted a standard price of \$US 2.00 per US gallon for transport of Used Oil from Saint Lucia to the refinery in Trinidad.

5.3.5.2 Cost of Acceptance

The cost of acceptance of Used Oil at refineries depends on whether the Used Oil is discharged to the refinery slop tank, or delivered to a contractor for pretreatment. There is no charge when the Used Oil is delivered into the refinery slop tank. Similarly, Oil Mop has indicated that it does not levy an acceptance charge for Used Oil at their facility, but they do charge for transport of the Used Oil as indicated above.

5.3.5.3 Cost of Treating Free Water Drain-off

If free water is drained off at the central collecting tank, an oil/water separator will be required to ensure that the final discharge quality is satisfactory. One such separator which has been used successfully in the West Indies is a Corrugated Plate Interceptor (CPI) separator. The price of such a unit will vary depending on its capacity, but a budget figure of \$US 12,500.00 to \$US 17,500.00 per unit is probably realistic in this application.

5.4 Use as Supplementary Fuel



Burning of Used Oil as a supplementary fuel harmonizes with the uniform waste management legislation, which encourages the reuse of waste products.

In this application, the Used Oil is burned as a supplementary fuel in boilers, furnaces or kilns. It recognizes the fact that waste oil has a significant calorific value. Zayed and Taweel (1994) indicated that Used Oil has a calorific value of about 38,000 kJ/kg, in contrast to a calorific value of 43,000 kJ/kg for new fuel. This is in harmony with the experience at Saint Lucia Distillers who reported that Used Oil consumption in their boilers is about 18.5 gallons per hour, in contrast to 16 gallons per hour for diesel fuel. One factor which appears to have a significant effect on the efficient burning of Used Oil is water content. This application also harmonizes with the draft waste management bill, which encourages recycling of waste products.

5.4.1 Operational Issues

The primary operational issues related to this option are:

- availability of facilities to burn the Used Oil,
- specialized Used Oil burners, and
- pretreatment of Used Oil.

5.4.2 Availability of Facilities

Saint Lucia has three (3) existing companies which have been utilizing used oil in boilers, furnaces or kilns in Saint Lucia.

CEHI (2000) estimated demand for Used Oil as a supplementary fuel in Saint Lucia as follows:

TABLE 5: ESTIMATED DEMAND FOR USED OIL

Industry	Actual Use (m ³)	Estimated Potential Demand (m ³)
Distillery	500	568
Linen Factory	197	413
Clay Products	136	545
TOTAL	833	1545

This suggests that, in Saint Lucia, all Used Oil generated on island can be disposed as supplementary fuel.

5.4.3 Pre-treatment of Used Oil

The most economical application of Used Oil as a supplementary fuel would involve no pretreatment. However, two problems may prevent this:

- i. water in the Used Oil will reduce its efficiency as a fuel, and may cause “blowbacks” in the burners if steam is generated; and
- ii. grit in the Used Oil will clog the jets of the burners, requiring more frequent

cleaning and servicing.

It can be said that both water content and grit content may constitute a problem with the burning of Used Oil as a supplementary fuel in Saint Lucia. The solution to this problem is to pre-treat the oil to remove a significant amount of the water and grit. One piece of equipment which is capable of this is a high-efficiency oil/water separator, many of which operate on the centrifugal principle.

5.4.4 *Environmental Issues*

- The major environmental issue associated with the burning of Used Oil as a supplementary fuel relates to air emissions.**

The major environmental issue associated with the burning of Used Oil as a supplementary fuel relates to the potential environmental and health effects of air emissions, and there are also spill concerns related to the transport and storage of Used Oil.

Lubricating oil contains varying concentrations of metals and aromatic compounds. According to Zayed and Taweel (1994), burning of Used Oils is quite effective in destroying aromatic compounds. However, metals are converted to oxides and emitted to the air. The concentration of these emissions, and hence their level of threat to health and the environment, depends on the concentration of these elements in the Used Oil, as well as dispersion characteristics in the area of emission.

In general, dispersion characteristics for air emissions in Saint Lucia are quite good. There is a relatively constant breeze in many locations, and thermal atmospheric inversions do not occur. As a result, it is very likely that Used Oil can be burned as supplementary fuel at many locations without significant adverse effects on human health or the environment. However this should be determined on a case-by-case basis.

A preliminary determination of the suitability of any particular Used Oil for burning may be evaluated by comparison with the limits specified by the US EPA:

TABLE 6: USEPA SPECIFICATIONS FOR USED BURNT FOR ENERGY RECOVERY

USEPA Specifications for Used Oil Burned for Energy Recovery			
Constituent	Allowable Level		Measured Values for Used Oil in Saint Lucia
Arsenic	5	ppm maximum	0.35
Cadmium	2	ppm maximum	0.06
Chromium	10	ppm maximum	0.05
Lead	100	ppm maximum	1.65
Total Halogens	4000	ppm maximum	not available

Flash Point	100	° F minimum	not available
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If the concentration of contaminants in Used Oil exceeds these levels, the oil should not be used as supplementary fuel. On the other hand, these limits should not be used as a “litmus test” for determining the suitability of Used Oil burning as a disposal option. In the case of Used Oil presently being burned as supplementary fuel by Saint Lucia Distillers Ltd., the concentrations of contaminants (see Table above) are significantly lower than the limits specified by the US EPA.

Consideration must also be given to the location of the facility relative to residences and sensitive ecosystems. The uniform waste management legislation provides for environmental assessment of the effects of waste treatment facilities, and it is recommended that this provision be used to require modeling of the emissions from Used Oil burning at proposed locations before permission is granted for such uses. The cost of a basic model suitable for this application ranges between US \$5,000 to US \$8,000.

Once a Used Oil Burning Facility has been approved, monitoring of its performance will be required. For practical reasons, the primary monitoring should focus on periodic testing of the Used Oil to verify that the constituents are not fundamentally different from that assumed during the initial modeling.

Direct monitoring of stack emissions is likely to prove difficult and expensive in light of the unavailability of suitable equipment within Saint Lucia. The monitoring program for each facility should form part of the initial approval as is provided for in the uniform legislation.

5.4.5 Policy and Regulatory Issues

Burning Used Oil as a supplementary fuel conforms to the spirit of the uniform legislation, which encourages resource recovery. Unlike the case of return to a refinery, the resource is recovered within Saint Lucia (as opposed to resource recovery outside the country). The uniform legislation also makes provision for assessing potential environmental impacts of waste disposal practices.

5.4.6 Financial Implications

The financial implications of burning Used Oil as a supplementary fuel are as follows:

- i. savings on fuel costs;
- ii. collection costs;
- iii. customs duties,
- iv. cost of pretreatment equipment; and
- v. cost of monitoring.

The first financial implication is a beneficial one. Used Oil which is burned replaces fuel, and thus represents a significant saving. As noted at the start of this section, the calorific value of Used Oil is a little lower than that of fuel, so the value of the Used Oil will be proportionately lower. Even allowing for this difference, though, significant cost savings can accrue to the industry which is burning the Used Oil. Another potential benefit is the possibility of an acceptance charge levied on the producer of the Used Oil. This is unlikely to be effective in the case of small producers, but may be accepted by larger producers and ships.

The cost of collecting Used Oil and bringing it to the industry for burning is the second financial implication of this method of disposal. In Saint Lucia, where several industries collect and burn Used Oil (see Section 2.3.3), an average cost of \$US 0.27 per gallon have been quoted for collection and transport of Used Oil.

The third financial implication of the burning of Used Oil as fuel relates to customs duties when Used Oil is acquired from ships. In Saint Lucia, some companies have been granted exemption from these duties and this practice should be encouraged in other countries.

The fourth financial implication relates to the purchase of a high-efficiency centrifugal oil/water separator to pre-treat the Used Oil. The only actual cost for such a unit available on this study was one acquired in Belize in 2000 (supplied, installed and commissioned) for approximately \$US 100,000. However, general brochure information suggests that such units can now be acquired at significantly lower prices (of the order of \$ US 25,000 to \$US 40,000).

The cost of monitoring will vary depending on the nature and frequency of the testing. However, information provided by the International Analytical Group regarding the cost of testing the Used Oil suggests that a single sample can be tested for the following parameters (in accordance with US EPA requirements): arsenic; cadmium; chromium; lead; volatile organic compounds; semi volatile organic compounds; and FL Petroleum Residual Organics at a cost of \$US 855.00.

5.4.7 Toxicants in the Used Oil

As with all treatment systems which rely on biological processes, bioremediation is vulnerable to the presence of toxicants in the material being treated. These toxicants may be part of the Used Oil itself, or may be introduced if other waste liquids are mixed in with the Used Oil. **The need to keep other waste liquids out of the Used Oil makes good economic sense.**

5.5 Comparison of Disposal Methods

Table 7 compares the two disposal methods discussed in this chapter: return to refinery and use as supplementary fuel.

TABLE 7: COMPARISON OF DISPOSAL METHODS

Issue	Return to Refinery	Supplementary Fuel
Resource Recovery	Oil becomes feedstock at refinery	Oil becomes fuel
Vulnerability to External Factors	Relies on the Policies of Oil Companies (for shipping) and the Receiving Countries (for availability of Oil Refinery)	None
Facility Requirement	Oil refinery to accept Used Oil	Industry (Distillery, Pottery/Ceramic/Textile Manufacturer or Asphalt Plant) with boiler, kiln or furnace.
Land Requirement	Not Applicable	Not Applicable
Limits on Use	Willingness of Refinery to accept Used Oil.	Willingness of Industry to accept Used Oil
Shipping and Treatment Fees	Approximately \$US 2.00/ gallon for shipping in ISO-certified containers for re-refining No direct cost for shipping in tankers for slipstreaming	Not Applicable
Operational Concerns	Presence of extraneous matter	Water content and grit
Pre-treatment	Not Applicable	Cyclonic treatment to remove water and grit
Environmental Concerns	Spills at Sea	Air Emissions (metal oxides)
Environmental Testing	Not Applicable	Testing of Used Oil for concentration of contaminants. Monitoring air emissions

During the discussions with key stakeholders which formed a part of developing this strategy there was reasonable consensus on the order of preference assigned to the methods:

1. Use as Supplementary Fuel
2. Return to Refinery

Table 7 also generally supports this order of preference. It is important to note, however, that neither the discussions nor the information in Table 7 fully explored the financial implications of these methods.

5.6 Backup Systems

In light of the relatively small volumes of Used Oil being produced in Saint Lucia and based on experience elsewhere in the Caribbean, it appears that a biopile, for example, can be designed and installed in a period of six months or less. Holding the Used Oil for such a period is well within the island's capability. Therefore, the investment in a backup system is not considered justifiable. Instead, should the need for a replacement system arise in Saint Lucia, the Used Oil can be held until that system is installed.

5.7 Oily Sludge

During the collection, handling and disposal of Used Oil, oily sludge and oil-contaminated soil will be produced. Sludges will accumulate in tank bottoms (for example), while contaminated soil will result from leaks and spills. Sludges and contaminated soil cannot be treated and disposed in the same way as Used Oil, and this section lists some basic approaches which may be used in treating and disposing of sludges and contaminated soil. These approaches include:

- Minimization of these Wastes,
- Secure Land filling,
- Adsorbent and Land filling, and
- Bioremediation.

The first approach to managing the problem of oily sludge and oil-contaminated soil is to minimize these wastes. This can be done by instituting proper "housekeeping" measures at the collection centres. Used Oil should not be allowed to stand in drums or tanks for a protracted period (several months), as this encourages biological degradation of the hydrocarbon and settlement of the heavier fraction (both of which increase the volume of sludge in the tank bottom). Similarly, measures to eliminate leaks and spills will reduce the volume of contaminated soil to be treated and disposed.

The measures described above will reduce but not entirely eliminate the volume of oily sludge and oil-contaminated soil which will be produced during the collection, treatment and disposal of Used Oil. The appropriate method of disposal of such waste will depend on the amount which is produced. As noted above, the disposal options to be considered include secure land filling, stabilizing and land filling, and bioremediation.

The new landfill at Deglos has been fitted with liners and under drain systems. As such, it may function as a secure landfill capable of receiving limited amounts of oily sludge and oil-contaminated soil. The final decision on this method will depend on the volume of such

waste to be disposed as huge volume increases the potential for leaching of oil within the landfill.

The second approach to treatment and disposal of oily sludge and oil-contaminated soil is the use of a proprietary product which would adsorb the hydrocarbon. These products greatly reduce the potential for leaching of the hydrocarbons, and they generally also enhance biological decomposition. Several such products are available in the region, many of which have shown good performance. In the context of Saint Lucia, the waste/adsorbent mixture can simply be placed in the landfill (even in the cover layer), and left to naturally decompose the hydrocarbons over time.

The final approach would be to construct a small biopile to treat the waste. Clearly, though, this approach would only be economically attractive if it is anticipated that there would be a fair volume of oily waste to be treated over a sustained period of time.

6 RECOMMENDED STRATEGY

- The recommended National Strategy for Used Oil Management in Saint Lucia is the burning of used oil as a supplementary fuel.**

This chapter begins by summarizing the need for and benefits of a Used Oil Strategy in Saint Lucia, and proceeds to make recommendations concerning:

- Policy and Regulatory framework,
- Collection of Used Oil In-Country,
- Treatment and Disposal of Used Oil,
- Financial Incentives,
- Public Education Campaign, and
- Long-Term Strategy.

6.1 Need and Benefits

The need for a Used Oil strategy in Saint Lucia was demonstrated by the problems associated with inappropriate disposal. These problems include soil and water contamination, fish kills, etc. Indeed, some producers of Used Oil have recognized the problems and have indicated their willingness to participate in a National Waste Oil Management Strategy.

The primary benefits of such a strategy to Saint Lucia may be summarized as follows:

- i. Reduction in the potential threat to Human Health,
- ii. Reduction in damage to the Environment,
- iii. Improved Quality of Life, and
- iv. Improved Competitiveness in the Tourism Sector.

6.2 Policy and Regulatory Framework

- The uniform waste management legislation generally addresses key issues relevant to this Used Oil strategy, but regulations are needed to give force to the National Action Plans.**

Saint Lucia is in the process of enacting waste management legislation based on a uniform model developed under the OECS Solid and Ship Generated Waste Management Project. The key issues relevant to this Used Oil strategy are: hazardous waste classification, control on the import of hazardous waste, the need for a waste oil management scheme (called a national action plan in this report), permitting of treatment and disposal facilities, financial incentives and monitoring.

The legislation provides the overall framework for the National Action Plan for Used Oil management scheme in Saint Lucia, but regulations will be required to give force to the specific requirements of a policy of no importation of hazardous waste (in which Used Oil is classified).

6.3 Collection of Used Oil In-Country

- The in-country Used Oil collection system should involve the key players: Governments, oil importers/ distributors, and large oil users.**

Without an effective in-country Used Oil collection system, no Used Oil management scheme can be effective. As stipulated in the uniform legislation, the collection of Used Oil within each country should be a collaborative effort between the Government through the Saint Lucia Solid Waste Management Authority and the suppliers/distributors of lubricating oils and the companies who utilize Used Oil as a supplementary fuel. In fact, the waste management legislation to be enacted will make this mandatory.

The system of transporting Used Oil from the collection centers to the facilities which utilize them for fuel should be the responsibility of these companies. This will necessitate the use of a vacuum truck which one of the companies already owns to transport it to the facility.

Notwithstanding the foregoing, large single-source producers of waste oil (such as power stations) must continue to bear the responsibility for transporting their own Used Oil to the treatment facility. The Used Oil collection system should include a manifest system for tracking Used Oil from the receiving centers to the factories tanks.

An integral part of any Used Oil strategy will be public education. Saint Lucia Solid Waste Management Authority will be required to take the lead in these efforts, and this is discussed further in Section 6.6, below.

The actions related to in-country Used Oil collection are summarized as follows:

TABLE 8: COMPARISON OF DISPOSAL METHODS

ACTION	BY	COST IMPLICATIONS
Provide receiving centres in communities.	Oil Suppliers/ Distributors /SLSWMA	Varies depending on the type of container for collection. SLSWMA will deploy 40 purpose built used oil containers
Equipment used to transport Used Oil to factories	Users of Oil as supplementary fuel	\$US 60,000 to \$US 100,000 for a vacuum truck.

The Saint Lucia Solid Waste Management Authority has already undertaken to procure forty waste oil storage containers which will be deployed island wide for use by generators.

6.4 Treatment and Disposal of Used Oil

- Return to Refinery and Use as Supplementary Fuel is all available for the treatment and disposal of Used Oil in Saint Lucia.**

6.4.1 Choice of Method

- The preferred option for the disposal of Used Oil is burning of oil as a Supplementary Fuel. However, significant environmental concerns were raised with regards to air emissions, and these must be addressed on a site-by-site basis. Pre-treatment of the Used Oil prior to burning seems to be a necessity for successful implementation. This method has been implemented on a small scale in Saint Lucia but requires improvements if it is not to compromise health and the environment.

Table 9 compares features of the two methods of treatment and disposal.

TABLE 9: SUMMARY OF KEY ISSUES ASSOCIATED WITH DISPOSAL METHODS

Issue	Return to Refinery	Supplementary Fuel
Resource Recovery	Oil becomes feedstock.	Oil becomes fuel
Vulnerability to External Factors	Relies on policies of Oil Companies and Governments of Countries of Oil Refineries.	None
Facility Requirement	Oil refinery to accept Used Oil	Industry with boiler, kiln or furnace.
Land Requirement	Not Applicable	Not Applicable
Limits on Use	Willingness of Refinery to accept Used Oil.	Willingness of Industry to accept Used Oil
Shipping and Treatment Fees	Approximately \$US 2.00/ gallon for shipping in ISO-certified containers for re-refining No direct cost for shipping in tankers for slipstreaming	Not Applicable
Operational Concerns	Presence of extraneous matter	Water content and grit
Pre-treatment	Not Applicable	Cyclonic treatment to remove water and grit
Environmental Concerns	Spills at Sea	Air Emissions (metal oxides)
Environmental Testing	Not Applicable	Testing of Used Oil, and monitoring air emissions

6.4.2 *Burning as Supplementary Fuel*



Burning Used Oil as a supplementary fuel requires prior analysis of potential environmental and health effects.

Burning Used Oil as a supplementary fuel recovers the calorific value of the Used Oil, and so harmonizes with the thrust toward resource recovery in the uniform legislation. This plan of action is to be developed as a private arrangement between the producers of Used Oil and the companies which will burn it. The role of the Saint Lucia Solid Waste Management Authority and other governmental or agencies should be purely regulatory.

6.2.4.1 Impact Assessment

Under the uniform waste management legislation, the conversion of a facility to burn Used Oil will require an analysis of the effects of such action. It is recommended that this analysis should focus on the dispersion of emissions downwind of the discharge point, and the concentrations of such emissions when they reach the nearest residences, workplaces, institutions or environmentally sensitive areas. There is limited capability in Saint Lucia to undertake such analyses, and it is therefore recommended that Saint Lucia could seek extra-regional funding to assist in this activity.

Another issue which arises with regard to assessment of potential impacts is the background levels of particular contaminants in the air. This is required for any modeling exercise, as the final concentration is the sum of the background concentration and the concentration which will arise from the proposed emission. Such background levels of air contaminants are not readily available in Saint Lucia. Again, it is recommended that expertise for collecting information on background concentrations of contaminants in the air be developed.

6.4.2.2 Pre-treatment

Pretreatment of Used Oil for burning should be the responsibility of the companies acquiring the oil. If a number of small operators wish to burn Used Oil, they may make arrangements among themselves for a central pretreatment unit. Conversely, a private sector operator may set up this facility on a commercial basis. In any event, if the burning of Used Oil is accepted as part of National Action Plan in Saint Lucia, consideration should be given to offering fiscal incentives to promote its viability. It is therefore seen that the introduction of an economic instrument which will encourage generators to return their oil to a collection centre should be considered in the future.

6.4.2.3 Monitoring

The limited availability of technical expertise and equipment in Saint Lucia will affect the capability of industries and governments to properly monitor the emissions from facilities which burn Used Oil. Saint Lucia should seek assistance in obtaining and or developing this expertise.

6.4.2.4 Summary

The actions related to the burning of Used Oil as supplementary fuel are summarized as follows:

ACTION	BY	COST IMPLICATIONS
Assist in developing expertise in Saint Lucia to model air emissions and collect background information so as to assess environmental impacts.	SLSWMA and Ministry of Planning.	\$US 8,000 to acquire a dispersion model.
Pre-treat Used Oil to remove water and grit.	Industries which will burn the Used Oil	\$US 40,000 to acquire a centrifugal separator.
Assist in developing expertise in Saint Lucia to monitor air emissions.	SLSWMA and Ministry of Planning	Varies depending on type of monitoring.
Consideration be given to the implementation of economic incentives to encourage the reuse of used oil.	SLSWMA/Ministry of Physical Development/ Ministry of Finance	Varies depending on the nature of the incentive proposed.

6.5 Financial Incentives

- Saint Lucia should consider the use of appropriate financial incentives to enhance the effectiveness of its National Action Plan for Used Oil Management.**

The Draft Waste Management Act suggests the use of appropriate financial incentives as a means of supporting Waste Management Strategies.

- Currently the Government of Saint Lucia exempt duty on Used Oil which is taken from ships for treatment.

Other incentives which may be considered:

- Tax exemptions on waste treatment and environment monitoring equipment are likely to be effective.
- Rebates on oil purchased if the used oil is returned

6.6 Public Education Campaign

It is recommended that a public information campaign be instituted for used oil recycling.

The target group for this initiative should include small generators of Used Oil, in particular. A phased approach is to be instituted targeting the collection centres first and then the general public in light of the existing large number of “do it yourself” persons who carry out oil changes on their vehicles.

To be effective, the campaign should be timed to coincide with the effective implementation of the national action plan. Specifically, the collection system should be in place when the campaign commences. Experience has shown that the campaign will lose credibility if it precedes the implementation of physical works, so that persons cannot immediately take the

actions suggested in the campaign.

6.7 Long-Term Strategy

6.7.1 Overview



In the long term, the Saint Lucia's Used Oil Strategy must be expanded to include measures to reduce Used Oil production.

The recommendations above are intended to address the Used Oil issue in the short and medium term. In the long term, however, the strategy will have to be expanded to include initiatives to reduce the production of Used Oil. Because electricity generation is a major single source of Used Oil in Saint Lucia, it offers opportunities for some reduction in Used Oil production.

Notwithstanding the foregoing, it must be recognized that Saint Lucia is a developing economy. As such, growth of electricity demand is inevitable as the needs of the population are increasingly met. Thus, any long-term strategy to reduce Used Oil production during electricity generation must acknowledge this natural increase in demand. In this context, two approaches are recommended for consideration: energy conservation at hotels and renewable energy.

6.7.2 Energy Conservation at Hotels

It is recommended that the Ministry of Planning should partner with the Saint Lucia Hotel and Tourism Association and the Caribbean Hotel Association to offer assistance to hotels in Saint Lucia in energy conservation. Hotels use significantly more energy on a per capita basis than residences, and some recent studies have shown that energy-saving devices can pay for themselves in the reduced cost of electricity. The first approach would therefore be to assemble information on the opportunities for energy saving in hotels, and the cost implications of implementing them. Once this information is available, it is likely that it will be useful for other industries as well.

6.7.3 Renewable Energy

Within Saint Lucia, there have been limited or no attempts to harness solar, wind and geothermal energy. The importance of energy conservation and the use of renewable energy has long been recognized by the government of Saint Lucia.

It is recommended that Government should continue to pursue such initiatives, especially since the cost efficiency of solar and wind energy devices appear to be improving due to continued research and development. Future initiatives may include demonstration projects on specific technologies for exploiting renewable energy, as well as the granting of financial incentives for the importation of equipment associated with the use of renewable energy.