SPREP PROE

Sustainable, transformative and resilient for a Blue Pacific

Vanuatu Feasibility study

Contract to conduct a feasibility study to develop a national used oil management plan for Samoa, Solomon Islands, Tonga and Vanuatu

Contract to Conduct a Feasibility Study and Develop a National Used Oil Management Plan for Samoa, Solomon Islands, Tonga and Vanuatu

Vanuatu Feasibility Study

December 2022

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Executive Summary

Pacific Island Countries and Territories (PICTs) are under increasing pressure from development and growing human population, and the social and economic pressures associated with this growth. Increased populations and urbanisation have led to increased product imports and waste generation. Much of the waste generated through these imported products cannot be economically managed due to issues of small and isolated populations; economic volatility; geographical isolation from large economies; limited institutional, financial, and human capacity; and inadequacy of infrastructure to capture and process waste materials. Poor waste management poses risks to the economies of PICTs, as most rely heavily on clean environments for agricultural activities and a vibrant tourism industry.

The overall work covered in this project is funded by the *Agence française de Développement* (AFD), referred to hereafter as "Committing to Sustainable Waste Actions in the Pacific (SWAP)", and it aims to improve sanitation, environmental, social, and economic conditions in Pacific Island countries and territories through proper waste management. This project focuses exclusively on used oil and four countries have been chosen to benefit, namely Samoa, Solomon Islands, Tonga and Vanuatu. The main outcome of the project is a National Used Oil Management Plan for each country.

Large volumes of used oil can potentially enter aquatic ecosystems in water runoff and ground percolation from urbanized areas. Once in the environment, oil hydrocarbons and associated metals may persist for years, with considerable harm to birds and animals. There are also major community health considerations around the fate of used oil due to its toxicity. Used oils typically contain a range of compounds that may have adverse impacts when released into the environment.

Used oil has been poorly managed in the Pacific in the past and is one of the priority environmental management issues for the region.

The project initially produced an Inception Report and an Analysis Report which mainly assessed used oil arisings and current management. This Feasibility Report now examines the findings to date and aims to presents the likely procedures, equipment, services and capacity-building needs necessary to meet the stated government and stakeholder needs within a draft national Used Oil Management Plan.

Background information is presented, including a summary of findings from the Analysis Report. Then an examination is made of best practice used oil management. A draft Used Oil Management Code of Practice is included as an Annex.

Options for managing used oil fall into the categories of local treatment and use, and export to other countries for recycling. A combination of these two options may also be viable. Both these options are examined in some detail, including an examination of potential local treatment technologies. If local refining is to be considered, then viable uses for the refined oil are needed. The promising NuFuels technology is examined, as is a typical treatment system provided by the Chinese company Yuneng. A pyrolysis proposal arising from the SPREP PACPLAN project is also discussed.

International used oil recycling options available in several countries are examined, and shipping services information is also provided. There is a focus on the need to comply with the transboundary movement requirements of the Basel and Waigani Conventions.

There is an upcoming Port Vila Used Oil Management Pilot Project also funded by AFD under the SWAP programme and this parallel work will considerably assist with the provision of effective used oil management. This project is also discussed, as are funding issues and education. One important means to directly fund an improved used oil management system is to establish an Advanced Disposal Fee (ADF) scheme that levies a uniform charge on imported lubricating oil.

The following recommendations are made for Used Oil Management in Vanuatu.

a. The first step is to establish a collection service and storage depot, using the funding provided for the SWAP Pilot Project, although this needs to be developed further. A budget of $US373,800 has been developed for this work.
b. Once the used oil is collected and safely stored, with an ongoing collection system, then the focus can turn to recycling the stored used oil.
c. The pilot study is only for Port Vila so once that is successfully underway, decisions will also need to be made regarding repeating such facilities and services elsewhere.
d. Public used oil collection points will also need to be established.
e. In the short term undertake a shipment, or multiple shipments, according to need, to clear existing stockpiles of used oil, thereby mitigating risks to the local environment. This may also end up being the long-term option. The existing stockpile may qualify for the Moana Taka shipping programme and this should be investigated.
f. Implement a pilot programme to address used oil management in remote communities using NuFuels units. The estimated cost for a ten-unit pilot, would be USD219,600.00.
g. Examine the feasibility of other local treatment options, including the PACPLAN Pyrolysis Unit and the Yuneng ZJC Series Unit.
h. Ensure the necessary training is carried out, including safe handling of used oil, based on the Used Oil Code of Practice
i. Improve government staffing levels to cope with the need to manage used oil effectively.
j. Carry out an education programme to use the public collection points and discourage the unsatisfactory disposal of used oil, including current uses for marking sports fields, treating timber, controlling dusty roads, and replacing chainsaw bar oil.
k. Set up the ADF system to assist in funding future used oil management. Some user-pay charges could also be implemented, as well as searching for some ongoing donor funding.
l. Successful implementation of the ADF System will require an improvement in the system for collecting information on the import of lubricating oil.
m. In the long term, increased use of solar power and other sustainable energy practices will reduce the production of used oil, and these should be encouraged. This would also be in keeping with the climate change goals of Vanuatu.

Abbreviations

ADF	Advanced Disposal Fee (Levee)
AFD	*Agence Française de Développement*
ARF	Advance Recycling Fee
BPS	Bluescope Pacific Steel
BV	Biosecurity Vanuatu
CBA	Cost Benefit Analysis
CEPA	Conservation and Environment Protection Authority (PNG)
CNG	Compressed natural gas
COP	Code of Practice
CSA	Chemical Safety Act
CSC	Container Safety Certification (plate)
DCIR	Department of Customs and Inland Revenue
DEPC	Department of Environmental Protection and Conservation
DFAT	Australian Department of Foreign Affairs and Trade
EPCA	Environmental Protection and Conservation Act
EPR	Extended Producer Responsibility
GDP	Gross Domestic Product
GEFPAS	Global Environment Facility - Pacific Alliance for Sustainability
GHS7	Globally Harmonised System Rev 7
IBC	Intermediate Bulk Containers
ISO	International Organisation for Standards
ISPM15	International Standards For Phytosanitary Measures No. 15
JICA	Japan International Cooperation Agency
LPG	Liquefied petroleum gas
MFAT	New Zealand Ministry of Foreign Affairs and Trade
MOH	Ministry of Health
MOU	Memorandum of Understanding
MRF	Material recovery facility
MTP	Moana Taka Partnership
NCPIP	National Chemicals Policy and Implementation Plan
NEPIP	National Environment Policy and Implementation Plan
NHWPIP	National Hazardous Waste Policy and Costed Implementation Plan
NIP	National Implementation Plan
NWMPCS	National Waste Management and Pollution Control Strategy
NZ	New Zealand
OES	Ocean Environmental Services
PACPLAN	Pacific Islands Regional Marine Spill Contingency Plan
PAHs	Polycyclic aromatic hydrocarbons
PCA	Pollution Control Act
PCBs	Polychlorinated biphenyls
PE	Pacific Energy
PFO	Processed Fuel Oil
PHA	Public Health Act
PICTs	Pacific Island Countries and Territories
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment
PPM	Part per million
RTC	Rural Training Centre

SAICM	Strategic Approach to International Chemicals Management (Programme)
SCL	Salters Cartage Limited (NZ)
SIAVRTC	Solomon Island Association of Vocational and Rural Training Centres
SPC	Sun Petrochem Corporation
SPREP	Secretariat for the Pacific Regional Environment Programme
SSP	Societé De Services Petroliers
SWAP	Sustainable Waste Actions in the Pacific
SWIRE	SWIRE Shipping
TEU	Twenty Foot Equivalent (Shipping Container)
TT	Tanktainer
TWM	Total Waste Management (PNG)
ULO	Used Lub Oil
UN	United Nations
UNDP	United Nations Development Programme
UNELCO	Union Electrique du Vanuatu Ltd
UNEP	United Nations Environment Programme
USEPA	United States Environmental Protection Agency
VUI	Vanuatu Utilities & Infrastructure Santo
WOPU	Waste oil processing unit
WMA	Waste Management Act
WPC	Waste Petroleum Combustion Ltd

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1.0 AFD Programme to Develop a Used Oil Management Plan

1.1 Project background

Pacific Island Countries and Territories (PICTs) are under increasing pressure from development and growing human population, and the social and economic pressures associated with this growth. Increased populations and urbanisation have led to increased product imports and waste generation. Much of the waste generated through these imported products cannot be economically managed due to issues of small and isolated populations; economic volatility; geographical isolation from large economies; limited institutional, financial, and human capacity; and inadequacy of infrastructure to capture and process waste materials. Poor waste management poses risks to the economies of PICTs, as most rely heavily on clean environments for agricultural activities and a vibrant tourism industry.

The overall work covered in this project is funded by the *Agence française de Développement* (AFD), referred to hereafter as "Committing to Sustainable Waste Actions in the Pacific (SWAP)", and it aims to improve sanitation, environmental, social, and economic conditions in Pacific Island countries and territories through proper waste management. To achieve this, the overall work focuses on three streams of wastes: used oil, marine debris, disaster wastes and an overarching issue on sustainable financing mechanisms. Eight countries and territories will benefit from this overall project which include Fiji, French Polynesia, New Caledonia, Samoa, Solomon Islands, Tonga, Vanuatu, and Wallis and Futuna.

This project focuses exclusively on used oil and four countries have been chosen to benefit, namely Samoa, Solomon Islands, Tonga and Vanuatu. The main outcome of the project is a National Used Oil Management Plan for each country. As part of this process, Araspring Ltd (New Zealand) in association with Going Troppo Consulting (Australia), Pacific Reef Savers (New Zealand) and POPs Environmental Consultants Ltd (New Zealand) were awarded a contract by SPREP/AFD to develop used oil management plans for Samoa, Solomon Islands, Tonga and Vanuatu in December 2021. This report focuses on the Vanuatu component of the work.

1.2 Used oil description

The United States Environmental Protection Agency (USEPA) and some other jurisdictions make a distinction between the terms "used oil" and "waste oil", with waste oil being the broader term encompassing oil with a wider level of contamination. In this report, however, they are treated as interchangeable terms. This is the approach taken by the Basel Convention Guidance document[1] and also the SPREP Used Oil Export and Import Guidance Document[2].

For the classification of hazardous waste under the Waigani[3] and Basel Conventions[4], the term "waste oil" is used, and this is taken to also mean "used oil".

For this report, "used oil" uses the definition in the Basel Guidance Document:

[1] "Basel Convention Technical Guidelines on Used Oil Re-refining or Other Re-uses of Previously Used Oil" UNEP 1997

[2] "Waste Assessment Guide for the Export and Import of Used Lubricants and Used Oil" SPREP 2015

[3] *Convention to ban the importation into Forum Island countries of hazardous and radioactive wastes and to control the transboundary movement and management of hazardous wastes within the south Pacific region* (1995).

[4] Basel Convention on the control of transboundary movements of hazardous wastes and their disposal and Annexes and Amendments (1998)

Used Oil includes any semi-solid or liquid product consisting totally or partially of mineral oil or synthesised hydrocarbons (synthetic oils), oily residues from tanks, oil-water mixtures, and emulsions. These may be produced from industrial and non-industrial sources where they have been used for lubrication, hydraulic movement, heat transfer, electrical insulation or other purposes and whose original characteristics have changed during use, thereby rendering them unsuitable for further use for the purpose for which they were originally intended.

Large volumes of used oil can potentially enter aquatic ecosystems in water runoff from urbanized areas. Typically, oil spilled on soil migrates downward by gravity into ground waters, and spreads laterally via capillary forces and soil heterogeneity. Once in the environment, oil hydrocarbons and associated metals may persist for years. Ingested oil may adversely impact the ability of animals to digest food and damage their intestinal tracts. Oil also reduces the insulating capacity of animal furs and the water repellency of bird feathers increasing morbidity and mortality due to exposure and eventual drowning.

There are also major community health considerations around the fate of used oil due to its toxicity. Used oils typically contain a range of compounds that may have adverse impacts when released into the environment. These compounds include polycyclic aromatic hydrocarbons (PAHs), heavy metals, additives and antioxidants, trace levels of chlorinated solvents, and polychlorinated biphenyls (PCBs). Exposure to these compounds can result in damage to the liver, kidneys, heart, lungs, and nervous system. Poly-aromatic hydrocarbons are also potent carcinogens. Oil concentrations as low as one part per million (ppm) can contaminate drinking water.

Used oil has been poorly managed in the Pacific in the past and is one of the priority environmental management issues for the region.

1.3 Project deliverables

The overall project deliverables are set out in Table 1 below:

Table 1: Project Deliverables

Deliverables	Task	Due Date
1. Inception Meeting	1.1 Participate in an initial meeting with the SWAP PMU organised by SPREP	Within two weeks of the project commencement on 10 January 2022
2. Inception Report	2.1 Host an Inception Workshop with National stakeholders 2.2 Undertake a detailed desktop review of existing legislation, policy, strategy and plans that address waste management, institutional frameworks, and other enabling frameworks relevant to waste management	Within 1 month following Inception meeting

Deliverables	Task	Due Date
3. Analysis Report	3.1 Undertake an analysis of used oil production and existing used oil collection, storage, treatment, disposal and export services 3.2 Analyse findings against government and stakeholder priorities	Within 2 months following approval of the Inception Report
4. Feasibility Study Report	**4.1** Development of a feasibility study based on all the information gathered and data obtained through the consultations, interviews, and investigations **4.2** Feasibility Study Presentation	Within 2 months following approval of the Analysis Report
5. Draft National Used Oil Management Plans	5.1 Compile all the gathered information to develop a Draft National Used Oil Management Plan 5.2 National Stakeholder Presentation	Within 2 months following approval of the Feasibility Study Report
6. National Used Oil Management Plans	6.1 Final national used Oil Management Plans	Within 1 month following approval of the Draft National Used Oil Management Plans

1.4 The Feasibility Report (This Report)

Under the terms of the contract, the Consultant is required to:

- Develop a Feasibility Report based on all the information gathered and data obtained through the consultations, interviews, and investigations reported previously in an Inception Report[5] and an Analysis Report[6].
- Present these findings on best practice national used oil management to Government and non-government Stakeholders.
- Provide a clear premise for the product and geographical scope and likely services necessary to meet the stated government and stakeholder needs within a draft national Used Oil Management Plan.

As per the contract, the Feasibility Study needs to address:

a) Products to be included in the Used Oil Management Plan
b) Sectors to be serviced by the Used Oil Management Plan
c) Recommendations for options on how to best deliver the Used Oil Management Plan and services
d) Identification and specifications of any equipment and materials required for the establishment of used oil collection, storage, treatment and disposal stations, including cost estimates.
e) Assessment of the capacity-building needs of government and the oil and waste industry to effect the implementation and operation of the proposed Used Oil Management Plan.
f) Identification of the system data capture and monitoring necessary to effectively manage service contracts, report to the community, and assist the country to report on its obligations under international conventions (monitoring system details, including any technological requirements, should be detailed).

[5]O'Grady and Mooney (2022). *Vanuatu Inception Report.* AFD/SPREP. 15pp.
[6]O'Grady and Mooney (2022). *Vanuatu Analysis Report.* AFD/SPREP. 48pp.

g) Provision of recommendations for national engagement and education of the oil / used oil sector and community to assist with the implementation and success of the National Used Oil Management Plan.

1.5 Assistance Provided

The writers hereby acknowledge and thank the Department of Environmental Protection and Conservation (DEPC) for their assistance with the scheduling of meetings and interviews with key stakeholders. Thanks also to all stakeholders interviewed for their time and information provided during interviews.

2.0 Key findings of the Vanuatu National Analysis Report

2.1 Vanuatu national background

The Republic of Vanuatu comprises of approximately 82 islands lying along the Pacific Ring of Fire in the south-west Pacific region. Its immediate neighbours include the Solomon Islands and New Caledonia, and Australia is the closest continent. The islands' topography varies from low coastal plains to rough, mountainous, and heavily forested interiors, with the highest peak rising to over 1,800 meters on the island of Espiritu Santo. The largest cities are the capital, Port Vila (Island of Efate), and Luganville (Espiritu Santo, the largest island). Coastal areas of most of the islands in Vanuatu are utilized for extensive developments, although smaller islands also have developments.

The two largest islands, Espiritu Santo (or Santo) and Malakula, account for nearly one-half of the total land area. They are volcanic, with sharp mountain peaks, plateaus, and lowlands. The larger islands of the remaining half also are volcanic but are overlaid with limestone formations; the smaller ones are coral and limestone. Geologically, Vanuatu is part of the Pacific Ring of Fire. Geologically young, the islands are mostly mountainous and volcanic with some raised reef islands and a few low coral islands and reefs. Earthquakes are frequent but usually very deep. Destructive tsunamis occur occasionally as the result of earthquakes. There are several active volcanoes in Vanuatu, including Yasur on the island of Tanna, one of the world's most accessible volcanoes, as well as several underwater ones. Volcanic activity is common with an ever-present danger of a major eruption, the last of which occurred in 1945.

The current population (2015) of Vanuatu is estimated at 272,45916, approximately 75% of which live in rural villages[7] Though small, the islands hold exceptional cultural and linguistic diversity. There are three official languages: English, French, and Bislama. Bislama is the only language that is understood and spoken by most of Vanuatu's population as a second language. In addition, 113 indigenous languages are still actively spoken in Vanuatu[8].

Vanuatu's economy is founded largely on agriculture and services. In addition, the Vanuatu government has maintained the country's pre-independence status as a tax haven and international financial centre. Based on GDP estimates at 2012 prices, agriculture, fishing, and forestry account for around 22.5% of output and 65% of the labour force, with crop production dominating.

Industry accounts for only around 9.5% of output and 5% of employment with the major contributors being construction, manufacturing, and electricity and water supply. The service sector accounts for nearly 68% of output and 30% of employment with the major contributors being public administration, retail trade, finance and insurance, transport, real estate, and accommodation and food services. The service sector relates primarily to tourism. Most residents live in rural areas and rely on agricultural production for their subsistence and for generating cash incomes.

7 Vanuatu National Statistics Office, 2014 Statistical Pocket Book
8 http://www.vanuatutourism.com/vanuatu/export/sites/VTO/en/culture/culture.html

About 75% of the population lives in rural areas, and 55% live on islands with no significant urban centres. Just under a quarter of the population lives in the two urban areas of Port Vila and Luganville, and these are the only two areas with any significant formal urban services.

2.2 Current national lubricant (oil) importation rates[9]

The following (Table 1 below) is the information obtained from Vanuatu Department of Customs and Inland Revenue (DCIR), regarding the import of lubricating oil and related products.

Table 1: Quantities of Hydrocarbon Products Imported into Vanuatu

HS Code	Item	Net Weight (kgs) 2019	Net Weight (kgs) 2020	Net Weight (kgs) 2021
27101211	Aviation Fuel	365,473	461,233	296,236
27101219	Petrol	13,574,827	11,330,882	15,519,973
27101220	Diesel	81,128,358	58,530,688	71,717,416
27101911	Jet Fuel	18,497,922	7,490,721	6,008,743
27101912	Kerosene	1,476	6,512	72,781
27101920	Grease	11,328	11,534	13,653
27101930	Lubricating Oil	627,377	528,213	637,606

2.3 Current used oil generation rates[10]

Very little useful information was obtained about the quantity of used oil generated in Vanuatu. The statistical information provided by the DCIR (Table 1 above) gave a figure of 637,606 kg lubricating oil imported in 2021. The 2013 Vanuatu used oil audit report[11] provided a "rule of thumb" that about 50% of lubricating oil added to engines ended up as used oil. Based on the 2021 figure, it could therefore be expected then that about 319,000 kg of used oil is generated per year.

There are other sources of used oil besides lubricating oil, such as hydraulic oil, heat transfer oil and a range of others as per Section 2.1 above. Some used oils also contain water, often as an emulsion that does not readily separate. These factors may add another 5% to the quantity of used oil, which would bring the figure up to around 335,000 kg.

[9] O'Grady and Mooney "Vanuatu Analysis Report" July 2022

[10] O'Grady and Mooney "Vanuatu Analysis Report" July 2022

[11] Consultancy for In-Country Used Oil Audit May 2013, Prepared for AFD/SPREP by Contract Environmental Ltd, P4

The figure for 2022 may be higher than that for 2021 with an increase in economic activity in the nearly post-covid environment. This may add another 10% going forward. This brings the quantity of used oil up to about 369,000 kg/year.

The density of lubricating oil (see Section 5.2.4 above) is about 0.825 kg/litre. It is likely that the density of used oil is higher due to heavier impurities, including water, so probably a figure of 0.85 kg/litre could be chosen. This means that the volumetric annual quantity of used oil generated in Vanuatu is about 435,000 litres per year.

By comparison, the 2014 Hydea Report[12] concluded that of the 750,000 litres of lubricating oils (their estimate that was unsupported) imported into Vanuatu annually in 2014, approximately 40% (compared with the 50% figure in the 2013 report) resulted in 300,000 litres per annum of used oil.

The average GDP growth rate for Vanuatu for the period 2015-2021 (World Bank[13]) has been 1.8% per year. If this is used to compare used oil generation in 2013 with 2022, the 2014 Hydea figure of 300,000 litres in 2013 would be equivalent to about 340,000 litres in 2022.

Given all the uncertainties above, the used oil generation per year could therefore be taken as being within the range of 340,000 – 440,000 litres per year. The Analysis Report advised that the Societé De Services Petroliers (SSP) is currently collecting about 60,000 litres per year as part of their take-back policy. That means that about **280,000 – 380,000 litres/year is being generated and not being managed properly**.

The above is summarized in Table 5 below.

Table 5: Used Oil Generation Calculation

Calculation Step	Lube Oil (kg)	Used Oil (kg)	Used Oil (litres)
DCIR Lube Oil Import Figure	637,606		
Used Oil based on 2013 Report 50% rule of thumb.		319,000	
Plus 5% to account for other used oil sources		335,000	
Plus 10% to account for increase in economic activity		369,000	
Conversion to litres at a density of 0.85 kg/l			435,000
2014 Hydea Report			300,000

[12] Used Oil Management Plan for SPREP, March 2014, Hydea
[13] https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=VU

Calculation Step	Lube Oil (kg)	Used Oil (kg)	Used Oil (litres)
Hydea figure adjusted for GDP Growth Rate of 1.8% per year to 2022			340,000
Estimate based on above calculations			340,000-440,000
Amount collected and managed properly by SSP			60,000
Probable quantity not being managed properly			**280,000-380,000**

2.4 Current used oil management practices

A small amount of used oil is being stored in an unsatisfactory way, awaiting a solution. It was hard to estimate the quantity stored locally but it was of the order or 10,000 -15,000 litres, held by numerous generators.

SSP have a satisfactory bunded 20,000 litre used oil storage tank at their terminal in Port Vila. This is the only large used oil storage facility in Vanuatu except for Ocean Environmental Services (OES). OES is storing an unknown amount of used oil recovered from a spill from the wrecked vessel "Solomons Trader" in the Solomon Islands and they are examining ways to process this recovered oil. As this OES used oil was imported separately from a once-off source, it is additional to and separated from the used oil arising from normal practices in Vanuatu.

Apart from the SSP and OES storage, used oil is stored in IBCs, drums and smaller containers, generally in un-bunded areas. It is estimated that about 15,000 litres of used oil are currently being stockpiled in this manner. SSP are currently sending the used oil they collect, to the copra plant in Santo, and in the past, they have exported used oil to various overseas destinations.

Advice was obtained from others, that SSP were at present only collecting back from generators, used oil above a certain volume, and were refusing pick-ups that did not meet this volume threshold.

This leaves a substantial discrepancy between the used oil generated, and the used oil know to be collected and stockpiled. This discrepancy may be as high as 360,000 litres per year.

It is known from interviews with numerous used oil generators that a large amount of used oil is collected from generators and used in various unsatisfactory practices, including:

- using used oil for dust control on roads and other locations,
- weed abatement and vegetation control,
- timber preservation by painting, staining or dipping,
- pest control or as a carrier fluid for agrichemicals (pesticides or herbicides),
- use as a marker, e.g. on playing fields,
- combustion in, for example, kerosene burners.

All these uses will result in used oil reaching the environment as a contaminant. It is also expected that significant amounts of used oil may just be disposed of directly to the environment in various unsatisfactory way, including direct disposal on the ground, or into watercourses, sewers or drainage systems.

Used oil may also be placed in rubbish bins to be collected as part of household waste, taken directly to the landfill for disposal, or burnt in open-air burning.

These practices, and other practices that were not specifically identified, will very likely result in

- contamination of the environment, ground and groundwater,
- migration to watercourses,
- contamination of air,
- negative impacts on humans, plants, animals or other organisms.

2.5 Environmental risks associated with current national practices

Used oil can potentially enter aquatic ecosystems in water runoff from urbanized areas if it is not contained. Once in the environment, oil hydrocarbons and associated metals may persist for years. Ingested oil may adversely impact the ability of animals to digest food and damage their intestinal tracts. Oil also reduces the insulating capacity of animal furs and the water repellence of bird feathers, increasing morbidity and mortality due to exposure and eventual drowning.

Used oils typically contain a range of compounds that may have adverse impacts when released into the environment. These compounds include polycyclic aromatic hydrocarbons (PAHs), heavy metals, additives and antioxidants, trace levels of chlorinated solvents, and polychlorinated biphenyls (PCBs). Human exposure to these compounds can result in damage to the liver, kidneys, heart, lungs and nervous system. Poly-aromatic hydrocarbons are also potent carcinogens. Furthermore, oil concentrations as low as one part per million (ppm) can contaminate drinking water.

3.0 Current Vanuatu Regulatory and Policy Environment

3.1 Relevant Legislation

3.1.1 Waste Management Act 2014

The Waste Management Act 2014 (WMA) commenced in June 2014 and provides for the protection of the environment by encouraging effective waste services and operations. It establishes specific responsibilities for identifying waste, collecting waste, disposing of waste, planning and reporting on waste management and managing hazardous waste. These responsibilities are shared between Department of Environmental Protection and Conservation (DEPC), municipal and provincial councils, the Ministry of Health (MOH) and Biosecurity Vanuatu (BV). Waste management responsibilities are assigned as follows in the Act (the Director is the Director of the DEPC):

The Department is responsible for implementing International Conventions and Treaties that relate to the management of hazardous waste;

- A waste management operator designated under section 19 is responsible for providing waste collection services to residential and commercial premises;
- A waste dump or a waste disposal site is to be managed by each relevant Municipal Council or Provincial Government Councillor, the MOH or BV;
- The collection and disposal of waste that cannot be managed by the normal waste collection services to residential and commercial premises, is to be undertaken in accordance with any requirements imposed by the Director;
- The MOH has the responsibility to collect and dispose of all medical waste and on the request of the Director, is to prepare and submit a report relating to any aspect of waste management under its responsibility; and
- BV has the function to collect and dispose of waste that is designated under any written law to be biosecurity waste and on the request of the Director, and to prepare and submit a report relating to any aspect of waste management under its responsibility.

3.1.2 Environmental Protection and Conservation Act 2011

The Environmental Protection and Conservation Act 2002 (EPCA) is the overarching environmental law of Vanuatu. It provides for the conservation, sustainable development and management of the environment and covers three main areas:

- **Administration –** Formally establishing the DEPC and outlining its roles and responsibilities.
- **Environmental Impact Assessment –** Providing a process for identifying and managing the impacts of a proposed project on the environment.
- **Biodiversity –** Recognising Community Conservation Areas and giving direction to communities considering registering their conservation areas at the national level; and providing for bioprospecting (research).

The Act originally started as the Environmental Management and Conservation Act in 2002 but its name was changed in 2011.

The Director of the DEPC is responsible for implementation of the provisions of the Act. Sections of the EPCA provide the Minister with the power to regulate (amongst other things) the environmental effects of importation and transportation of hazardous substances; pests and weeds; waste management; air and water pollution. These powers provide opportunities to strengthen the DEPC's

capacity to monitor the environment for industrial waste (including used oil), pollution, and other chemicals or biological agents in relation to management of pests and weeds.

3.1.3 Pollution Control Act 2013

The Pollution Control Act 2013 (PCA) commenced in June 2014 and aims to control the discharge and emission of pollution in Vanuatu. Importantly, the PCA creates a framework for DEPC to develop and introduce pollution standards and permit systems and allows the Department to take compliance action when pollution is occurring. This includes the regulation of used oil.

3.1.4 Public Health Act 1994

This Public Health Act 1994 (PHA) makes general provisions for public health, including through regulating waste management, sanitation, and prohibiting water pollution. Part 8 of the 2006 consolidation, in particular, dealt with sanitation and waste disposal, with specific provisions on littering and inappropriate waste disposal (ss 65, 66 and 72). Part 8 was substantially amended by the 2018 amending legislation and the provisions on littering repealed.

Many provisions now relate to sewage sanitation systems. More relevant are ss 73H, 73I and 73J on the provision of rubbish bins and interference with rubbish bins and tips.

Healthcare waste is not specifically identified in the legislation. Other provisions relating to inappropriate waste disposal and litter management now fall under the Waste Management Act 2014.

3.1.5 Luganville Municipal Council Used Oil By-Law

Luganville Municipal Council has drafted a 'Used Oil Management By-Law, No XX 2019 regulating the storage treatment and disposal of used oil, which is still waiting to be gazetted by the State Law Office.

3.2 Policy, Strategy and Planning Documents

3.2.1 National Waste Management and Pollution Control Strategy 2016 – 2020

The National Waste Management and Pollution Control Strategy 2016–2020 (NWMPCS) addresses, among other things, used oil as a waste stream and through the support of SPREP, studies have been completed looking at generation rates and current and potential recyclability. These statistics however are from 2013/2014. The strategy also sets a goal of 2018 for a used oil stewardship system to be established and enforced. Unfortunately, this is yet to be completed.

The goal of the strategy is an environmentally sustainable Vanuatu, in which all types of wastes generated are reduced, collected, reused, recycled and treated by environmentally sound technologies suited to local conditions and waste going to landfill is minimized to the lowest possible amount.

The strategy covers all sources of solid wastes (residential, commercial, institutional, industrial, disaster waste, medical waste, e-waste and scrap metal, and quarantine wastes), hazardous wastes (such as used oil) and liquid wastes (mainly pollutants discharge to water sources – treated wastewater discharges) and gaseous wastes (mainly emissions from vehicles and other air pollution sources of emission).

The following wastes are not covered in this strategy:

- Liquid wastes (such as raw sewage and septic sludge).
- Gaseous wastes
- Hazardous wastes (such as Persistent Organic Pollutants, POPs)

3.2.2 National Environmental Policy and Implementation Plan (2016-2030)

The National Environment Policy and Implementation Plan 2016–2030 (NEPIP) is an overarching policy for the sustainable conservation, development and management of the environment of Vanuatu.

Policy objectives include reduced waste and pollution through effective waste management and pollution control including the identification and development of chemical and waste storage and disposal facilities. This includes the storage and disposal of used oil.

3.2.3 Waste Management Plans

The Municipal and Provincial Waste Management Plans acknowledge used oil under the broader topic of Hazardous Waste but aside from Luganville Municipality's specific Used Oil By-law mentioned above there are no specific actions targeting this waste stream within the Plans.

3.2.4 Vanuatu National Implementation Plan for Persistent Organic Pollutants

The Vanuatu National Implementation Plan (NIP) for Persistent Organic Pollutants (POPs) was developed in 2021 in connection with the Stockholm Convention which provides an international regulation system for POPs. The 2021 NIP was an update on a previous NIP.

The 2021 NIP sets out two goals for used oil:

- In the Contaminated Sites Action Plan to 'Maintain and monitor used oil recycling activities and ensure regular shipment offshore of collected used oil for recycling'
- In the Public Awareness Information and Training Action Plan to 'Conduct regular awareness campaigns on used oil recycling'.

3.2.5 National Hazardous Waste Policy and Costed Implementation Plan (NHWPIP)

3.2.5.1 Background

This report was prepared for the DEPC as a parallel report to the National Chemicals Policy and Implementation Plan" (NCPIP). These reports, together, form the first part of a UNEP-funded Special Programme project for the Vanuatu "institutional strengthening of chemical management and their wastes".

The second part of the project has involved a review of existing legislation and the preparation of drafting instructions for new legislation. This work is almost complete and the draft instructions now need to be turned into legislation, followed by the implementation of the NCPIP and the NHWPIP.

The reforms proposed by the NCPIP are planned to be incorporated into a new Chemical Safety Act (CSA). The reforms posed by the NHWPIP are planned to be incorporated into amendments to the Waste Management Act 2014 (WMA).

Used Oil was seen by the NHWPIP as one hazardous waste stream among several, that all need to be managed in a unified way.

3.2.5.2 Common Hazardous Wastes in Vanuatu

Common hazardous wastes identified by the NHWPIP in Vanuatu that can be directly related to their chemical and chemical product origins are used oil, expired laboratory chemicals, Persistent Organic Pollutant (POPs) chemical wastes, solvent and paint waste, and a variety of industrial wastes, including acid and alkali waste, mercury wastes and chemicals that are no longer required, including expired and unwanted pesticides.

Examples of common hazardous wastes in Vanuatu that are indirectly related to their chemical and chemical product origins are used batteries, including lead-acid batteries, Ni-Cd batteries and lithium batteries, many varieties of e-waste, and plastic waste.

There is also medical waste and asbestos waste.

3.2.5.3 General Principles for Managing Hazardous Wastes

The NHWPIP concluded that the following general principles should govern the new system for managing hazardous wastes in Vanuatu:

a. Simplicity – A complicated system will not be used and all the effort will be wasted.
b. Usefulness – The system should be perceived as useful so that hazardous waste generators turn to it because it helps them.
c. Inclusiveness - All hazardous wastes should be managed by the system, except for radioactive wastes. Radioactive wastes are a special class of hazardous waste that require management under separate legislation.
d. Adherence to the waste hierarchy and promotion of cleaner production.
e. Environmental protection – hazardous wastes should be contained and not escape into the environment.

3.2.5.4 Overlaps with the NCPIP

There is considerable overlap with the arrangements proposed for managing hazardous wastes in the NHWPIP and with managing chemicals in the NCPIP and the proposed Chemical Safety Act. The following are important direct overlaps.

a. Hazardous wastes that are not contaminated and retain their identity as individual chemicals or products should be subject directly to the provisions of the Chemical Safety Act.
b. Hazardous wastes that are mixtures of chemicals or products, also need to be characterized and assigned Globally Harmonised System Rev 7 (GHS7) classifications and management requirements.
c. There should be a reliance on existing resource documents (such as Codes of Practice and Standards) available internationally.
d. A new Chemical Safety Information (CSI) website is proposed for hazardous substances and this website can also cover hazardous wastes.

3.2.5.5 Policy Features for Managing Hazardous Waste, including Used Oil

The following are new policy features that are proposed by the NHWPIP for managing hazardous wastes:

a. Ownership and responsibility concepts for waste need to be clarified including hazardous and non-hazardous waste. Ownership of waste is to be retained by the generator unless transferred under contract. Responsibility is borne by whoever has control at any particular time, and can be shared at any one time.

b. Assignment of waste as either low hazard, medium hazard or high hazard will be required. These terms are described in the NCPIP and are quite specific in terms of distinguishing the different levels of hazard.
c. Designated Waste Management Operators (DWMOs) (as defined in the WMA) are to characterize chemical wastes. Where wastes are a mixture of chemicals or products they are to be characterized, including assigning GHS7 classifications and management requirements. A guidance document will be prepared to assist DWMOs.
d. Contracting of Private Waste Operators to store and transport waste once it has been characterized by a DWMO in accordance with the waste characterization and the assigned GHS classification. This will include special secure storage areas for CSA medium hazard or CSA high hazard waste.
e. All exports of hazardous wastes are to be carried out in full accordance with the requirements of either the Basel Convention or Waigani Convention as appropriate.
f. There needs to be a duty imposed on waste generators and waste service providers to protect human health and the environment.
g. Special provisions are required for certain special classes of wastes, including e-wastes, used oil, asbestos wastes, old batteries and end-of-life vehicles. These requirements can be managed by Codes of Practice.
h. Product stewardship schemes are required for some waste streams e.g. used oil, e-waste, batteries and end-of-life vehicles.

3.2.5.6 Infrastructure Improvements

The NHWPIP proposed that some improvements in infrastructure will be required, including:

a. All hazardous wastes are to be managed (stored and transported) in accordance with the requirements pertaining to their GHS7 classifications.
b. Solid hazardous wastes with minor hazards (CSA low hazard) can be landfilled.
c. Liquid hazardous wastes with minor hazards (CSA low hazard) can be collected and discharged to suitable treatment systems, none of which currently exist. The facilities for the reception of liquid waste at the Bouffa landfill needs to be upgraded considerably.
d. Treatment of wastes is required for CSA medium hazard and CSA high hazard waste to bring them down to CSA low hazard or alternatively they will be exported for treatment and disposal. Therefore treatment, facilities will need to be established where that is a practical option.
e. Special secure storage areas are required for hazardous wastes awaiting export.

3.2.5.7 Additional Elements of the New System

The following further elements should be part of the overall approach:

a. The system should not place too much of a load on government officials as then inefficiencies and delays will occur, due to overwork.
b. The system should not impose too much cost on users as it will then be by-passed and evaded. It is logical to have user-pay charges but they should not be onerous.
c. There needs to be penalties and enforcement but emphasis should be placed on education and cooperation.
d. The legislation can be largely general and simple rather than prescriptive. Detailed and prescriptive information can be placed in support documents. This is an extension of the "simplicity" principle.
e. The new elements of the system will need to be phased in, probably over a two year period so everyone has time to learn, understand and assimilate the new ideas and requirements
f. Extensive training will be required.

3.2.5.8 Backup Support Matters

In addition to all the above, the following back-up matters will need to be attended to:

a. Special provisions are to be prepared by end of 2024 for the following waste streams, by way of Codes of Practice:
   - Used oil
   - Used batteries, including used lead-acid batteries (ULABs), Ni-Cd batteries and lithium batteries
   - E-Waste
   - Plastic waste
   - Asbestos waste
   - Medical waste
   - Expired laboratory chemicals
   - End of life vehicles
   - POPs chemical wastes
   - Mercury wastes
   - Other chemical waste besides POPs wastes
   - Solvent and paint waste
   - Industrial wastes, including acid and alkali waste, expired chemicals or chemicals that are no longer required.
   - Expired pesticides
b. A Code of Practice is also needed to explain the new management arrangements for generators, transporters and receivers of wastes.
c. Product stewardship schemes are to be developed for used oil, e-waste, batteries and end-of-life vehicles, by the end of 2024.
d. Legislative provisions will also be made to incorporate the Basel and Waigani Conventions into Vanuatu legislation.

4.0 Best practice used oil management

Used oil is a hazardous substance that poses a potential threat to both humans and the environment, and failure to manage it appropriately could endanger human health, environmental protection and may breach national regulations. Safe, best practice management of used oil can be categorised into five main areas - collection, transport, bulk storage, export, and recovery. More detailed information regarding the safe and effective management of used oil can be found in the "Draft Used Oil Code of Practice for Pacific Countries" in Annex 1.

4.1 Used oil collection

The effective collection and transport of used oils from the point of generation to end-use locations is essential if used oil is to be utilised or disposed of in an environmentally acceptable and safe way. Best practice used oil collection prevents contamination of the used oil and provides safe handling and efficient collection and transportation procedures for used oil.

4.1.1 Public used oil generators

For the collection of used oil from small volume (<60 Lts) generators to be effective, an appropriate number of public drop off points need to be available. These public collection sites safely aggregate and store used oil collected from small volume generators. Lubricant retailers should prominently display a sign advising customers of recommended recovery arrangements including the location of collection points for used oil. To mitigate any risk to the public or the environment, it is important that large quantities of used oil are not allowed to build up on-site. Regular used oil collections from the site should be arranged as often as is necessary.

4.1.2 Industrial and commercial used oil generators

Industrial and commercial operators (automotive repair workshops, industrial manufacturing operations and other commercial operators) must store or dispose of their used oil in a manner that is not detrimental to human health and the environment. Used oil must be:

- Collected and stored in dedicated facilities which are designed, labelled, and operated to minimise contamination and spillage.
- Used oil storage containers should be within a bunded enclosure that is not open to the rain.
- The used oil must be prevented from becoming contaminated with other substances such as petrol, diesel, solvents, agricultural chemicals, water, or engine coolants.
- If contamination with other substances does occur, the contaminated substance must be immediately treated as a hazardous waste that requires competent management.
- All staff must be trained in the correct procedures for the storage and handling of used oil, and of the need to keep used oil separate from other substances, especially flammable liquids.

4.2 Used oil transportation

Used oil transporters are those Parties who commercially collect used oil from one or more used oil generator or collection points and transport it to a used oil transfer or bulk storage facility. (This does not include domestic users of oil who transport small quantities (e.g. less than 60 Lts) of used oil from the point of generation to a collection site (Section 3.1.1)). Used oil must be collected and transported in a manner that is not detrimental to human health and the environment.

- All drivers must have the current driver's licence for the vehicle they are driving and appropriate used oil transportation training.
- All tank wagons used in the collection of used oil must comply with relevant national regulations for the transport of hazardous substances, including static electricity protection.
- Transported used oil must have a flash point greater than 60^0C (determined by a flash point test or vapour test at each collection point).
- Records must be kept for each site detailing the date and volume of used oil collected.
- Records must be kept of each shipment of used oil that is delivered to another used oil transporter, user or transfer facility.
- All tank wagons must carry a road tanker spill kit for cleaning up any minor spillage. If oil is accidentally discharged during collection and/or transportation, immediate action to protect human health and the environment must be taken.
- National Legislation and Regulations should provide a mechanism whereby any collection contactor must be licensed by the authorities and hold appropriate quality assurance and environmental certifications.
- Contractor(s) should be audited annually to ensure compliance with collection and transport procedures and proper documentation.

4.3 Used oil bulk storage

4.3.1 Bulk used oil storage

A used oil bulk storage facility is defined as any facility at a site that receives, and aggregates used oil from used oil transporters for subsequent additional transportation. Typically, a bulk storage facility is likely to receive used oil from used oil transporters in large volumes. Best practice requires that owners and operators of used oil bulk storage facilities must:

- Hold current consents to operate such facilities.
- Maintain and operate them in accordance with these consents.
- Comply with all relevant requirements of the relevant legislation.
- Ensure that used oil storage tanks must have some method to determine the volume of used oil in it.
- Ensure that all tank maintenance is to be recorded and the records kept for five years.
- Provide signage that notifies employees, emergency services and other people of the presence of hazardous substances.
- Have in place a detailed emergency response plan.
- Have available at least two dry powder fire extinguishers
- Have available a spill kit that is appropriate to manage the volume of used oil that will be stored on the site.

4.3.2 Bulk used oil spill containment system

Best practice requires that above ground stationary tanks of 1000L or more must have a secondary containment system (e.g. a bund wall) in which the used oil is contained if it escapes from the container or containers in which it is held.

- The used oil must be able to be recovered from the secondary containment system.
- The secondary containment system must have a capacity of at least 110% of the largest tank at the site.
- The containment (bund) floor and walls must be impervious.
- If the used oil storage area is not protected from rain by a roof, there must be a way or ensuring that rainwater does not build up in the bunded area

- When used, double skinned storage tanks avoid the need for bunding, provided they meet acceptable codes for such tanks.

4.3.3 Bulk used oil transfer operations

Best practice dictates that during loading and unloading of used oil at a used oil facility:
A staff member must attend at all times.

- Records of incoming oil by date, volume, source and flash point must be recorded.
- Employers and staff must be properly prepared to manage an oil spill and other emergency situations.
- Staff involved in oil transfer should wear appropriate personal protective equipment (PPE) that may include overalls, boots, gloves, and eye protection.

4.4 Used Oil Export

4.4.1 General Considerations

Responsible national management of used oil in Vanuatu will probably require collected bulk used oil to be exported from Vanuatu for reuse or recycling into the future. This will usually involve a commercial transaction, with the ownership of the used oil generally passing on to the collector (and then to the exporter/receiver). The responsibility for environmentally acceptable disposal practices also passes on to the collector and then the exporter/receiver. Prior to export, collected used oil is analysed to assess its suitability for export and reuse, before being treated in the appropriate manner to salvage whichever fuels, lubricants or metals are present in the mixture.

Used oil recovery is a best practice as it significantly minimises impact on the environment as it:

- Prevents waste oil from re-entering the local ecosystem and causing damage.
- The carbon footprint of recovered oil is significantly lower than crude oil.
- A new recycled product is created from the used oil.
- Every litre of recovered oil is a litre that does not have to be extracted as crude oil from the ground.

Recycling of bulk quantities of used oil from Pacific Island countries typically involves export of the bulk used oil in appropriate containment to an accredited and licenced used oil importer and recycler. Used oil export must comply with international Convention requirements.

4.4.2 Used oil export containment options

4.4.2.1 Preferred Containers

Used oil can be shipped offshore in various types of containment, the most common acceptable ones in use are:

- 20 Foot ISO Tanktainers;
- 205 litre UN rated drums; and
- 1,000 litre Intermediate Bulk Containers (IBCs).

Drums and IBCs are loaded into and transported in 20’ General Purpose shipping containers (TEUs).

Table 4 lists used oil containment and transport options.

Table 4. Used oil containment and transport options

Containment	Volume transported in one 20ft container equivalent (lts)	Cost to purchase (container load)	Cost to rent including cleaning costs (4 month round trip)	Risk factors
ISO Tanktainer	23,000	$US 35,000	$US 4,500	Built to carry large volumes of liquids
205 Lt Drums (80 per container)	16,000	$US 2,220		If container is packed correctly, this system will be unlikely to fail
IBCs (20 per container)	20,000	$US 1,000		Must be in excellent (new) condition for shipping used oil
Flexitanks				Generally considered unsuitable for transport of used oil. If used oil is de-watered and filtered it can be classified as re-refined oil and transported in flexitanks as product with no Basel or Waigani issues

4.4.2.2 ISO Tanks

An ISO Tank is a tank container which is built according to ISO standards (International Organisation for Standardisation). ISO tanks are designed to transport and store hazardous and non-hazardous liquids. They offer a safe and cost-efficient method for transporting used oil. ISO tanks offer the advantage of maximising the volume that can be transported (23,000 litres) in a 20' container footprint. A disadvantage is that if the unit is on hire for an extended term, it must be re-positioned for subsequent shipments, and as a result, the shipping cost is potentially doubled.

4.4.2.3 Drums

Drums used for shipping waste oil must be UN rated and carry the UN stamp. Closed head drums used for liquids are designated UN 1A1. Open head drums used for solids are designated UN 1A2. Drums are usually steel and must be in "as new" condition. Plastic drums may be acceptable if they have not been stored outdoors and subject to UV rays from sunlight which may cause deterioration of the plastic.

Wood pallets used for packing drums must carry the ISPM15 stamp[14]. ISPM 15 was developed to address the global spread of timber pests by regulating the movement of timber packing and dunnage used in international trade. ISPM 15 describes phytosanitary measures that have been used and are designed to reduce the risk of the introduction and/or spread of invasive species pests associated with timber packaging material.

4.4.2.4 IBCs

Intermediate Bulk containers (IBCs) (also known as IBC tank, IBC tote, IBC, or pallet tank) are industrial-grade containers engineered for the mass handling, transport, and storage of liquids, semi-solids, pastes, or solids. Intermediate bulk containers can be manufactured from various materials based on the requirements of the application or service the IBC will be used for. Traditional materials include high-density polyethylene. Rigid intermediate bulk containers are stackable, reusable containers with an integrated pallet base mount that provides forklift and/or pallet jack manoeuvrability. IBC tank capacities generally used are often 1,040 and 1,250 litres (275 and 330 US gal). Caged IBC totes are commonly used due to their low cost, wide compatibility, and versatility. If they are used for transporting used oil, they must be in "as new" condition and carry a registration

[14]https://www.mpi.govt.nz/export/timber-wood-products/using-wood-packaging-for-exports/requirements/country-ispm-15-requirements/

plate that indicates it is certified for transporting dangerous goods. The base of the IBC should be metal, wood bases are generally not suitable. The bottom valve of the IBC must be lockable in the closed position and be fitted with a blanking cap.

4.4.2.5 Flexitanks

Flexitanks are flexible bladders that are used inside 20' general purpose shipping containers to transport some liquids. As used oil is usually categorized as waste, shipping companies and liability insurers generally refuse to carry or provide liability cover for used oil shipped in flexitanks. This is not always the case but generally shipping used oil in flexitanks is not considered best practice.

4.4.2.6 Packing the shipping container

Where 20' general purpose shipping containers are used for the marine transport of used oil, the shipping container must have a valid CSC plate. This is the safety approval plate that contains the main details of the container. The details shown on a CSC plate are as prescribed by the Convention for Safe Containers (1972). Drums should be strapped and/or wrapped to secure them on pallets. Where IBCs are stacked two high the bottom frame of the upper IBC should be secured to the top of the lower IBC using strong cable ties, to prevent movement during shipment. The contents of the shipping container should be strapped or braced with timber to prevent movement during shipment. In particular, the front row of the cargo must be strapped or braced to ensure the cargo does not shift during shipment and put pressure on the doors of the container.

4.4.2.7 Labelling and placarding

Used oils should be classified under the Environmentally Hazardous Substance class as:

- UN Number: 3082
- Dangerous Goods Class: Class 9 (Miscellaneous dangerous substances and articles)
- Proper Shipping Name: Environmentally Hazardous Substance, Liquid, N.O.S. (Used Oil)
- Hazchem Code: 3Z (The HAZCHEM Emergency Action Code specifically designed to inform emergency services / fire brigades of actions required).

4.4.3 Used oil export Convention requirements

4.4.3.1 Classification of Used Oil for collection, transport and marine shipment

Used oil that has not been treated or processed is classified as waste. The SPREP Guidance document[15] states:

> *Annex I of both the Basel and Waigani Conventions lists broad categories of waste streams and waste constituents that may be regarded as potentially hazardous. Of these, used oil would fall into one or both of the following categories:*
>
> - ***Y8 Waste mineral oils unfit for their originally intended use***
> - ***Y9 Waste oils/water, hydrocarbons/water mixtures, emulsions***
>
> *A waste which falls under any of the Annex 1 categories is considered to be hazardous unless it can be shown not to possess or exhibit any of the hazardous characteristics (explosive, flammable, corrosive, toxic, etc.) which are listed in Annex II of both the conventions. Oils themselves are not especially toxic, but contaminants such as additives, breakdown products,*

[15] "Waste Assessment Guide for the Export and Import of Used Lubricants and Used Oil" SPREP 2015

and other substances which may have become mixed with the oils during use, can be much more so.

In addition, oils have the potential to cause environmental damage by virtue of their persistence and their ability to spread over large areas of land or water. Films or coverings of oil may reduce or prevent air from reaching life forms of all types within an area of land or sea, and can rapidly result in significant degradation of environmental quality in those media.

Therefore, used oil is likely to possess at least one or more of the following hazardous characteristics listed in Annex II:

H6.1 Poisonous (acute)
H11 Toxic (delayed or chronic)
H12 Ecotoxic

As a result of the above considerations, used oil should be regarded as a hazardous waste and is subject to the controls applied under both the Basel and Waigani Conventions.

Used oil that has been processed to the standard that it can be considered as usable fuel is no longer waste and is no longer subject to controls under the Basel and Waigani Conventions.

Authorities in the relevant countries (export, import and transit countries) should control the transboundary shipments of used oil to ensure that environmentally sound management of the used oil is achieved, there is compliance with national and international laws and regulations, and that where possible local management solutions are prioritized and implemented.

Used oil that is being exported under the Y8 or Y9 waste classifications should not have a flash point or it will need to be assigned the H3 "Flammable Liquids" classification.

Based on the New Zealand Code of Practice for Used Oil[16], used oil can be derived from any one of the substances in List A, or be a mixture of these substances. These substances have a flash point (closed cup) above 60^0C, which means they do not need ot be classified as H3.

List A

- Engine oil – typically includes crankcase oils from gasoline, diesel and LPG/CNG engines
- Brake fluid
- Gear oils
- Transmission fluids
- Hydraulic oils and fluids
- Compressor oils
- Refrigeration oils
- Industrial process oils
- Electrical insulating oil except oil likely to contain PCBs
- Neat metalworking fluids and oils (excluding chlorinated products) – these must not be diluted
- with water or any product from List B
- Heat transfer oils
- Machining oils

[16] "Management and Handling of Used Oil HSNOCOP63" New Zealand Environmental Protection Authority Nov 2013

- Ship's slops, bilge water, tank cleanings produced by vessels during normal shipboard operations
- Bottom clean-out waste from virgin fuel storage tanks, virgin fuel oil spill clean-ups, or other oil wastes that have not been used, providing the flash point of the material is greater than 60oC.

Oily wastes from sources in List A should not be mixed with any wastes from List B below. Many, although not all, of the products in List B will have a flash point (closed cup) below 60°C. Regardless of flash point, however, List B products must not be mixed with List A products and then disposed of as used oil.

List B

- Petroleum distillates used as solvents, such as turpentine, kerosene, parts washing solvents
- Petrol and/or diesel (including biofuels) – including mixtures from refuelling errors
- Antifreeze, radiator flushing, or other inhibitor packages (e.g. stabilising coolant additives (SCAs))
- Oils derived from animal or vegetable fats and oils – including those used as a lubricant
- Paint and paint brush washings
- Chlorinated oil or solvents
- Any virgin or used oil which may contain PCBs (> 5 mg/kg)
- Soluble cutting fluids

Small amounts of **some** List B products such as vegetable oils may not greatly change the actual properties of the List A products. However, mixing of List A and List B products is strongly discouraged as there is no guarantee that the resulting mixture would be suitable for used oil collection and future export under the Y8 or Y9 classifications.

As per Section 3.2 above, before used oil is picked up for transport, it must be demonstrated that the used oil has a flash point greater than 60^0C, and such a requirement will also ensure that all used oil is also suitable for export. The flashpoint can be determined by a flash point test or vapour test at each collection point. If the used oil generator is reputable, it may also be sufficient to receive an assurance from the generator that the used oil is free of contamination from any List B substances.

4.4.2.2 Transboundary protocols: The Basel and Waigani Conventions

An overview of the Basel and Waigani Conventions and the status of the Parties is detailed on the Basel Convention[17] and SPREP websites[18]. The Conventions aim to reduce hazardous waste generation and promote environmentally sound management of hazardous wastes, wherever the place of disposal. This is addressed through several general provisions requiring States to observe the fundamental principles of environmentally sound waste management (Basel Convention Article 4).

Hazardous wastes may not be exported to a State not party to the Basel Convention, or to a party having banned the import of hazardous wastes (Basel Convention Article 4). Parties may, however, enter into bilateral or multilateral agreements on hazardous waste management with other parties or with non-parties, provided that such agreements are "no less environmentally sound" than the Basel Convention (Basel Convention Article 11). In all cases where transboundary movement is not, in principle, prohibited, it may take place only if it represents an environmentally sound solution, if

[17]http://www.basel.int/default.aspx?tabid=4834
[18]https://www.sprep.org/convention-secretariat/waigani-convention

the principles of environmentally sound management and non-discrimination are observed and if it is carried out in accordance with the Convention's regulatory system.

The regulatory system is the cornerstone of the Basel and Waigani Conventions and is based on the concept of prior informed consent, it requires that, before an export may take place, the authorities of the State of export to notify the authorities of the prospective States of import and transit, providing them with detailed information on the intended movement.

The movement may only proceed when all States concerned have given their written consent (Basel Convention Articles 6 and 7). In the event of a transboundary movement of hazardous wastes having been carried out illegally, i.e. in contravention of the provisions of articles 6 and 7, or cannot be completed as foreseen, the Convention attributes responsibility to one or more of the States involved, and imposes the duty to ensure safe disposal, either by re-import into the State of generation or otherwise (Basel Convention Articles 8 and 9).

The **Basel Convention** on the Control of Transboundary Movements of Hazardous and their Disposal (the Basel Convention) is the broadest and most significant international treaty on hazardous and other wastes. Its objectives are to regulate international trade in hazardous waste and other wastes, to minimise their generation and transboundary movement, and to ensure their environmentally sound disposal. The Basel Convention was adopted in March 1989 and entered into force in May 1992. It is ratified by Vanuatu, with DEPC being the Competent Authority.

The **Waigani Convention** is modelled on the Basel Convention and constitutes the Pacific regional implementation of the international hazardous waste control regime. There are however some differences between the two conventions: the Waigani Convention also covers radioactive wastes; and its territorial coverage includes each Party's Exclusive Economic Zone (200 nautical miles) (rather than extending only to the outer boundary of each Party's territorial sea (12 nautical miles) as under the Basel Convention). The Waigani Convention bans the importation of Hazardous and Radioactive Wastes into Forum Island Countries and controls the Transboundary Movement and Management of Hazardous Wastes within the Pacific Region. The Waigani Convention entered into force in 2001. It is ratified by Vanuatu, with DEPC being the Competent Authority.

4.4.2.3 Role of Competent Authorities

All shipments of hazardous waste under the auspices of the Basel or Waigani Convention must have the prior written approval of the countries of export, import and any transit countries. The approvals are managed by DEPC, the Competent Authority for Vanuatu. Each Competent Authority shall *be responsible for the implementation of notification procedures for transboundary movement of hazardous wastes* in accordance with the text of the Convention.

4.4.2.4 Transboundary shipment permits

4.4.2.4.1 Notification & Movement Pages

Applications for approval to make used oil shipments under either the Basel or the Waigani Convention use a common format based on the Basel documentation format for applications for approval to make shipments. Instructions for completing the notification and movement pages for an application can be found on the Basel Convention website *"Revised notification and movement documents for the control of transboundary movement of hazardous wastes and instructions for completing these documents"*[19]. The validity of an approval is 12 months.

[19]http://www.basel.int/Portals/4/Basel%20Convention/docs/techmatters/forms-notif-mov/vCOP8.pdf

4.4.2.4.2 Contract & transfer of ownership and responsibility

The existence of a valid contract between the exporter and the disposer is required. The point at which the responsibility and ownership of the waste transfers from the exporter to the disposer must be clearly stated in the contract. If an authorized transboundary movement of waste cannot be completed in accordance with the terms of the contract or the convention, the waste is to be returned to the exporter. Alternatively, the importer may, with the agreement of the concerned Parties, arrange for another suitable disposal facility in the import country to manage the environmentally sound management of the shipment.

4.4.2.4.3 Insurance requirements

The Basel and Waigani Conventions require that for any transboundary movement of hazardous wastes there shall be an adequate public liability insurance, bond or other guarantee as may be required by the exporting, importing and any transit Parties. The insurance cover must be appropriate for the type of waste and the amount being shipped and must be sufficient to cover any incident including personal injury or damage to property, and the cost of remedying all contamination, spillage or pollution caused by a sudden, accidental event. Reference can be made to the guidelines for importing hazardous waste into New Zealand for further details on insurance requirements for transboundary shipments[20].

4.4.2.4.4 Shipping pre-requisites

The Conventions require that the Competent Authority of the export country shall not allow a transboundary movement until it has received written consent for the shipment from the import country and all other concerned transit countries. The shipping company may also impose other controls on the waste substances it may accept for shipment and for the packing of the waste. For example, most shippers will not accept used oil in flexi-tanks.

4.4.2.4.5 Environmentally Sound Disposal

Competent Authorities are required to ensure that transboundary shipments are destined for facilities that provide for environmentally sound management of the waste. Parties are required to ensure the availability of treatment and disposal facilities for the environmentally sound management of hazardous wastes, which shall be located, to the extent practicable, within areas under its jurisdiction, considering social, technological, and economic considerations. However, where Parties are for geographic, social or economic reasons, unable to treat or dispose of hazardous waste safely within those areas, co-operation should take place between Parties to facilitate the availability of adequate treatment and disposal facilities and to improve and achieve the environmentally sound management of hazardous wastes.

4.4.2.4.6 Basel/Waigani Movement document procedures

Movement pages must be completed and sent to the Competent Authorities of all concerned countries before a shipment can commence. Instructions for completing the movement page for a shipment can be found in the text for the Waigani Convention Annex VI A[21]. The following documents are required for transboundary shipments:

- Container packing lists;
- Dangerous goods declaration;
- Valid notification and completed movement document;

[20]https://www.epa.govt.nz/assets/Uploads/Documents/Hazardous-Substances/Guidance/2e44f5838c/Importing-hazardous-waste-into-New-Zealand.

[21]https://www.informea.org/en/treaties/waigani-convention/text

- Transit port approvals; and
- Bill(s) of Lading.

5.0 Options for disposal of bulk used oil

5.1 National used oil recycling options

5.1.1 Overview of Available Technologies

There are logistical and financial barriers to implementing waste management technologies on small island nations. Current practices often require wastes to be exported for processing overseas, which can be associated with high upfront costs. Additionally, there are potential benefits from on-island processing of waste, including job opportunities and revenue from recovered products that are lost.

Several potential options to reuse used oil locally are available,[22] but most are not relevant for uptake in Vanuatu (Table 5).

Table 5. Potential used oil reuse options

Processing Option	End product	Suitability for Vanuatu
Local reuse	Used lubricant reused for other mechanical purposes	Used oil widely reused in the construction industry and for use in small hand tools such as chainsaws (Section 2.4)
Controlled incineration	Heat or electricity generation	Unsuitable as requires pre-treatment of the used oil to remove contaminants[23]
NuFuel Pyrolysis	Collected liquid used for heating	NuFuel[24] prototype may have applicability in non-urban villages to help recycle plastic and to generate fuel to cook food
Regional or sub-regional Pyrolysis Hub	Usable Fuel	The PACPLAN Resilience Project is considering the purchase and establishment of a suitable Regional or Sub-regional Pyrolysis Plant to process marine spill and other oily waste.
Reprocessing	Blended with fuel oil	Impractical due to lack of end user
De-watering and Filtration	Re-refined oil suitable for generating process steam & heat	Being done by some companies
Activated clay treatment	Production of new lubricant base stock	Impractical due to high cost and small feedstock volumes

5.1.2 NuFuel Pyrolysis Process

This is an innovative system that converts plastic waste to produce fuel using low technology pyrolysis (the cracking of hydrocarbons in the absence of oxygen). It is being trialled in the Solomon Islands. Plastic waste is put into a closed chamber surrounded by a firebox which can be fuelled by wood. The system can also process biomass and tyres, used oil and plastics coated in aluminium.

The chamber is heated up and the hydrocarbons are cracked, thus producing a usable gas. Depending on the system design, the gases can be flared off directly for heat with a small amount going through a condenser and becoming liquid fuel. If more liquid fuel is wanted rather than mainly gas, then more liquid fuels can be produced.

Gas with a similar profile to LPG or natural gas is produced, together with a liquid fuel and a very small amount of solid fuel. The current two systems in the Solomon Islands produce about 20% gas in real time and 80% waxy liquid fuel which can be used in burners. The waxy liquid fuel while usable in burners is not easy to use in the oven that has been developed. Recent development work back in New Zealand now removes most of the wax and produces a 'runnier' liquid fuel which makes it

[22] MRA (2022). *Used Oil Management Technology Options report*. SPREP. 49pp.
[23] MRA (2022). *Used Oil Management Technology Options report*. SPREP. 49pp
[24] https://www.nufuels.biz/

easier to use in the oven and 'rocket' burner that have also been designed by Nufuels for the community.

The further development work since late 2019 has also resulted in the ability to produce 80% gas with the remainder a liquid fuel. This gives more flexibility to communities around what kind of energy they want. A flare burner has also been produced which can use the gas to temperatures of up to 800^0C. As these improvements are developed, they will be provided back to the communities who have systems. At present the gas is used virtually real time alongside but a simple storage system (under minimum pressure) can also be used. With simple adaptations to small petrol generators the gas can also be used to produce electricity.

Costing estimates to establish the NuFuels units is the Solomon Islands are presented in Table 6. Cost efficiencies are possible by fabricating some parts of the unit locally, and further cost efficiencies can be achievable by increasing the batch quantity of units manufactured (10+). Training and local liaison costs incurred in the Solomon Islands account for about 25-30% of total cost, thereby contributing to locally generated revenue.

Table 6. NuFuel Cost estimates

Cost Components	NZ single unit (USD)	NZ single unit (10 unit scale-up)(USD)	Vanuatu single unit (USD)
Build	13 750	10,670	13,440
Shipping costs from NZ	3,125	3,125	925
Total Build Cost	16,875	13,795	14,365
Total Package	25,500	21,310	21,960

A further description of the NuFuel Technology is described in Annex 2.

5.1.3 Regional/Sub-regional Pyrolysis system

The PACPLAN Maritime Spill Preparedness Improved Self-Reliance Programme 2022-25 (PACPLAN Resilience Project) funded by DFAT. For the six target countries (Papua New Guinea, Solomon Islands, Vanuatu, Nauru, Kiribati and Tuvalu), it is designed to deliver three outcomes[25]:

a) Lowering the risk of inadequate financial recovery and impact restitution, through international conventions and ratification through domestic law.
b) Lowering the risk of inadequate response outcomes, through reviewing national risk, plans and preparedness, and building regional and international cooperation, doctrine development, and training and exercises.
c) Building capability across all PACPLAN countries and the region, through improved and shared systems, improved training and development, improved strategic planning and governance, and a new multinational Pacific Ready Response Taskforce.

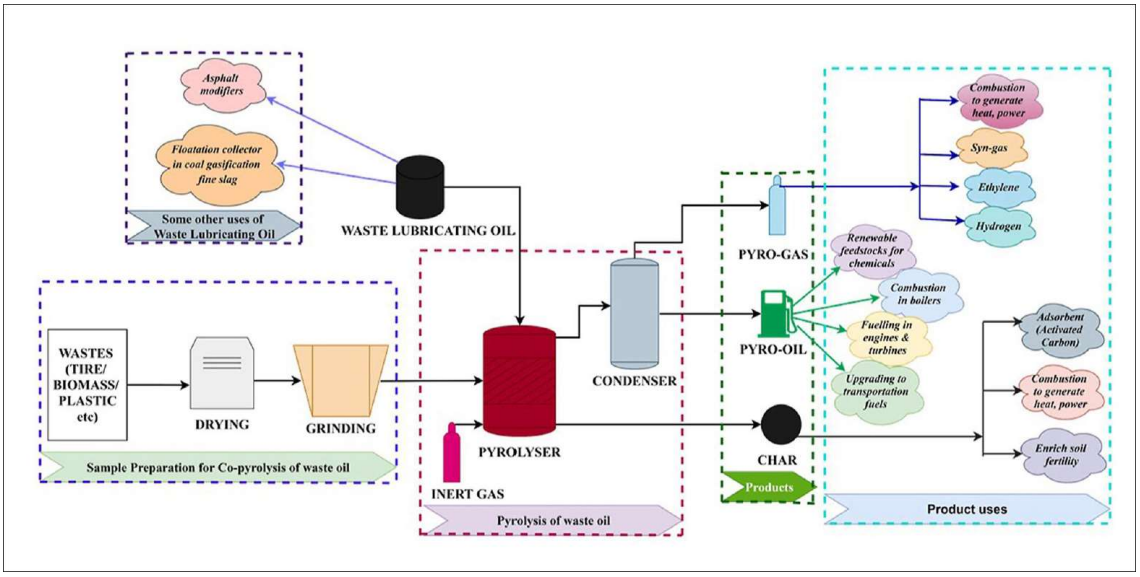
PACPLAN is the Pacific Islands Regional Marine Spill Contingency Plan (PACPLAN 2019), which is core to the success of this project. It is designed to promote and implement regional cooperation in prevention of, planning for and response to marine spills and maritime emergencies, including building capability and arrangements for regional and international assistance for pollution incidents.

[25] Pacific Regional Mechanism for Oil Spills. PACPLAN Resilience Project 2022-2025, Backgrounder (Paul Irving. Project Officer October 2022)

One important issue associated with managing oil spills is dealing with the waste oil that is collected from the spills. The PACPLAN Resilience Project has investigated the purchase of a Waste Oil Pyrolysis Plant and has looked at a number of such plants, including the Chinese "Beston" process[26]

Figure 1 below was supplied by SPREP

Figure 1 – Pyrolysis Plant Flow Diagram



PACPLAN are discussing the possibility of:

- Purchasing a suitable pyrolysis plant (or plants)
- Locating the plant (or plants) in a suitable central location, possibly Suva in Fiji.
- Using the plant to process oil collected from marine oil spills, as well as other stored used oil from around the Pacific.
- Using the processed fuel that is produced from the Pyrolyser as a supplementary fuel for ships. (SPREP is discussing this possibility with relevant Pacific Shipping Companies.)

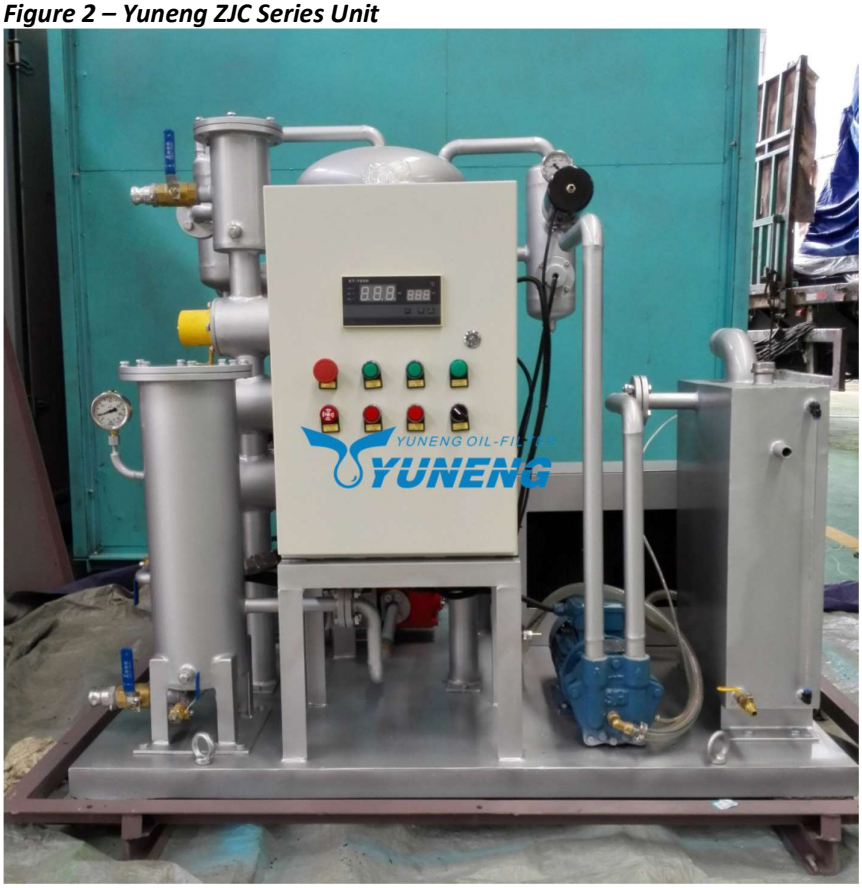
This initiative clearly has implications for the management of used oil in the Pacific.

5.1.4 Dewatering and filtering – The Yuneng Unit

The Yuneng ZJC Series Hydraulic Oil Filtration Machine (see Figure 2 below) is developed and sold by the ***Chongqing Yuneng Oil-Filter Manufacturing Co., Ltd*****, Chongping, China**, is used to quickly purify used oil by dehydrating any water, removing gas and mechanical impurities in the oil, removing the light acid and hydrocarbons by flashing, thus restoring the performance of hydraulic oil lube oil.[27] It is designed to process various industrial waste oils with the viscosity less than 320 mm^2/s, such as turbine oil, mechanical oil, hydraulic oil, compressor oil and refrigeration oil which have become contaminated by water infiltration, emulsification and mechanical particles during processing, transportation and application.

[26] Personal Communication, Paul Irving, SPREP
[27] https://www.yunengoilpurifier.com/zjc-series-hydraulic-oil-filtration-machine.html

Figure 2 – Yuneng ZJC Series Unit



The oil to be filtered is pumped through an internal electric heater and the heated oil passes through the strong magnetic filter, and the metal particles and large particle impurities are filtered or removed. Fine impurities are removed by second and third stage filters. The filtered oil is then demulsified, dehydrated and degassed in a flash tower prior to a final filtration step. The machine can process between 30-200 lts/min of used oil, depending on the plant model.

The quoted price for a 50 lts/min unit is US$ 9,500 ex-factory (July 2022). The parameters of a suitably sized unit, model ZJC3KY-GR, are presented in Table 7.

Table 7 – ZJC3KY-GR Hydraulic Oil Filter Specifications

Parameters	Model ZJC3KY-GR	Before Purification	After Purification
Flow Capacity	3,000L/H – 50L/M		
Viscosity		Up to 320 mm^2/Sec	
Water content		Up to 3,000ppm	Less than 50ppm
Filter Capacity			Less than 3 micron
Heating Power	30KW		
Total Power	33.5KW 3Phase		

Some key features of the plant are advertised as follows:

- High-efficiency filtration,
- Convenient portability for moving and operation.
- Vacuum-segregating chamber
- Photoelectric control technology to manage the liquid level sensitively.

- Over-pressure protection device
- Electric interlocking protection to reduce operating error.
- The vacuum oil filter pump is low noise and durable.

This plant is typical of quite a large number available on the market that would provide efficient treatment of used oil to allow it to be shipped as refined oil, thus avoiding the need for a transboundary permit.

5.1.5 Uptake of used oil not collected

As discussed in Section 2.4 above, a large amount of used oil is collected from various generators and used in various unsatisfactory practices, including:

- using used oil for dust control on roads and other locations
- weed abatement and vegetation control,
- timber preservation by painting, staining or dipping,
- pest control or as a carrier fluid for agrichemicals (pesticides or herbicides)
- use as a marker, e.g. on playing fields
- combustion in, for example, kerosene burners.

All these uses will result in used oil reaching the environment as a contaminant, and these practices should be discouraged, once a satisfactory system for managing used oil is in place.---

5.1.6 Local Recycling Plant

Section 2.3 of the Inception Report identified a key issue with in-country recycling of used oil. In-country processing is only viable if there is an end user who can take the refined product. Most diesel and other internal combustion engine manufacturers will not warrant their engines unless the correct fuels are used, and this means that refined used oil is generally limited to use for heating, such as in furnaces and steam boilers.

Therefore, although offshore disposal/recycling may not be regarded by some as best practice, the reality is that shipping to a facility that can recycle and re-use the end product may be most cost effective and sustainable option.

5.1.7 Industrial Users

There are some potential local reuse /disposal options available that may be satisfactory, including at the COPSL Copra plant in Santo and the OES facility.

The COPSL Copra plant has been taking used oil for their process from SSP for several years, although this was interrupted when the plant closed down during the Covid pandemic.

OES are planning to set up a used oil processing plant to provide processed oil to the local market, which would be more useful than unprocessed used oil.

There may also be other industries that could potentially use unprocessed used oil, but none were identified during the research and interviews for the Analysis Report.

5.2 International used oil recycling options (Export)

5.2.1 Regional overview

Improved management of used oil has been recognised as a regional pollution priority since the 1990s and has been a focus of hazardous waste management in the Pacific region for the last 10 years.[28] Used oil has been exported for recycling from Pacific Island countries to a range of destinations in the past. These destinations have included Fiji, Japan, Singapore, New Zealand, South Korea, Australia, and India.[29]

5.2.2 New Zealand

New Zealand is a proven option for recycling used oil from Pacific Island countries. Tonga, Samoa, Solomon Islands, Cook Islands, and Kiribati, among other Pacific Island countries, have exported used oil to New Zealand for recycling since 2010. New Zealand continues to be a viable export destination option for recycling used oil currently stockpiled in the Pacific region.

Salters Cartage Ltd (SCL) is a major company based in Auckland New Zealand that receives, and processes used oil and related hydrocarbon waste streams. Their main outlet for reuse of the used oil is the New Zealand Oji Fibre Solutions company, a producer of a range of kraft mill pulps for use in the manufacture of various papers, boards and specialty products. SCL has been receiving used oil from various Pacific countries for many years and are keen to continue and expand this source of used oil. SCL recycle most of the used oil generated in Tahiti, French Polynesia (1,000+ tonnes per year) and receive hydrocarbon liquids and sludges from New Caledonia (500+ tonnes per year). SCL receive not only used oil, but also used oil filters, plastic oil containers, oily rags, oily sludge, and hydrocarbon-contaminated soils. Filters are shredded and the component parts recycled, and plastic containers are washed, shredded and the plastic is recycled by a company[30] who manufacture environmentally friendly plastic fenceposts. SCL receives used oil in a variety of containers, drums, IBCs, pallets and ISO Tanktainers.

There are two other used oil recyclers based in Auckland:

- **Waste Management New Zealand Ltd**[31] operate a large hazardous waste management facility at East Tamaki in Auckland, and a used oil recycling plant located in Mt Maunganui. They also offer a viable option for recycling used oil from Pacific Island countries and import waste hydrocarbons from New Caledonia and French Polynesia for recycling and disposal.

- **Waste Petroleum Combustion Ltd**[32] (WPC) operate an oil recycling facility based at Pukekohe, south of Auckland. WPC's point of difference is that for used oil meeting certain specifications (usually from a single point generator) they may offer to take the used oil for no charge. WPC do not have a significant track record of imports from Pacific Island countries.

5.2.3 Fiji

Bluescope Pacific Steel (BPS)[33] collect and burn used oil in their steel processing plant in Suva. They have been proactive in the local Fiji market in collecting used oil for this purpose in the past and operate a professional collection and storage system. They have quite a large storage capacity, but it

[28]Haynes et al. (2018). *Desktop review of used oil management data*. SPREP. 21pp.
[29]Haynes et al. (2018). *Desktop review of used oil management data*. SPREP. 21pp.
[30]https://www.futurepost.co.nz/
[31]https://www.wastemanagement.co.nz/for-business/hazardous-waste/
[32]https://www.oilrecovery.co.nz/waste-oil-collection/
[33]Haynes et al (2018) Report # 2 Review of Oil Management Data, Section 6.3 Page 7 SPREP.

is not sufficient to take very large amounts of used oil. They have a limited capacity to manage sludge and they do not have a tank cleaning capacity. The local market keeps them well supplied to meet their used oil needs and their core business is steel making, not used oil. They are therefore not focussed on importing bulk quantities of used oil directly into Fiji from overseas countries. They do receive used oil from other countries indirectly if they have the capacity - for example from Pacific Energy shipments from other countries such as Tuvalu.

The BPS operation is sound and meets audit criteria for health, safety and environmental impact, with the possible exception of the air emissions, which BPS is working to address now. BPS may be willing to take part in plans to import used oil from other countries in the future but only as an indirect partner, and only if they have the capacity and resources to manage the used oil. As of August 2022, BlueScope have shut down their plant due to Covid and staffing issues.

5.2.4 Australia

Collecting and recycling used oil is a significant part of the waste sector in Australia, accounting for 5% of all national hazardous waste processing.[34] Accordingly, there is a substantial industry which collects and recycles used oil. The Australian Government provides industry incentives to increase the recycling of used motor oil through the Product Stewardship for Oil Program[35]. As used oil is a hazardous waste, its importation into Australia requires an import permit under the *Hazardous Waste (Regulation of Exports and Imports) Act 1989*. The fee for the 2022-2023 year is AUD$ 13,123. For a typical shipment of 16,000 litres in 80 drums, the fee adds AUD$ 0.82 cents per litre to the disposal cost, which is a significant cost factor.

The Port of Brisbane is serviced by vessels which call into ports in most Pacific Island countries. Used oil has been imported into Australia sporadically and only in small volumes in the past. In 2021, Total Waste Management (TWM) held a permit to import 2,000 tonnes of used oil from Papua New Guinea to Queensland Australia. There are no other current permits from Pacific Island countries to import used oil into Australia for recycling.

Cleanaway Waste Management Limited[36] is the largest used oil processor in Australia, processing over 150 million litres of used lubricating oil and oily water from over 35,000 workshops and businesses. Cleanaway operates two ISO certified waste oil refining facilities in Queensland and New South Wales. These facilities recycle used oil into new base oils and fuel oils. Fuel oil is used by Cement Australia's site at Gladstone in Queensland, and new base oils are sold in Australia and exported overseas. Used oil to be treated requires a laboratory analysis of the bulk waste prior to acceptance. Bulk oil suitable for recycling costs **$AUS0.43 per Lt** to be recycled by this company (excluding other charges). Other waste oil processors are operating in Queensland nd other parts of Australia and can provide a similar service to Cleanaway.

5.2.5 Papua New Guinea

Total Waste Management (TWM) operate a used oil management plant in Papua New Guinea. TWM are a PNG company located in the Roku/Porebada area of the Central Province, Papua New Guinea. TWM engage in processing of used oils at the company's Integrated Waste Management Facility, and also export materials for recycling. TWM operations are noted as being compliant with national laws and operating permit conditions together with maintaining third party facility accreditation that is a requirement of their tier one Clients. The company has had a significant number of Australian (Waigani) hazardous waste import permits (not confined to used oils) since 2016 for the transboundary movement of hazardous wastes (Basel Convention).

[34] https://www.dcceew.gov.au/sites/default/files/documents/hazardous-waste-in-australia-2021.pdf Appendix B14.
[35] www.oilrecycling.gov.au
[36] https://www.cleanaway.com.au/services/waste-oil/

TWM commenced construction of the Integrated Waste Management Facility (IWMF) at their Roku facility (head office) in 2018, the first locally commercially owned site of its kind in Papua New Guinea. The IWMF currently operates a high temperature incinerator; industrial wastewater treatment plant; hazardous waste storage facility and used oil processing unit. Through the design phase and about to commence construction is an engineered industrial landfill and material recovery facility (MRF).

Where capacity is not available at the Roku IWMF, TWM manage the export of materials to offshore consignees for sustainable treatment, disposal or recycling. TWM facilities are designed to meet US standards which operate under a Level 3 Environmental Operating Permit regulated by PNG's Conservation and Environment Protection Authority (CEPA). TWM is accredited to internationally recognised standards:

- ISO 9001 Quality Management
- ISO 14001 Environmental Management
- ISO 45001 OHS Management

The indicative cost to process used oil (per Lt/tanktainer and other) is PGK7.24 (~US$2.06) per litre.

Current annual acceptance of used oil is limited by storage availability in the on-site Dangerous Goods building. TWM hold Basel permits for exporting used oil to Australia, volume up to 2 million litres per year. Used oils are exported to Australia for processing after which the materials are generally accumulated and supplied to a third party as fuel (other than direct incineration) or other means to generate energy e.g. cement kilns. TWM also operate a portable unit that recycles waste oil into a Processed Fuel Oil (PFO) product using a 20ft containerised waste oil processing unit (WOPU) capable of recycling used oil products. Used oil products are fed into the WOPU unit which removes additives, solids and water to produce a clean PFO. The PFO is used as a fuel extender in boilers, kilns and incinerators. Used oil is processed at a rate of 1,000L per hour and under optimum operating conditions the WOPU will process 7,000L (35 drums) of used oil per day. TWM have been using PFO as fuel for the high temperature incinerator on site.

5.2.6 India

In a new initiative brokered by JICA, Sun Petrochem Corporation (SPC) have indicated a willingness to export all bulk used oil currently held in storage in Samoa for processing in India at no cost. Samoa will be responsible for the local costs involved (i.e. packing, loading, transportation of used oil from the storage facility to the wharf, custom documentation and Basel documentation, etc.). All used oil will need to be dewatered and transferred into new IBCs prior to shipment overseas. SPC are suggesting that the first shipment will be made before the end of 2022. to test the process for future shipments from other Pacific Islands, although the details have yet to be finalised.

SPC operate a large used oil processing plant in the southern Indian state of Tamil Nadu and receive used oil locally and also internationally through the Port of Chennai. They also operate in the Middle East through Dubai and have an office in Australia.

They are also involved in used oil collection in PNG and where they are expecting to export significant amounts of used oil. They are planning to set up a processing plant in PNG so they can course filter the oil and remove the water. This will enable them to categorise the oil as supplementary fuel and avoid the need to obtain a transboundary permit under the Basel Agreement.

The refined oil they produce in India is used in steel mills and other heavy industries, and as boiler fuel in a range of industries. It is also used as a fuel to melt bitumen for roadmaking.

The following points should be noted[37]:

- SPC will pick up used oil from a country if the volume exceeds 100,000 litres per shipment. They have no upper limit.
- SPC provide this service free of charge, and will continue to do so, provided the price of virgin oil remains high.
- They need the water removed and the oil filtered, at least to take out the grosser contaminants.
- The do not take sludge.
- They can pick up used oil in drums and IBC's, which need to be placed in shipping containers. They will also receive oil in isotanks, which is their preferred container.
- They also use flexitanks or plastic bladders, which are inserted into containers. They purchase the flexitanks from Infinity Logistics and Ventures Ltd (Infinity), Malaysia, a large international supplier of flexi-tanks. Where flexi-tanks are employed for used oil transport, SPC will provide training in their installation, and will supervise the installation and the loading of the flexitanks.
- SPC require suppliers of used oil to undertake at the supplier's cost, all the "in-country" work of packaging, transport to the wharf and documentation including those required to meet the Waigani and Basel Conventions, so the used oil is ready for shipment.
- Once the shipment is loaded on the vessel at the port of export, SPC take ownership and responsibility for the used oil.
- SPC also take out the necessary insurance cover. They pointed out that for flexi-tanks, Infinity provides their own insurance cover for $US7M.

According to the rules of SPREP and the Basel/Waigani Conventions, any export of used oil from a Pacific Island Country to India that has not been effectively treated, including dewatering and filtration processing, to bring it up to an approved standard for used oil derived fuel, would be an illegal shipment.

[37] Pers Com Mr Ramani, CEO Sun Petrochem Corporation

6.0 Used Oil Shipping Services

6.1 Pacific Carriers

Most Pacific Island countries are serviced by one or other of the shipping companies operating in the Pacific region – see Table 9 for the destination ports. Services are generally regular, but routes and port calls may change at short notice according to the marine trade requirements. Some services involve trans-shipment of containers from one vessel to another at an intermediate port between the export and import ports. Some services transit through intermediate ports where the container stays on the vessel. Transhipments and transits through intermediate ports must be included on Waigani transboundary permits, and when routes change during the validity of a permit, competent authorities of the export, import and transit countries must be informed.

Table 9 - Destination ports

Export location	Swire Shipping	NPDL	Matson	Sofrana ANL
Vanuatu	Auckland Brisbane Suva	Auckland Brisbane Suva	No Service	Auckland Brisbane Suva

6.2 Shipping Costs

Table 10 shows typical shipping costs ex Port Vila for the main shipping lines.

Table 8 – Costs per Shipping Company (Costs in USD)

Destination	NPDL		Swire		Sofrana ANL	
	TEU	ISOTank	TEU	ISOTank	TEU	ISOTank
Auckland	7700	5800	2050	2050	2150	2150
Brisbane	No Service	No Service	2000	2000	2210	2210
Suva	7800	8500	2700	2700	3200	3200

NB: Suva is via Auckland

6.3 Moana Taka Partnership

In March 2018, the China Navigation Company Ltd/Swire Shipping Agencies, and SPREP signed a Memorandum of Understanding (MOU)[38] to address critical waste management issues in the Pacific Islands under the Moana Taka Partnership (MTP) project. The Moana Taka Partnership enables Swire Shipping vessels to utilise empty shipping containers to transport non-commercial recyclable waste from Pacific Island countries.

[38]https://www.sprep.org/sites/default/files/documents/publications/moana-taka-partnership.pdf

Swire Shipping will provide free container hire and free shipment of eligible waste shipments between Swire Shipping serviced ports. The waste is transported to countries with appropriate waste disposal facilities, ensuring that everything from oil to plastics to aerosols are properly recycled. Swire can also carry eligible waste from a non-Swire shipping network port, if the Shipper can get it to a port serviced by Swire.

“Non-Commercial” waste cargoes are those that, without the assistance of the Moana Taka Partnership, would not have been shipped as the cost of container hire and shipping would be close to or greater than the value of the cargo. If a waste cargo has been shipped for profit in the previous two years it is regarded as “commercial” for the purpose of determining MTP eligibility. The referenced SPREP publication includes guidance for applicants on eligibility and the procedure to apply for a potential shipment. A shipment of used oil was made in 2018-2019 from RMI to New Zealand using the Moana Taka Partnership.

7.0 National Best Practice Issues

7.1 Vanuatu Used Oil Management Pilot Project

Vanuatu has been invited by SWAP to prepare a used oil management pilot project based on the collection and storage of used oil. This initiative has not yet been taken up by Vanuatu as they preferred to wait until this Feasibility Study was prepared.

The storage facility could be located at the Bouffa Landfill, but it is quite a long way out of Port Vila. Other options closer to Port Vila are being explored, including at the Port.

A concrete slab with a low bund wall would need to be constructed, say 24M x 16M with a low bund wall 0.5M high. It would be preferable for this structure to be covered as otherwise, rainwater would need to be pumped out regularly, probably with a pump operated by a float valve, and the pumped waste wastewater would need to go through an oil interceptor before discharge. The cost of a bunded slab that is covered by a roof is estimated to cost about $US120,000.

It would be sufficient to use polyethylene tanks for the pilot project. Six x $30M^3$ polyethylene tanks could be purchased from New Zealand (Big Water Tanks, Auckland) for $US2800 each, plus pipes, fittings, valves, and a pump suitable for used oil (plus backup), probably a mono pump. A total budget of $US40,000 would be sufficient, including freight and installation.

The collection tanks could be double-skinned plastic tanks that are left at generators' locations for pick-up when full. Advance Fluid Control in New Zealand specialise in use oil management, and they sell such tanks. Twenty 1000 litre waste oil double-skinned plastic tanks could be purchased from Advance Fluid Control Ltd to leave at numerous places. These tanks are $US2000 each. The total cost including freight to Vanuatu would be $US45000. They could initially be placed at the storage site.

The best way to drop off and pick up the collection tanks would be to use a small crane truck. The crane truck could pick up the double-skinned plastic tanks and also any IBCs that are currently being employed for storing used oil at the various generator locations. A PC sum of $60,000 including freight would cover a second-hand fully serviced crane truck.

It would also be useful to have a public drop-off centre at the storage location. For another $US12,500 ($US16,000 including freight) a ready-made public drop-off centre can be obtained from Advance Fluid Control.

The total cost, including necessary additional items, is shown in Table 9 below:

Table 9 - Cost to Establish Used Oil Pilot Project

Item	Cost (USD)
Storage facility construction:	120,000
Tanks, pumps, plumbing:	40,000
Collection tanks:	45,000
Crane truck:	60,000
Public drop-off centre:	16,000
Fire extinguishers (2 x Dry powder):	3000

Item	Cost (USD)
LEL Meters for detection of volatile contaminants (2)	2000
PPE	20000
Construction Supervision	20,000
Operation	20,000
Training	5000
Publicity	5000
Total	**356,000**
Contingency 5%	17800
Total plus contingency	**373,800**

7.2 Policy

The national policy documents relevant to best national practice are set out in Section 3.2 above. The key national documents are:

- National Waste Management and Pollution Control Strategy 2016 – 2020
- National Environmental Policy and Implementation Plan (2016-2030)
- Municipal and Provincial Waste Management Plans
- Vanuatu National Implementation Plan for Persistent Organic Pollutants
- National Hazardous Waste Policy and Costed Implementation Plan (NHWPIP)

7.3 Legislation and Regulation

The national legislation relevant to best national practice are set out in Section 3.1 above. The key national legislation is:

- Waste Management Act 2014
- Environmental Protection and Conservation Act 2011
- Pollution Control Act 2013
- Public Health Act 1994
- Luganville Municipal Council Used Oil By-Law

7.4 Regulatory Compliance

Interviews with key stakeholders during the Analysis phase of the project indicated that there are issues with compliance that are impacting negatively on compliance which in turn leads to poor used oil management practices. The biggest factor appears to be a shortage of skilled personnel to undertake monitoring and compliance activities.

Poor used oil management practices are more of an issue in the community, both in built up areas and in the provinces. Although individuals in the provinces are only taking small volumes for their own purposes and using poor management practices, collectively the volumes are significant. Interviews with key stakeholders indicate that the larger generators of used oil are generally making

positive efforts to manage their used oil. Their issue is the lack of a disposal service which is leading to the creation of stockpiles.

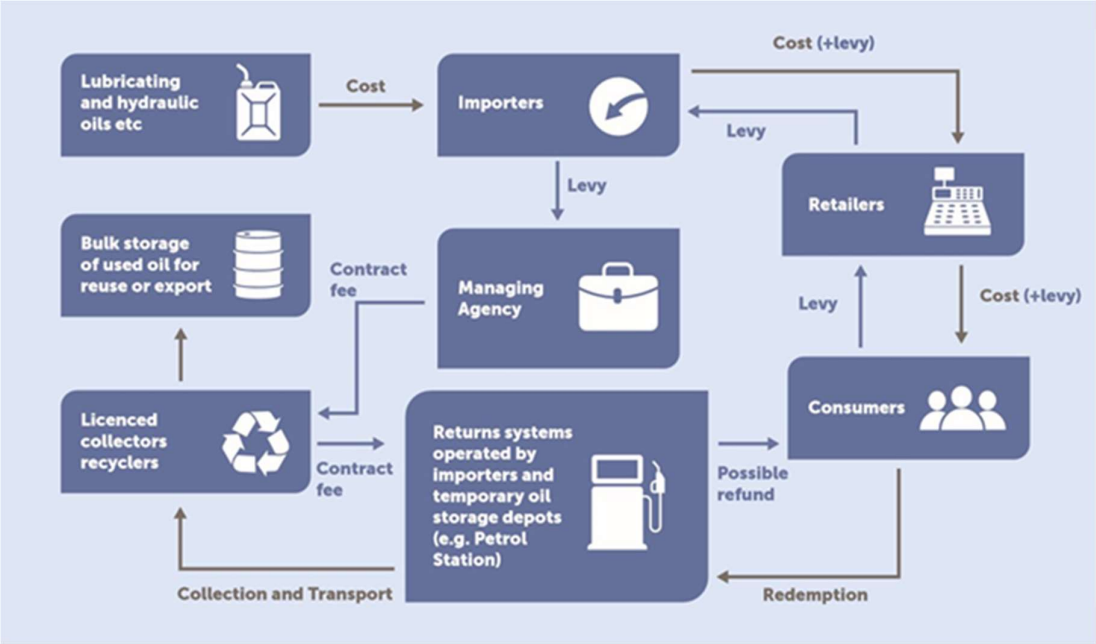
7.5 Sustainable funding and cost recovery

Sustainable used oil management in the Vanuatu will require establishment of a user-pays management system enforced under the Waste Management Act. This will require the collection of an ADF on all imported lubricant products, to be enforced under Government regulations.

7.5.1 Introduction

The principles of Extended Producer Responsibility (EPR) require in simple terms for used oil, that the cost to collect and treat or export used oil is added to the purchase price of the product. This can be done by collecting an Advance Disposal Fee (ADF)- also called an Advance Recycling Fee (ARF) - before the product is sold, and then directing this money to whoever conducts the recovery for recycling or export. This scheme is presented in Figure 3 below.

Figure 3 - Advanced Disposal Fee Procedure



7.5.2 Setting the ADF Levy

Setting the ADF levee is dependent on an accurate understanding of the total cost to manage the generated used oil. The amount of used oil to be processed is generally only half of the amount lubricant imported, as oil is lost during use, mostly by being burnt in engines or through leaks. Therefore, the amount of the ADF per litre of imported lubricant need only be around half of the total used oil management cost per litre. **The current viable ADF is estimated to be 75 Vatu per litre of imported lubricating oil.**

7.5.3 Used Oil Management System

There are two types of management models that are common:

- The Special Fund model, where the government operates the fund that holds the Advance Disposal Fees, alongside a used oil recovery system which may be either private or government owned and operated, or
- The Managing Agency model, where the government simply sets the rules through legislation while the system is run by a non-government Managing Agency and the funds sit outside the government financial system.

For Vanuatu, the best approach is to use a Special Fund model, where the government collects the ADF and pays it back out to a contracted System Operator (Managing Agency) who manages the national collection and export of the used oil.

7.5.4 Legislative Framework

The primary piece of legislation required will be to create a Special Fund, and the provisions by which a Special Fund can be set up will be laid out in existing national financial legislation. A Special Fund is a separate government account to the normal General Revenue account. Expenditures from General Revenue usually have to conform to budgets passed by national parliament, but a Special Fund is ring-fenced, with rules about what the money can be spent on and sits outside the normal government budgetary process.

Any Special Fund will almost certainly need its own Act, which can be short and simple. Regulations regarding what is required to pay an ADF, how much and when, and the appointment of a System Operator (the Managing Agency) maybe required to be under this Act or may be possible under existing waste management legislation. The advice of the national Attorney General's office is best sought in this regard. The System Operator (the Managing Agency) may be nominally the government in legislation, as long as that power is able to be passed across to an 'agent'.

The regulation can be used to deal with the details of the ADF system, such as the value of the ADF to be paid, rather than putting this into the Act, as this makes it easier to adjust critical values - such as the ADF - without having to amend the Act. Amending a regulation is usually a much simpler process. The regulations do not need to set the amount per litre that the System Operator (the Managing Agency) can claim, as this can be set in the contract with the System Operator (the Managing Agency). This is an important point to note. The regulations must be clear about which part of government holds the contract with a System Operator (the Managing Agency).

7.5.5 Advanced Disposal Fee collection

For Vanuatu, as all lubricating oil is imported, the point of import becomes a suitable place in which to collect the fee. If Customs is used to collect the ADF, then it is simple to place that money into the dedicated Special Fund which will be operated under the Ministry of Finance, as the Customs service is always a part of the Ministry.

It should be noted, however, that not all entry points are currently controlled, which will make it difficult to implement an overall ADF. The control on entry points needs to be tightened up. This matter is referred to in Section 6.7 below.

7.5.6 Contracting a System Operator (Managing Agency)

The System Operator (the Managing Agency) could be an entity who has storage tanks suitable for holding the used oil. A contract can be quite simple, in that the System Operator (the Managing Agency) claims a pre-agreed fee from the Special Fund per litre of used oil processed (exported). The key factors of any contract are to:

- Identification of the claim rate per litre of used oil collected and exported
- Accounting for litres processed (exported)

- Monitoring of collection and export of used oil, and
- For compliance with pollution control regulations.

It generally is best if the Ministry of Finance holds the contract to pay out the System Operator (The Managing Agency) claims, whilst the environment ministry is the regulator regarding the conditions to be complied with. The contract will specify on what basis the used oil is considered to be 'processed'. For example, if export is the management option chosen in the National Used Oil Management Plan, then once a litre is exported the System Operator (the Managing Agency) can claim the payment allotted.

7.5.7 Claims for ADF Payments

If export is the requirement of the 'processing' in the contract, then production of a Bill of Lading should be included in any payment claim documentation. Such claim documentation might also include relevant Basel/Wagaini permit information. Together, these would show that oil was exported and that it met the trans-boundary movement requirements. It could be that a receipt might also need to be provided by any receiver of the used oil overseas. It is essential that any System Operator is only paid upon proof of export (or other agreed processing method). If any payments are made before processing is completed, then a perverse incentive will be in place for the System Operator to collect and store, but not process, used oil, with all the long-term consequences that a National Plan wishes to avoid.

7.6 Education and Awareness to increase used oil collection

A programme of education and awareness is needed to promote improved used oil collection and management. This can only be undertaken when suitable facilities are in place to collect and manage used oil. This programme can start with the upcoming pilot project and can be built on, once suitable facilities are in place throughout Vanuatu.

It will be necessary to explain why numerous current practices to manage used oil are unsatisfactory, and substitute products and techniques will need to be developed to replace these uses.

8.0 National Best Practice Implementation

8.1 Existing Infrastructure and Organisations

There is no infrastructure or organization currently operating in Vanuatu that is dedicated to the collection and management of used oil. SSP operate a take-back system which services their major clients. SSP have storage facilities for used oil at their fuel terminal, storage and distribution business in Honiara. SSP are currently stockpiling used oil.

There is a lack of accurate data available on volumes of used oil generated, this limits the ability of the government to initiate necessary management actions to tackle the issue.

8.2 Compliance Staff Shortages

A common theme from government department officers and key stakeholders throughout the Analysis Phase of the project was the lack of staff to carry out monitoring, inspection, and compliance activities. The outcomes of the Analysis report indicate a need for the establishment of several full-time positions.

Initiatives are currently underway as part of the NHWPIP to make amendments to the Waste Management Act 2014. This should result in much improved management of hazardous substances including used oil, and the NHWPIP includes provisions to employ more staff to manage hazardous wastes including used oil.

8.3 Projected costs for collection, temporary storage, transport and bulk storage

The upcoming SWAP Pilot Project to manage the collection and treatment of used oil is described in Section 7.1 above. This project should result in a satisfactory collection system for Port Vila and the whole of Efate. It will be necessary to set up similar arrangements for the rest of Vanuatu and in particular for Luganville.

8.4 International shipment

To ensure National Best Practice management of used oil disposal, it is very important to ensure that any shipment of used is undertaken in compliance with all International and regional conventions both now and in the future.

Used oil which has not been treated or processed locally must be categorized as waste and managed in accordance with the requirements of the Basel/Waigani Conventions.

8.5 Sustainable funding and a levy on Imports to fund the Management Plan

The principals of Extended Producer Responsibility (EPR) require that the economic externality of the cost of dealing with a waste product should be internalised. In simple terms for used oil, this means adding the cost to collecting and treating or exporting used oil to the purchase price of the product.

This can be done by collecting an Advance Disposal Fee (ADF) or Advance Recycling Fee (ARF) before the product is sold, and then directing this money to whoever conducts the recovery for recycling or export. For the purposes of this analysis, ADF will be the term used to denote the levy collected, and 'processing' will be used as a general term that will cover both processing in-country in some way or exporting. This is described in Section 7.5.

8.6 Recommendations for Used Oil Management

These recommendations mostly emerge from the Analysis report and the Feasibility Study:

a) The first step is to establish a collection service and storage depot, using the funding provided for the SWAP Pilot Project, in accordance with the budget in Section 7.1, although this needs to be developed further. Once the used oil is collected and safely stored, with an ongoing collection system, then the focus can turn to recycling the stored used oil.
b) The pilot study is only for Port Vila so once that is successfully underway, decisions will also need to be made regarding repeating such facilities and services elsewhere.
c) Public used oil collection points will also need to be established.
d) In the short term undertake a shipment or multiple shipments, according to need, to clear existing stockpiles of used oil, thereby mitigating risks to the local environment. This may also end up being the long-term option. The existing stockpile may qualify for the Moana Taka shipping programme and this needs to be investigated.
e) Implement a pilot programme to address used oil management in remote communities using NuFuels units. The estimated cost for a ten-unit pilot, based on the costs in Section 5.1.2 Table 6 would be $US21960 x 10 = $US219,600.
f) Examine the feasibility of other local treatment options, including the PACPLAN Pyrolysis Unit and the Yuneng ZJC Series Unit.
g) Ensure the necessary training is carried out, including safe handling of used oil, based on the Used Oil Code of Practice
h) Improve government staffing levels to cope with the need to manage used oil effectively.
i) Carry out an education programme to use the public collection points and discourage the unsatisfactory disposal of used oil, including current uses for marking sports fields, treating timber, controlling dusty roads, and replacing chainsaw bar oil.
j) Set up the ADF system to assist in funding future used oil management. Some user-pay charges could also be implemented, as well as searching for some ongoing donor funding.
k) Successful implementation of the ADF System will require an improvement in the system for collecting information on the import of lubricating oil.
l) In the long term, increased use of solar power and other sustainable energy practices will reduce the production of used oil, and these should be encouraged. This would also be in keeping with the climate change goals of Vanuatu.

Annex 1 - Draft Used Oil Code of Practice for Pacific Countries (2022)

Please note:

- This Code is largely based on the New Zealand Document – "Management and Handling of Used Oil HSNOCOP 63" November 2013, NZ Environmental Protection Authority.

- References to the GHS7 are to the UN Globally Harmonised System Rev 7. This is an international system for classifying hazardous substances and all references are to the flammable liquids classification. The following categories apply:

Table 1: GHS7 Flammable Liquids Categories

Category	Criteria
1	Flash point < 23 °C and initial boiling point ≤ 35 °C
2	Flash point < 23 °C and initial boiling point > 35 °C
3	Flash point ≥ 23 °C and ≤ 60 °C
4	Flash point > 60 °C and ≤ 93 °C

1.0 Definition of used oil

In this document, the term 'used oil' is used. However, this is intended to be synonymous with the term 'waste oil' in the context of the contents of the document.

While it is appreciated that, in general, 'used oil' can be derived from many different sources and mixtures of different waste streams, have many different compositions and mean different things to different people, used oil is taken to have the following definition:

> *Any oil that has been refined from crude oil, or any synthetic hydrocarbon oil, that has been used, and as a result of such use, has become unsuitable for its original purpose due to the presence of impurities or contaminants or the loss of original properties.*

Used oil is oil from industrial and non-industrial sources and can be derived from any one of the substances in List A, or be a mixture of these substances. These substances have a flash point (closed cup) above 60^0C.

List A

- Engine oil – typically includes crankcase oils from gasoline, diesel and LPG engines
- Brake fluid
- Gear oils
- Transmission fluids
- Hydraulic oils and fluids
- Compressor oils
- Refrigeration oils
- Industrial process oils
- Electrical insulating oil except oil likely to contain PCBs
- Neat metalworking fluids and oils (excluding chlorinated products) – these must not be diluted with water or any product from List B
- Heat transfer oils
- Machining oils
- Ship's slops, bilge water, tank cleanings produced by vessels during normal shipboard operations
- Bottom clean-out waste from virgin fuel storage tanks, virgin fuel oil spill clean-ups, or other oil
- Wastes that have not been used, providing the flash point of the material is greater than 60^0C.

Used oil should not include any of the products in List B or a mixture of products in Lists A and B

List B

- Petroleum distillates used as solvents, such as turpentine, kerosene, parts washing solvents
- Petrol and/or diesel (including biofuels) – including mixtures from refuelling errors
- Antifreeze, radiator flushing, or other inhibitor packages (e.g. stabilising coolant additives (SCAs))
- Oils derived from animal or vegetable fats and oils – including those used as a lubricant
- Paint and paint brush washings
- Chlorinated oil or solvents
- Any virgin or used oil which may contain PCBs (> 5 mg/kg)
- Soluble cutting fluids

Please note:

- Many, although not all, of the products in List B will have a flash point (closed cup) below 60^0C. Regardless of flash point, however, List B products must not be mixed with List A products and then disposed of as used oil.

- If used oil becomes contaminated with products from List B, the resulting product will usually become unsuitable for collection for re-use as a fuel.

- Small amounts of **some** List B products such as vegetable oils may not greatly change the actual properties of the List A products.

- However, mixing of List A and List B products is strongly discouraged as there is no guarantee that the resulting mixture would be suitable for used oil collection.

Within the scope of this document, used oil must either not have any flammable liquid classification (Flashpoint > 93^0C) or have a Flammable Liquids Category 4 Class under the UN GHS7 Classification System (Flashpoint >60^0C or ≤93^0C).

2.0 The used oil collection system

The used oil management system can be divided up as follows:

- small volume generators
- public collection points
- industrial/commercial generators
- collectors and transporters
- storage and processing
- end users (e.g. industrial boilers)
- exporters

The effective collection and transport of used oils from the point of generation to end-use locations is essential if used oil is to be utilised or disposed of in an environmentally acceptable and safe way.

The following sections of this code address each of the components of the used oil collection system and provide advice to the relevant parties on their roles and responsibilities with regard to used oil.

The aim is to:

- prevent contamination of used oil with inappropriate materials
- encourage small volume oil generators to deliver their used oils to local collection centres
- encourage retail outlets which sell lubricating oils to arrange for used oil collection facilities to be available to their customers and the general public
- encourage the provision of publicly available collection facilities in rural areas that are inadequately served by retail outlets selling lubricating oils
- provide safe and efficient collection and transportation procedures for used oil
- set out the operational and testing procedures and equipment to be used by any party aggregating used oil in a transfer or tank farm facility
- provide guidance and information on what is and what is not an appropriate use for used oil
- ensure the safe handling of used oil by those who collect, transport, store, process, use or dispose of used oil.

3.0 Small volume generators

Many people buy small amounts of lubricating oil to use at home. Collectively this ends up generating significant volumes of used oil. This section of the code aims to provide information to these "small volume generators" on how to handle and what to do with their used oil.

3.1. Definition of a small volume generator

Small volume generators are those oil users who have no on-site used oil storage, and typically accumulate volumes of less than 60 litres of used oil at any one time. The large numbers of private motorists who change their own oil fall into this category.

3.2. What are your responsibilities?

People who maintain their own vehicle(s) and who change the engine and/or other oil(s) should comply with the following procedures:

- Place a drip pan directly under the vehicle's oil pan plug to collect as much as possible of the used oil and to prevent spills, before draining oil from the sump.
- If you are changing your oil filter, loosen the old filter (use a filter wrench if necessary), then spin it off and drain as much oil as possible into the drip pan. Place the filter upside down in a container. Drain for 24 hours. Add the used oil to what you already have in your collection container. If you can, take the old filter to a local scrap metal dealer or public collection point. If you don't have any other alternative, wrap the filter in newspaper and dispose of it through your domestic waste collection.
- Pour the used oil into a clean, empty container with a tight lid (e.g. the plastic container the clean oil was supplied in)**. DO NOT MIX IT WITH ANY OTHER SUBSTANCE.**
- Take the used oil to your nearest used oil public collection site.

3.3. Where do you take your used oil?

Public collection sites fall into two types: those where the public can leave the used oil in its container at a drop-off bin and those where the used oil is poured into a bulk tank.

Drop-off bins are available at a number of locations including:

- oil retail/reseller sites such as;
- auto accessory stores
- DIY stores

Bulk tanks are available at some landfills and other properly designated sites.

3.4. Inappropriate methods of disposal of used oil

The following methods of disposing of used oil are inappropriate due to the actual or potential adverse environmental impacts:

- unauthorised disposal on the ground, or into watercourses, sewers or drainage systems
- burial
- using used oil for dust control, weed abatement, vegetation control, timber preservation by painting, staining or dipping, pest control or as a carrier fluid for agrichemicals (pesticides or herbicides)
- use as a marker, e.g. on playing fields
- placing used oil in rubbish bins to be collected as part of household waste (except for disposal of well drained used oil filters and oily rags)
- open-air burning
- combustion in, for example, kerosene burners, or as a fuel
- any other practices, in which the used oil may cause contamination of the ground and ground water, migrate to watercourses, contaminate air or have negative impacts on humans, plants, animals or other organisms.

4.0 Public collection sites

For the collection of used oil from small volume generators to be effective, there needs to be an appropriate number of public collection points available. This section aims to encourage retailers of virgin oil to the public to recover the used oil, and local authorities to take a more proactive role in used oil collection. It also provides a guide on what is required to comply as a used oil public collection site.

4.1. Definition of a public collection site

Any site or facility that accepts/aggregates and stores used oil collected from small volume generators is a public collection site. Public collection sites fall into two types: those where the public can leave the used oil in its container at a drop-off bin and those where the used oil is poured into a bulk tank.

4.2. What are your responsibilities?

All retailers of oil are strongly encouraged to promote the recovery and/or reuse of their oil. This can be enhanced by posting a sign at the point of sale either advising the consumer that the outlet accepts used oil, or that you have made arrangements for another outlet to accept used oil on your behalf.

Oil retail/reseller sites

All sellers of oil in packages of 20 litres or less are therefore encouraged to:

- have a suitable facility available to take back used oil at the point of sale at no charge to the consumer, or
- arrange for a third party within a 10 km radius in an urban area, and at an appropriate location in a rural area, to accept oil on their behalf.

Sellers should also prominently display a sign advising customers of recommended recovery arrangements for the site.

If the aggregate quantity collected exceeds 1000 litres, the sites must comply with the requirements of Appendices 3 (Site requirements) and 5 (Spill management).

Local authorities

Where a public collection site utilises bulk tanks, such as at landfills, those facilities must comply with the provisions of section 5 below and the appendices of this code.

4.3. Classification of public collection sites

Used oil public collection points are classified as either controlled collection or as general collection sites based on the ability to prove that the used oil on site is not contaminated by other products.

Controlled collection sites - A used oil public collection point can be classified as a controlled collection site when the site can demonstrate, by appropriate in-house procedures for handling used oil that it is protected from receiving unwanted or contaminated oils (see Appendix 1). In particular, it is protected from receiving flammable liquids.

General collection sites - Used oil public collection points that cannot show they are protected from receiving unwanted or contaminated oils will be classified as general collection sites. The site requirements specified in Appendix 1 are to be applied.

5.0 Industrial and commercial used oil generators

Industrial and commercial operators must store or dispose of their used oil in a manner that is not detrimental to human health and the environment. Industrial and commercial generators may have complicated operations and must take care to segregate used oils generated from different processes to avoid contamination of the separate oil streams. This includes:

- not contaminating segregated oil with any other oily fluid that may appear to be the same substance, and
- not contaminating oils with flammable liquids.

5.1. Definition of an industrial or commercial used oil generator

Industrial and commercial generators are defined as those parties who in the course of their commercial operations generate or accumulate used oil. In all cases the site storage of used oil is unlikely to exceed 5000 litres.

Typical sites include:

- automotive vehicle repair workshops
- industrial manufacturing operations
- other commercial operators, for example sites generating used gear oil and sites generating used hydraulic oil.

These are essentially sites that are not public collection sites.

Industrial and commercial generators of used oil are classified as either a controlled collection site or as a general collection site.

Controlled collection sites are sites where the used oil has not been contaminated by other hazardous substances. This means being able to demonstrate by in house procedures that the used oil comes from closed systems where cross-contamination with other substances has not occurred during typical industrial processes, for example contamination with refrigerants or solvents.

General collection sites are sites where it cannot be demonstrated that the site is protected from receiving contaminated oils or unwanted substances. The site requirements specified in Appendix 1 must be applied.

5.2. What are your responsibilities?

As a generator of used oil you must collect and store used oil in dedicated facilities which are designed, labelled and operated to minimise contamination and spillage. The used oil must be prevented from becoming contaminated with other substances such as petrol, diesel, solvents, agricultural chemicals, water, or engine coolants. If contamination with other substances does occur, the contaminated substance must be immediately treated as a hazardous waste that requires competent management.

You must provide separate dedicated facilities for each of the main types of used oil:

- automotive engine lubrication and circulating oils, including engine oil, transmission fluids, final drive and drive-line fluids, brake fluids and power steering fluids, hydraulic oils, turbine oils, heat transfer oils, compressor oils, industrial gear oils
- used metal working/cutting oils, including neat cutting, grinding, machine, rolling, quenching and coating oils, and undiluted soluble metal-working fluids (but excluding chlorinated products)
- electrical insulating oils. If these contain polychlorinated biphenyls (PCBs) or other chlorinated organics they must not be mixed with any other oil. If you suspect that the oil might contain more than 5 ppm PCBs, you should contact the EPA for advice on handling and disposal.

You must ensure that your staff have been trained to be aware of the procedures for the storage and handling of used oil, and of the need to keep used oil separate from other substances, especially flammable liquids.

5.3. Site Requirements

The site requirements, including management procedures which must be followed, are specified in Appendix 1.

The requirements for storage tanks are specified in Appendix 2.

Procedures for spills are specified in Appendix 3.

6.0 Collection and transportation

This section sets out the operational, testing, equipment and recording procedures to be used for the transportation of used oil in bulk.

6.1. Definition of a transporter

Used oil transporters are those parties who commercially collect used oil from more than one used oil generator or collection point and transport it to a used oil transfer facility or tank farm facility (as defined in Section 7.1). This does not include domestic users of oil who transport small quantities (e.g. less than 60 litres) of used oil from the point of generation to a collection site.

6.2. Your responsibilities

Used oil must be collected in a manner that is not detrimental to human health and the environment. When collecting and transporting used oil you must ensure that the used oil has a flash point greater than 60^0C. To do this you must either:

- conduct a flash point test or vapour test at each collection point, or
- conduct a pre-collection audit of the site you are collecting oil from.

It should be noted that portable flash point testing equipment is available but may not be considered practical in some Pacific contexts. Transporters can, however, easily carry LEL gas detectors, which are often combined with detectors for other gases (e.g. oxygen, carbon monoxide, hydrogen sulphide.) An audible alarm is usually set at 10% of the detector calibration gas and conversions are available to calculate LELs for other gases. LEL detectors should be calibrated regularly and records should be kept of the calibrations.

The LEL is the “Lower Explosive Limit” and at the LEL is defined as the lowest concentration (by percentage) of a flammable gas or vapour in air that is capable of causing a fire in presence of an ignition source.

The site inspection should cover the following areas:

- storage equipment
- site management procedures
- general site tidiness
- potential hazards
- source of used oils
- whether the site is a controlled collection site
- collection of List A substances only
- where there is any doubt, a flash point test or vapour test must be undertaken

If the site meets the criteria for collecting used oil, you and the site operator can agree on an appropriate collection service schedule for the site.

If you are a used oil transporter you must ensure that the vehicle transporting the used oil meets the criteria for the type of sites that the used oil is being transported from (see Section 6.3). The types of vehicles that are required for a general collection site and a controlled collection site differ.

You should keep records for each site detailing the date and volume of used oil collected. This can be an invoice/receipt for each site. If invoices are not provided, the site operator must subsequently have access to your collection records if required, for use as evidence of appropriate used oil management.

If oil is accidentally discharged during collection and/or transportation, you must take immediate action to protect human health and the environment; for example, contain the spill by bunding the discharge area, notify local authorities and clean up the spill. Spills must be reported to the site operator and to the appropriate agency, such as a local council, as soon as possible.

Sites should keep records of each spill in excess of 5 litres. These records should be retained for at least 3 years.

6.3 Requirements for drivers and vehicles

The following requirements are to be observed:

- All tank wagons used in the collection of used oil must comply with relevant national regulations for the transport of hazardous substances. If used oil is collected in bulk from general sites where there is a possibility of contamination with Flammable Liquids of GHS7 categories 1, 2, or 3, then the used oil must be transported in a tank wagon suitable for the transport of petrol.
- If you collect and transport used oil in bulk from controlled sites where the oil can be guaranteed to have a flash point (closed cup) above 60^0C (that is, it has a GHS7 Flammable Liquid Category 4) then a tank wagon suitable for diesel will be sufficient. If the flashpoint is above 93^0C then a tank wagon suitable for non-flammable substances will be sufficient.
- All tank wagons must carry a road tanker spill kit for cleaning up any minor spillage. For further information on spill kits, spill preventions, response and clean-up procedures for transporters see Appendix 3.
- Any spillage of used oil at a customer site must be cleaned up. This may be by using the vehicle's spill kit. If the spill is greater than can be handled by the spill kit, the driver must wait at the site until a clean-up crew has arrived and responsibility for the clean-up is handed over to them.
- All hoses must be plugged or capped when not in use. All suction pipes are to be stored in an enclosed leak-proof container or locker complete with a drain point so that it can be drained of product if necessary.
- All tank wagons should work on a no-product-to-ground policy.
- All drivers must undergo training for tank wagon work, and this must be documented.
- All drivers must have the current drivers licence for the vehicle they are driving. If the substances being transported, including any local requirements for licensing drivers for transporting dangerous goods, then these requirements must also be observed. Special training is necessary.
- Additional precautions are required if the used oil being transported has a flash point less than 60^0C. This includes applying hazardous atmosphere zones for substances with GHS7 flammable liquid categories 1 and 2. These zones are areas around the tankers where sources of ignition must be excluded.
- Vehicles with product that could be contaminated with GHS7 flammable liquid categories 1, 2 or 3, are to be labelled with UN Number "1993", Shipping name "Waste Flammable Liquid NOS", and Common Name "Used Oil, Hazchem 3[Y]". This information must also be stated on the accompanying transport documents.

6.4 Vacuum tankers

Prior to using a vacuum tanker, even in controlled sites, the driver should check to ensure that GHS7 Categories 1, 2 and 3 flammable liquids have not inadvertently been disposed of in the tank which is being collected from. Vacuum tankers can only collect these liquids if the vehicle is designed and constructed for them, or otherwise there is a risk of fire or explosion.

6.5 Static electricity

Static electricity is a problem when pumping petroleum substances. The following precautions must be taken whenever used oils are pumped.

- Always earth road vehicles before loading or unloading. Before pumping commences and the tank is being unloaded or loaded, attach a loading or unloading hose that is electrically continuous to the tank. You can also use a separate static strap that can be attached to the tank. The tank must be earthed.
- Avoid splash loading when top loading into empty vehicles. Ensure that the fill pipe reaches as close as possible to the bottom of the tank or use bottom filling.
- Avoid pumping water or air with petroleum substances.
- Maintain a slow loading rate until the fill pipe on the receiving vessel is covered by at least 100 mm.

6.6 Records

When you collect and deliver used oil you should maintain records of this transaction for a minimum of three years. Each tank wagon load of used oil must undergo flashpoint testing or vapour testing (See Section 6.2

above) before it is delivered to a used oil transfer facility. This will ensure contaminants are not present in the load. Records of this testing should be retained for three years.

Acceptance

As a used oil transporter you must keep a record of each used oil batch accepted for transport. Records for each batch must include:

- the name, address and ID number (if applicable) of the transporter and whoever provided the used oil for transport, and
- the date of acceptance of the used oil, and
- a description of the used oil being transported, and
- the quantity of used oil accepted, and
- the signature of a representative of whoever provided the used oil for transport. The signature must be dated on receipt of the used oil.

Delivery

As a used oil transporter you must keep a record of each shipment of used oil that is delivered to another used oil transporter, user or transfer facility. Records of each delivery must include:

- the name and address of the receiving facility or transporter, and
- the ID number (if applicable) of the receiving facility, and
- the date of delivery, and
- the quantity of used oil delivered, and
- the signature of a representative of the receiving facility or transporter. This must be dated on receipt of the used oil, and
- the results of the flashpoint test or vapour test of each tank wagon loads of used oil.

6.7 Delivering used oil

Used oil transported from a collection point must only be unloaded at a site that meets the criteria for a used oil transfer facility/tank farm facility (see Section 7).

6.8 Transportable containers

Where IBCs (Intermediate bulk containers) are used for the collection and transportation of used oil, these must comply with chapter 6.5 of the UN Model Regulations on the Transport of Dangerous Goods.

IBCs are required to be inspected at 2.5 yearly and 5 yearly intervals. These inspections are required to be in accordance with the UN Model Regulations.

A compliant IBC needs to be marked and needs to display the date of the latest inspection.

Where portable tanks are used for the collection and transportation of used oil, these must comply with chapter 6.7 of the UN Model Regulations. Furthermore the attachment of the portable tank to the deck of the vehicle must be able to resist the forces experienced when being transported.

7.0 Storage and processing

This section concerns owners and operators of used oil bulk storage facilities together with those who have operations for processing, refining or disposing of used oil. It does not apply to people who carry out incidental processing operations on used oil during the normal course of transportation (see Section 6). It includes the use of used oil as a fuel in any operation.

7.1. Used oil facilities

Bulk storage facilities

A used oil tank bulk storage facility is defined *as any facility at a site that receives and aggregates used oil from used oil transporters (as defined in Section 6.1) for subsequent additional transportation, processing, re-refining or use and which is not a used oil generator.*

A bulk storage facility typically consists of a tank farm and may include the incidental processing of used oil through, for example, stripping water.

Typically, bulk storage facilities are likely to receive used oil from used oil transporters in large volumes i.e. received in bulk by tank wagon.

Processing and use plants

Used oil processing or use plants are *any facilities which either receive and aggregate used oil from used oil transporters (as defined in Section 6) and which also process, re-refine or use the used oil.*

These are facilities that engage in physical operations designed to make used oil more amenable for the production of fuel oils, lubricants or other used oil-derived products. Processing includes, but is not limited to, any mechanical or chemical treatment, as well as blending used oil with virgin petroleum products (excluding those with flammable liquids classifications GHS7 Categories 1, 2 and 3).

Bulk storage facilities are subject to more rigorously controlled practices than for either virgin oil stored at commercial operations or used oil stored at public and industrial / commercial collection points. The reasons for this are:

- storage of greater volumes
- the likelihood that such sites will sometimes receive used oil contaminated with flammable liquids.

7.2. What are your responsibilities?

Owners and operators of used oil bulk storage facilities and used oil processing, refining or burning sites must hold current consents to operate such facilities, and maintain and operate them in accordance with these consents. Used oil bulk storage facilities must also minimise contaminated waste which will require disposal to landfills, for example, by shredding, washing and recycling plastic oil containers.

Each site must comply with all relevant requirements of the relevant legislation.

7.3. Storage facilities

Tanks

Tanks must comply with the following:

- Stationary tanks must be compliant with Appendix 2 (New Tanks) or Appendix 5 (Existing Tanks) of this code.
- A means to prevent unauthorised access is to be provided; this can include padlocking inlet and outlet valves when not in use.
- Above ground stationary tanks of 1000L or more must have a secondary containment system. A secondary containment system is a system in which the used oil is contained if it escapes from the container or containers in which it is held. The used oil must be able to be recovered from the secondary containment system. A common form of secondary containment is a compound with bund walls. The secondary containment system must have a capacity of at least 110% of the largest tank at the site.

- The bund floor must be impervious.
- Below ground stationary tanks must have a secondary containment system of at least the capacity of the tank.
- Each tank is to have some method to determine the volume of used oil in it.
- All tank maintenance is to be recorded and the records kept for five years.
- At each site the operator is to have a sufficient storage capacity on site certified for flammable liquid storage to allow for discharge from the largest capacity of a vehicle that may be received, in the event of a load being contaminated with a low flash point substance.
- The vehicle discharge area must be bunded. The bund must equal or exceed the volume of the largest compartment of any vehicle to be discharged.
- Operating requirements are specified in Appendix 1 to this code.

7.4. Transfer Operations

During loading and unloading of used oil at a used oil facility, a staff member must be in attendance at all times.

Records

All sites that hold, process, refine or dispose of used oil are to keep records of incoming oil by date, volume, source and flash point. Records of oil going off site should indicate date, volume, and destination. Owners and operators of sites that hold, process, refine or dispose of used oil must keep documentation that acts as an audit trail, Sites must also keep disposal records for any hazardous by-products generated in the process. This includes sludges and ash, and spent fuller's earth containing oil.

All records should be retained for at least three years.

Spill/ Emergency Management Procedures

Employers and staff must be properly prepared to manage an emergency involving hazardous substances, including having emergency response procedures and equipment. These include:

- At least two fire extinguishers if at least 500L of used oil is held when the used oil is of GHS7 Flammable Liquid Category 4, although it is good practice to have fire extinguishers available regardless of the hazard classification of the used oil.
- A spill kit that is appropriate for cleaning up used oil. This should contain personal protective equipment (PPE) that may include overalls, boots, gloves, eye protection. It should also contain spill handling equipment, containment equipment, absorbent materials and information on what to do when a spill occurs.
- Signage that notifies employees, emergency services and other people of the presence of hazardous substances. Refer to Appendix 1 for details of signage.
- A secondary containment system that meets the requirements set out in section 7.3.
- An evacuation plan
- An emergency response plan if your site holds greater than1000L of used oil. If your site holds less than 1000 litres of used oil it is still good practice to have an emergency response plan.
- Where applicable, emergency response procedures for low flash point substances and/or substances at elevated temperatures.
- Emergency response plans must be site specific and cover all reasonably likely occurrences and the responses for your site and shall include a description of what you will do to:
    - call emergency services
    - warn people at the workplace and in nearby areas that an emergency has occurred
    - advise people how they can protect themselves and how they can help other people involved in the emergency
    - manage the emergency so that damage is minimised.
- The plan must also:
    - Name the people with specific responsibilities (such as fire wardens, first aiders) and include the contact information for them and emergency services.
    - Include how to get information about the hazardous properties of the substances involved in the emergency.

    - State the location and purpose of emergency equipment and materials that may be needed.
    - Set out the actions to take for each potential emergency and the order in which to take them.
    - Be available to all people that are listed in the plan as having responsibilities and also to emergency services.
- Emergency response plans must be tested at least annually; records of tests must be kept for at least two years. You must update your plan if there are changes to the hazardous substances present at your workplace, or if there are changes to staff that have specific emergency responsibilities. You must test altered plans as soon as possible, and in any event no later than 3 months after the change.
- After any emergency, you should review your plan and identify steps to prevent future incidents.

8.0 Use or disposal of used oil

8.1. Air quality

Open burning of used oil is environmentally unacceptable, due to a wide range of potential emissions, including dioxins.

Combustion of used oil for purposes of generating useful heat, steam, power or electricity must also be done with due regard to air emissions.

If you collect and transport used oil to people who intend to utilise the used oil as a fuel, you should ensure the user intends to use it in an environmentally acceptable manner.

Combustion processes must meet ambient air concentration requirements for fine particulate (PM10), sulphur dioxide, nitrogen dioxide, ozone and carbon monoxide.

Complying with the fuel specifications in 8.2 below does not ensure that the combustion process will ensure compliance with these requirements.

8.2. Reprocessed oil specifications

Used oil reprocessed for use as a fuel oil must be converted into a distinct marketable substance. It must meet the following fuel specifications:

Maximum levels
Lead 100 ppm maximum
Arsenic 5 ppm maximum
Cadmium 2 ppm maximum
Chromium 10 ppm maximum
Total halogen content 1,000 ppm maximum (no PCBs allowed)
Flash point 60°C minimum

Each batch of reprocessed oil must be tested to ensure this specification is complied with. Such testing would normally be undertaken by the provider of the used oil and the records should be retained for at least 5 years. This includes situations whereby used oil is collected and used directly as fuel oil.

For practical purposes smaller batches e.g. batches less than 10,000 litres, may be consolidated for testing so long as the sample is representative.

8.3 Disposal of used oil

Used oil that is to be disposed of (as opposed to being used for burning or being re-used) will usually involve a commercial transaction, with the ownership of the used oil generally passing to the collector.

In this case, the responsibility for environmentally acceptable disposal practices passes to the collector.

The used oil must be disposed of by:

- Exporting it as a waste – all requirements of the Basel Convention or Waigani Convention (whichever is relevant), must be followed.
- Treating it so that it is no longer hazardous.

The latter point does not include depositing it in a sewage facility or spreading on land surfaces (including roads) but does include combustion in a managed incineration facility.

8.4 Disposal of packaging

Unless the package is to be reused or recycled, the package must be rendered incapable of containing any substance and disposed of:

- in a manner consistent with disposal of the used oil itself, or
- through a public or commercial waste collection service.

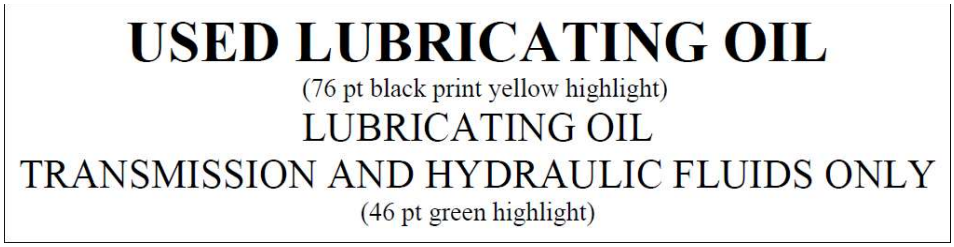
Appendix 1: Site Requirements

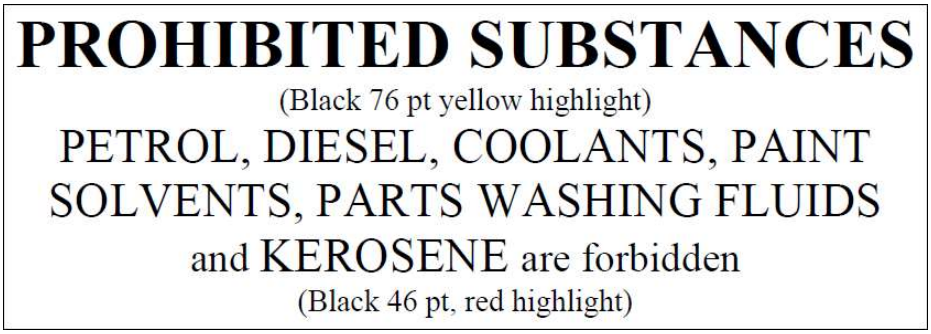
Management procedures

- The operator must provide written material to staff about the appropriate procedures for handling used oil and oil filters. Safety datasheets must be available.
- The used oil collection and transportation agent must comply with the guidelines in Section.
- Collection facilities are sited to prevent used oils from entering sewerage and storm water systems, drainage channels and the natural environment.
- Storage facilities should be inspected visually on at least a weekly basis to ensure that a standard of cleanliness and that environmental management is maintained, and that regular collections are carried out.
- Stationary container facilities should be audited annually, with records retained on site until the next audit. These audits will generally be by internal staff (i.e., conducted by storage facility staff).
- The site must have a management plan in the event that the storage tanks and other receptacles become contaminated with other hazardous materials, such as flammable solvents. This may entail calling a transporter able to handle GHS7 Categories 1, 2, and 3 flamamble liquids and arrange for collection of it.
- The site must have health and safety procedures that are appropriate to the handling that is taking place.
- In the event that a spillage occurs, records should be kept for all spills in excess of 0.5L. These records should be retained for at least 3 years.

Additional management procedures for controlled collection sites

- Controlled collection sites must be able to show they are protected from receiving unwanted or contaminated oils by having the following management procedures in place on site and by ensuring that staff are aware of them. Only used oils from List A are acceptable.
- A legible and visible sign must be prominently mounted which advises persons wanting to dispose of used oil to avoid contaminating it and either:
  - lists the products that are not accepted (antifreeze, paints, solvents, petrol, diesel etc.), and says where unacceptable products should be disposed of, or
  - specifies the used oils that the storage tank is limited to receive.
- Signs that meet this requirement include:





- For public collection sites where used oil is poured into a tank, the operator must visually inspect the used oil and reject any that he or she suspects may contain something unacceptable. This is unnecessary for public collection systems where the used oil is retained in sealed leak proof containers such that each batch of used oil is separated from other material.
- For sites generating used oil, the operator must have a documented process for accepting the used oil and this process must be made aware to the staff involved.

Segregation of incompatible substances

Used oil must not be in contact with any substance or material with which it is incompatible. Incompatible substances, including those held in packages, must be held separately. Used oil must be separated from:

- Explosive substances
- Flammable gases
- Flammable solids
- Oxidising substances

Public collection facilities

The collection agent at a public collection site must provide a safe, leak proof facility for the collection of customer's contaminated containers/receptacles. The agent must ensure that contaminated receptacles are recycled. If recycling is not available, containers must be disposed of in a safe and appropriate manner, e.g. at a suitable landfill.

All public collection sites must:

- be monitored at all times they are available to the public, and
- be inaccessible to the public when not monitored e.g. at night, and
- be weather tight, and
- be located away from sources of ignition, gutters, storm water drains, waterways and environmentally sensitive areas, and
- be advised to local fire and pollution response authorities in order to minimise the risk of spills, fires, contamination and over-filling.

If the used oil has a GHS7 Category 4 Flammable Liquids classification, the used oil containers/receptacles must be stored:

- outside, or in a detached building, or
- in a room with walls and ceiling constructed with 60/60/60 fire resistance rating provided not more than 450 litres are situated in the store, or
- in a room with walls and ceiling constructed with 120/120/120 fire resistance rating provided not more than 2000 litres are situated in the store.

Rooms in the third and fourth bullet points may have a door opening into the building provided that:

- The door of the room has a fire resistance rating of -/60/60 in the case of bullet point three and -120/120/120 in the case of bullet point four, and
- The door is fitted to be self-closing in the event of a fire near the doorway, and
- There are no combustible materials within 3 metres of the doorway, and
- No portion of the structure within 3 metres of the doorway is constructed of combustible materials, and
- The door is kept closed except when goods are placed in, or removed from, the room.

This code of practice is not applicable to used oils which have a flashpoint 60^0C degrees Celsius or lower. These oils may require additional precautions.

Removal of used oil

Removal of used oil from public collection sites as well as industrial and commercial generator sites should only be done through a commercial collection agent who complies with procedures as set out in Section 6.

Fire extinguishers

Fire extinguishers must have a capability of 30B4 (the rating should be marked on the fire extinguisher) and must be positioned within 30 metres of the used oil.

Emergency response plan

Employers and staff must be properly prepared to manage an emergency involving the used oil. The site must have a single emergency response plan for all of the hazardous substances held in it. This plan must describe all of the reasonably likely emergencies that may arise and for each of these must:

- Describe the actions to be taken to
  - Warn people at the place, and in surrounding areas that may be adversely affected by the emergency, that an emergency has occurred, and
  - Advise those people about the actions they should take to protect themselves, and
  - Help or treat any person injured in the emergency, and
  - Manage the emergency so that its adverse effects are first restricted to the area initially affected, then as soon as practicable reduced in severity, then if reasonable possible eliminated' and
  - If any of the substances remain, re-establish the conditions imposed on it when it was approved, and
- Identify every person with responsibility for undertaking any of the actions described above and give information on:
  - How to contact the person, and
  - Any skills the person is required to have, and
  - Any actions that person is expected to take, and
- Specify
  - How to obtain information about the hazardous properties of and means of controlling the substance or substances that may be involved, and
  - Actions to be taken to contact any emergency service provider, and
  - The purpose and location of each item of equipment or material; to be used to manage the emergency, and
  - How to decide which actions to take, and
  - The sequence in which actions should be taken.

All equipment, materials and responsible people specified in the plan, must be

- present at the location, or
- available to reach the location within the times specified , or
- in the case of trained persons, be available within a specified time frame.

The emergency response plan must be available to every person responsible for executing the plan or part of it and to every emergency service provider.

The emergency response plan must be tested:

- at least every twelve months and
- within 3 months of a change to the plan, persons or procedures.

The test must demonstrate that every procedure and action is workable and effective. The results of the test must be documented and held for at least 12 months.

Furthermore the site must demonstrate that it has a spill-response and clean-up plan, which includes:

- up-to-date procedures for contacting clean-up contractors and
- procedures for notifying the relevant municipal authorities, and
- staff awareness and
- having a spill kit available (see Appendix 3).

Secondary containment systems

Secondary containment systems are required when the quantity of used oil is equal to or greater than 1000 litres. It is also recommended that secondary containment systems are installed when the quantities are below

1000 litres. The capacity of the secondary system is dependent on the capacity of the containers in which the substances are held whether they are held above or below ground, and whether the used oil has a flammable classification or not.

Table 2: Minimum secondary containment capacity for used oil that is flammable i.e. Category 4

Container Size Categories	Quantity – Total Aggregate Capacity	
	Less than 5,000 litres	Greater than or equal to 5,000 litres
≤ 60 litres	At least 50% aggregate capacity	2,500 L or 25% aggregate capacity whichever is the greater
> 60 and up to 450 litres	At least 100% aggregate capacity	5,000 L or 50% aggregate capacity whichever is the greater
> 450 litres	At least 110% of the capacity of the largest container	

Table 3: Minimum secondary containment capacity for used oil that is not flammable.

Container Size Categories	Quantity – Total Aggregate Capacity	
	Less than 20,000 litres	Greater than or equal to 20,000 litres
≤ 60 litres	At least 25% aggregate capacity	5000 L or 5% aggregate capacity whichever is the greater
> 60 and up to 450 litres	At least 25% aggregate capacity or 110% of the largest container whichever is greater	5,000 L or 5% aggregate capacity whichever is the greater
> 450 litres	At least 110% of the capacity of the largest container	

Common forms of secondary containment systems include:

- a compound with bund walls or a depression in the ground, and
- a tank with a double skin and where the interstitial space is monitored, and
- for small volume collection, leak proof containers held within a larger receptacle.

In order to avoid the secondary containment system collecting rainwater during periods of rain, a shelter or roof can be placed over the tank and secondary containment system.

Signage requirements

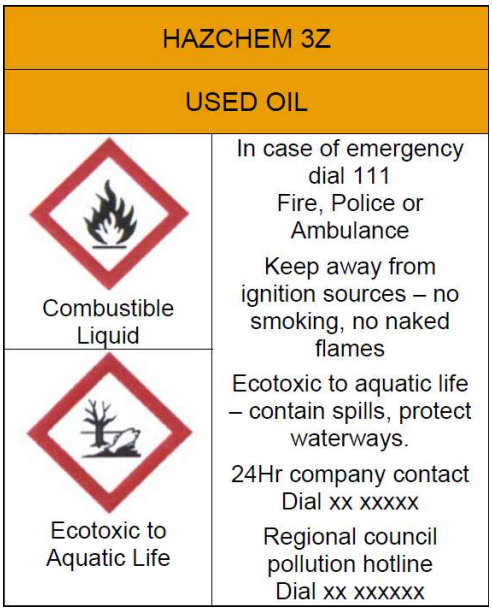
- Signage is required when the quantity of used oil is equal to or greater than 1000 litres.
- Signs must advise people of the hazardous properties of the substances that are present at a site and must have precautionary statements that tell people what to do to avoid unintended consequences.

- Signage needs to be in English, clear, easily understood, and able to be read from a distance of 10 metres.
- If the used oil is located in a building, signs must be positioned at every vehicular and pedestrian access to the building and at each entrance to any room or compartment inside the building which the used oil is located in.

These requirements are complied with by signs which show the following:

- The hazardous substances present, with the use of signal words such as HAZCHEM, or WARNING.
- The hazardous properties of the substances and the type of hazard of each substance present. If substances have multiple classifications these all need to be considered when displaying signs.
- Precautionary statements that prevent unintended ignition or combustion.
- Emergency actions to be taken in the event of an emergency.

This can be provided in pictorial form, for example by pictograms (as in the example below).
The sign below is suitable for used oils with a flash point above 60oC. (Separate consideration is required if the flash point is 60^0C or below.)



Personal Protective Equipment

A person who handles the used oil in a place of work must use protective clothing or protective equipment that is designed, constructed, and operated to ensure that the person does not come into contact with the used oil and is not exposed to a concentration of the used oil that is greater than the workplace exposure standard for the used oil, or any component of it.

Practical application of these requirements for the handling of used oil includes the use of gloves and safety goggles and a mask. Additional personal protective equipment may be necessary for other reasons for example, the use of safety boots/shoes to minimise physical injuries.

Equipment to handle the used oil

A person in charge of the used oil must ensure that equipment used to handle it—

a) retains the used oil, without leakage at all temperatures and pressure for which the equipment is intended to be used; and
b) dispenses or applies the used oil, without leakage, at a rate and in a manner that the equipment is designed for.

Appendix 2: Tanks for used oil

This appendix specifies the minimum standard for used oil stationary container systems at small volume industrial/ commercial and public collection sites that is, for tanks less than 5000 litres capacity.

Design and Construction

All new above ground tanks with a capacity of 250 litres or greater and all new below ground tanks must comply with a recognised international code of practice which should be stated on the tank, and can be manufactured from steel or fibreglass reinforced plastic. Steel tanks can have integral secondary containment to avoid the need for external secondary containment.

For used oil at controlled sites and which does not have a flammable hazard classification, that is, the flash point is greater than 93^0C, thermoplastic tanks and rotationally moulded polyethylene tanks are also acceptable. Again they must comply with a recognised international code of practice which is stated on the tank.

Information to be supplied with tanks

Tanks installed on site should be supplied with sufficient information to readily support their compliance.

Existing tanks

Tanks installed prior to the date of this code must comply with the provisions of Appendix 5 of this code.

Design considerations for tanks

In addition to the requirements of the recognised international code of practice, the following must also be adhered to:

Openings

All openings should be located in the top of the tank above the safe fill level. Where it is necessary to install an opening below the safe fill level, e.g. for use as a water drain or sediment removal, this opening must have a secure closure which is only open under the supervision of a trained person. A secure closure is one which is locked and which requires a key to open or one which requires tools to open.

Fill point

Where the used oil is tipped into the tanks from containers, the fill point is to be of sufficient size to allow easy draining of the oil containers. A mesh is to be provided in the fill point to stop the ingress of solid particles or matter.

Discharge

The discharge point must be suitable for the collection truck to pump out the used oil. If permanently fitted, the pipe on the suction discharge should terminate as close to the bottom of the tank as practicable to enable the collection of as much sludge as possible. If sludge stays in the bottom of the tank it will become hard and reduce the workable volume of the tank. Sludge is not easily removed.

Colour

The external surface of the finished tank may be any colour.

Safe fill level

The tank is to be marked, or have an indicator, showing the safe fill level.

Security

Unless unauthorised access to the tank is prohibited e.g. the tank is located in a lockable building:

- All openings for the tank must be able to be locked, and.
- Tanks are to be kept locked at all times, unless they are being loaded or unloaded.

Siting of used oil tanks

- Tanks are to be sited to minimise the possibility of leakage through malicious or accidental damage.
- The tank's location must be where there is some degree of supervision by the site operator, who has responsibility for what is emptied into the tank.
- The tanks should be sited so that oil can be safely loaded and unloaded from the tank.
- Tanks must be mounted on an impermeable surface such as concrete or asphalt. They must not be placed on soil.
- If the tanks are located near vehicular traffic, consideration should be given to the movement of vehicles. Where impact that is resulting in damage to the tank is likely to occur, protection should be installed e.g. barriers or bollards.
- Tank wagons must be able to manoeuvre safely around the site.
- Potential hazards, such as recycling and rubbish bins, should not be placed within 2 metres of a used oil tank sited outdoors.
- On sites equipped with drainage interceptors, tanks must be located within the interceptor's catchment area. On sites not equipped with interceptors, the tank should be located at least eight metres from any storm water, sump or other drain.

Tanks containing used oil may be located inside buildings:

- at controlled sites and
- when the used oil does not have a flammable hazard classification, that is, the flash point is in excess of 93 deg C5, and
- when fabricated from steel, or
- when fabricated from fibreglass reinforced plastic or plastic with a capacity no greater than 1000 litres.

When tanks are located inside, they should be located so that a used oil collection truck can park within five metres.

Tanks for the collection of used oil situated outside must be separated from buildings and site boundaries by the following separation distances. These separation distances are only applicable where there is no possibility of contamination with Category 1, 2 or 3 substances:

Table 4: Separation Distances

Tank capacity	Separation distance
Up to 600 litres	0 metres
600 L to 1000 L	1.5 metres
1000 L to 2500 L	2 metres
2500 L to 5000 L	3 metres
500 L to 25,000 L	4 metres
25,000 L to 50,000 L	5 metres
50,000 L to 100,000 L	6 metres
100,000 L to 250,000 L	7 metres

Separation distance between tanks

Tanks up to 5,000 litres capacity used for the collection of used oil must be separated from each other by 0.5 m. Tanks greater than 5,000 litres capacity or where there is possibility of contamination with Category 1, 2 or 3 liquids require greater separation distances..

Secondary containment systems

If tanks are above-ground and have a capacity of at least 1000L, a secondary containment system is required. Details are provided in Appendix 1.

Markings

All tanks used for the collection of used oil should have signs which specify the oils which are accepted and the oils which are not accepted. This sign may be mounted on the tank or in a prominent place nearby. A suitable sign is specified in Appendix 1.

Appendix 3: Spill prevention, response and clean-up procedures

Spill kit: suggested contents list
Suitable for vehicles and also sites storing up to 5,000 litres.
(This may be varied to suit local conditions if required).

Table 5: Spill kit contents

Contents	Quantity
Hydrocarbon absorbent pads	10
Bag of particulate (Oil Dry or similar)	1
Absorbent socks	1 x 1.5 m 1 x 3 m
Hydrocarbon pillows	2
PVC drain cover	1
Folding trenching tool	1
Pair PVC gauntlets	1
A pot of Vetta Paste, Plug 'N' Dike, Pig Repair putty, or similar	1
Polythene disposal bags	2
Contents list	1

Spill prevention
Key precautions are as follows:

Table 6: Precautions

Do	To prevent
Park away from traffic flows, and/or use safety cones if necessary	Tank wagon being hit by other traffic
Protect tank with barriers or bollards if there is nearby vehicle movement	Tank being hit by traffic
Dip tank wagon and site tank before collection	Tank wagon overflow
Regular inspection of hoses, pumps and other equipment	Equipment failure

If spills do occur
Any spillage or similar escape, or contamination of other products by the used oil shall, where possible, be rectified before the collector leaves the site.

- For each action, put on appropriate personal protection equipment.
- Isolate the source of spillage and close vehicle valves.
- If it is safe, contain and control the spill.
- Stop all operations in the immediate areas of concern and remove or shut down any ignition sources.
- Close the interceptor valve if there is one on site, and close and/or block any drains leading off the site.
- Report spillage to site operator.
- Start the clean-up. Request assistance if necessary.
- Ensure that any materials used in the clean-up are disposed of appropriately.

- If the spillage occurs on unsealed ground, the soil must be removed and disposed of to an appropriately approved facility – either landfill, transfer station, or hazardous waste treatment facility.
- If there is a risk of oil entering a sewer, storm water drain or natural waterway, the relevant local authority should be notified immediately.

Notice of any such incident shall be given to the appropriate agency as soon as possible by way of a report detailing the cause and severity of the incident and the remedial measures taken. Your emergency management procedures must include the possibility of a spill of used oil occurring.

Appendix 4: Tank wagon operating requirements.

Prior Use
Before a tank wagon is used to carry a hazardous substance of any hazard classification that differs from a hazardous substance previously carried:

- the tank wagon must be completely emptied of the previously carried substance; or
- the mixture of the hazardous substance with any residue of the previously carried substance remaining in the tank must not create a substance of a different hazardous property, nature, or degree.

Filling tank wagons
A person in charge of a tank wagon must ensure that a tank compartment is not filled to a level beyond the maximum filling level.

The person in charge of transferring a liquid hazardous substance to or from any tank wagon must—

- attend the tank wagon from the time the transfer of the hazardous substance commences and until it is completed; and
- ensure that, from the time the transfer of the hazardous substance commences and until it is completed, the tank wagon does not move; and before the tank wagon is moved, ensure that all tank openings are securely closed when the transfer of hazardous substance is complete.

Supervision of tank wagons
The person in charge of a tank wagon that contains a liquid hazardous substance of any hazard classification (or residue vapour from the hazardous substance) may leave that tank wagon unattended—

- in suitably managed transit depot that takes into account the hazardous nature of the tank contents; or
- on a road or elsewhere for up to 5 minutes if the tank wagon is—
    - at least 30 m away from all areas of high intensity land use other than roads;
    - and at least 8 m away from all areas of low intensity land use other than roads.

Firefighting capability
A tank wagon that carries a Flammable liquid equal or below Flashpoint 93^0C must have—

- at least 1 fire extinguisher in the tank wagon cab; and
- on each tank at least 1 fire extinguisher.

Fire extinguishers must be installed and located on a tank wagon in a way that the person in charge of the tank wagon is able to extract any extinguisher from its location and hold it ready for use within 10 seconds.

Authorised persons
A person in charge of a road tank wagon with a tank capacity of not less than 2 000 litres must, at any time a hazardous substance (or residue of a hazardous substance) of any hazard classification is contained in the tank, ensure that no person is in or on the tank wagon except the persons—

- necessary for the operation of the tank wagon; and
- who carry out maintenance, inspection, training, or management duties

Appendix 5: Existing Tanks

Existing tanks may be constructed in accordance with the following parameters:

Materials
The materials for used oil tanks shall be fit for purpose. All materials used in the construction of used oil tanks must be able to retain product for the life of the tank without leakage or deterioration from either the product contained or external conditions. To minimise the hazard from static electricity, the mixing of conductive and nonconductive materials shall be avoided in the construction of containers.

Plastic Tanks
Tanks constructed from plastic materials (including fibreglass reinforced plastic tanks) shall be capable of withstanding exposure to ultraviolet radiation in the environment within the temperature range -18°C to +55°C.

Containers made from plastics shall contain anti-static inhibitors.

When a container is moulded of polyethylene it should be tested for stress cracking in accordance with Appendix G of AS/NZS 2906:1999, and it shall not crack. **Note:** This requirement may be waived if the manufacturer can provide evidence that the polyethylene is crack-resistant.

Tanks with a capacity of less than or equal to 1000 litres,
The maximum size for fibreglass or plastic igloos shall be 1000 litres.

Capacity
The container will have an overflow capacity, to the lowest opening, not less than 105 percent of the safe fill level.

Colour
The external surface of the finished tank may be any colour.

Safe fill level
The tank is to be marked, or have an indicator, showing the safe fill level.

Tank fixing
The tank is to have suitable points for fixing to the ground. These are to be clearly identified by the manufacturer. The mountings and the tank need to be able to withstand a side force equivalent to the weight of the container and the used oil contained in the tank. The average specific gravity of lubricating oil is to be taken as 0.9. The purpose of this side force requirement is to allow for wind and earthquake forces, not for impact resistance.

Tanks compliant with this specification and which are constructed from a form of plastic material have a have a finite life of 10 years from the date of manufacture. Where the date of manufacture is not known, the tank must be removed from service within 5 years from the date of this code.

IBCs
IBCs (intermediate bulk containers) are designed as transportable containers. They are not designed for, or approved as, stationary tanks. Information on IBCs is included in section 6.8 of this code.

Annex 2 – Nufuel Technology

1.0 Overview

Nufuels Ltd is a wholly owned subsidiary of Blended Fuel Solutions NZ Ltd (BFSNZ) a New Zealand owned company. BFSNZ specialises in making fuels fit-for-purpose, and this usually involves blending with other fuels including fossil fuels if this is required. Both are based in Otaki, New Zealand and share an operational site in Foxton.

Nufuels' main focus to date has been the conversion of plastic wastes to a usable fuel using a technology and engineering that can be manufactured locally in Pacific Island countries and transported to small communities. Gaseous and liquid fuels are produced in ratios that can be varied.

Due to the nature of the system and the complexities of storing gas, the gaseous fuel cannot be stored (for example, like a 9kg cylinder is) so must be used as it is produced, although techniques have been devised to store it in containers under a small water pressure that can deliver the gas to cooking elements or a small generator, by providing a buffering effect. The storage time of the gas can be a few hours depending on maximum production and use rates, which means the gas does not have to be used immediately.

The liquid fuel is a waxy fuel in the New Zealand winter conditions that applied during a recent inspection on 7 Sep 22, but it becomes thinner in warmer Pacific Island conditions. The fuel from plastic can be used in a rocket burner, designed by Nufuels which can then be inserted into a stove and/or hot water heater. Nufuels has shown through trials that with the introduction of a reflux column and more control it can produce petrol and further gasify 95% of the plastic into petroleum gas.

The process involves pyrolysis, or heating the plastic in the absence of air, apart from the small amount of air that is trapped in the sealed vessel at the start of the "cook". The process does NOT involve incineration or burning. The sealed vessel is surrounded by a firebox that can be heated using wood or other combustible materials like Used Lub Oil (ULO) or the wax fuel.

The pyrolysis process operates at around 300-400C and causes the thermal decomposition of the plastics into shorter carbon chain products (liquid and gas) and a small amount of ash remains. Chlorinated plastics such as PVC must be excluded, and sea water salts must be washed off, to avoid the production of dioxins and furans. If PET plastics are processed, then a ratio of PET to polypropylene/polyethylene (PP/PE) must be observed to avoid the production of condensed tarry solids such as benzoic acid that can cause blockages in the pipework.

A Solomon Islands project based on Nufuels technology that was funded by MFAT is described below in Section B. There is also a current UNDP project underway in the Solomon Islands.

2.0 History of the NuFuels Plastic Waste to Energy Programme in the Solomon Islands.

2.1 History of Project Concept

The NZ Government (MFAT) funded a pilot project delivered by three partners – the Solomon Islands Association of Rural Vocational Training Centres, Nufuels NZ Ltd (the developer of the system) and Caritas Aotearoa who work in the Solomon Islands which took place during 2018-2020. The project was set up to create an incentive/ value for local people to collect plastic waste by being able to easily process the plastics into usable energy in a way that saves them money.

This allows local people to substitute the energy they recover from the plastics for the purchase of gas, or diesel or burner fuel. This energy can be used in homes or cooking huts, to use as heat for small businesses (e.g. drying of foods for markets) or boiling clean water. The gas produced can be used in small petrol generators (e.g. to run lights or electric tools).

As much as possible the build is to be local (either Don Bosco or other RTCs), with the idea that a small business in partnership with Nufuels in NZ could be created.

Alongside the actual build and costed into the systems is:

- project co-ordination – locals would work along with NZ project members, to identify how the energy could be used. The NZ co-ordinator would work with each community to monitor operator safety and look for wider applications.
- training
- a minimum of a year-long commitment from NZ to really get the full benefits from the system. This support in the first year is very important.

2.2 How it Works: The Retort and Condenser

The process used is pyrolysis – the cracking of hydrocarbons in the absence of oxygen. Plastic waste is put into a closed chamber surrounded by a firebox which can be fueled by wood. The process can accept biomass, tyres, used lube oil and plastics coated in aluminium.

A formula of PE and PP plastics to a ratio of PET allows PET bottles to be processed.

The chamber is heated up and the hydrocarbons are cracked turning it into gas. It is <u>not</u> incineration. Depending on the system design, the gases can be flared off directly for heat with a small amount going through a condenser and becoming liquid fuel. If more liquid fuel is wanted rather than mainly gas, then more liquid fuels can be produced.

2.3 Products

Gas with a similar profile to LPG or natural gas is produced, together with a liquid fuel and a very small amount of solid fuel. The current two systems in the Solomon Islands produce about **20%** gas in real time and **80%** waxy liquid fuel which can be used in burners. The waxy liquid fuel while usable in burners is not easy to use in the oven that has been developed.
Recent development work back in NZ now removes most of the wax and produces a more 'runny' liquid fuel which makes it easier to use in the oven and 'rocket' burner that have also been designed by Nufuels for the community.

The further development work since late 2019 has also resulted in the ability to produce **80% gas** with the remainder a liquid fuel. This gives more flexibility to communities around what kind of

energy they want. A flare burner has also been produced which can use the gas to temperatures of up to 800 degrees. As these improvements are developed they will be provided back to the communities who have systems.

At present the gas would be used virtually real time alongside a cook but there is potential to design a simple storage system (under minimum pressure).

With simple adaptations to small petrol generators the gas can be used to produce electricity.

2.4 Unit Design

The unit is designed:

- to be easily transportable, including by small boats. The NZ government who part funded the project for the two systems at Henderson and Munda, was particularly interested that the systems around Munda and places like Gizo could be used to keep the lagoon water clean.
- for easy use by women as well as men.
- so simple tools can be used for repairs.

2.5 Rocket Burner and Oven

The rocket burner and oven were developed by Nufuels to provide options for using the energy for households' end use, or small businesses. This simple burner was developed from adapted LPG bottles to take either the waxy liquid fuel or a dripped fuel into the burner. These items can be built locally.

2.6 Environmental and Health Impacts and Benefits

2.6.1 Waste Diversion

The current adopted design delivers the following waste diversion results[1]:

- One system can deliver between 2-3 cooks per day, each taking about 120 minutes (followed by a cool down period)
- Each cook will process 5-6 kgs of soft plastics and about 2-3 kgs of plastic bottles, or up to 21 kgs per day. Measurement by volume can be undertaken but is less useful as compression will vary.
- On average each person from a low-income household in Honiara produces about 0.1 kgs of plastic per day, or 36.5 kgs of plastic waste per year. Honiara City Council Waste Characterisation Study 2011 and National Waste and Pollution Control Strategy 2017-2026
- One system will remove the following waste quantities annually from the environment under low, medium and high use scenarios:

Table 1: Waste Diversion

Use Scenarios	Annual Waste Diverted (kg)
Low (I daily cook)	1827
Medium (2 cooks)	4382
High (3 cooks)	7665

One system will divert the household waste of the following number of households:

Table 2: Household Waste Diversion		
Use scenarios	Number of households with full plastic waste diversion (Average Household size [1])	Number of low-income households with full plastic waste diversion[1]
Low	11	9
Medium	23	18
High	35	26

These metrics are calculated using Honiara City waste data which identified approximately 0.86kg of waste per capita per day overall. Low-income households generate about 0.81kg. Of this about 12% is plastics. Per capita and household waste produced is likely to be lower in provincial communities. These smaller communities will also have commercial and some small-scale industrial waste plastics which these systems can also process. A key issue will be processing waste plastic washed in on ocean currents.

Note: the current design may be adapted in the future to perhaps take up to 10-12 kgs per cook.

2.6.2 Waste management

Plastics do not have to be clean or sorted but if retrieved from the sea or beaches a simple wash down in the rain to remove salts would prolong the life of the system.

- The systems can be used for people to revisit into old dump sites and clean up plastics – e.g. at Ranadi tip or illegal dump sites.

2.6.3 Emissions and Climate

The energy produced is still from fossil fuels so there will continue to be impacts.

- The benefit lies in the fuel substitution which avoids greenhouse gas emissions associated with oil extraction, transportation to the Solomon Islands etc. A nett 20% reduction is estimated.
- The technology can be used for other sources, e.g. used oil and biomass such as copra waste.
- Discharge of toxic gases and particulates are avoided from burning of plastics as a disposal method.

2.6.4 Nature of Emissions

There will be emissions from the wood fuel charging the retort

- The emissions from the fuel produced have a similar profile to LPG or natural gas, and diesel/ kerosene like fuels. These have been independently tested in New Zealand against New Zealand discharge to air standards. That data can be provided.
- The combusted gases burn cleanly with no particulates at temperatures rising up to 500-800 degrees Celsius.
- There are health benefits from avoided exposure to the burning of plastics.

2.7 Social and Economic Benefits

A simple calculation of the value of the energy as a substitution fuel is shown below. The tables are based on a 20% gas production rate: with recent improvements an 80% gas production rate can be achieved. It shows the benefit from imported fuel substitution – through measurement of recovered energy (liquid and solid) generated per annum, and the net of energy used to power on-going batch pyrolysis.

The table below shows the conversion of the annual energy produced relative to standard purchasing units for four energy types (LPG, diesel, kerosene and wood) across the three cook scenarios. In effect this illustrates the level of substitution for commercial fuels that is achievable from one system.

Table 3 - Annual Energy Produced by One System Calculated as Substitute Energy Type – Usual Unit of Purchase				
Substitution for Commercial Fuels for One Year				
	LPG **No. of 9kg gas bottles**	**Diesel** **Litres**	**Kerosene** **Litres**	**Wood** **No. of 6kg bundles**
Cook Scenarios				
Low (1 cook per day)	141	1,352	1,339	623
Medium (2 cooks)	338	3,244	3,214	1,496
High (3 cooks)	591	5,678	5,625	2,618

The substitution value for wood is shown as an example and for information. However, the focus in the pilot is on substitution of liquid fuels and gas.

The table below shows the potential income arising from fuel substitution from one system, under the more conservative processing scenarios. Whether this is realized as avoided energy costs or as revenue from fuel sales will depend on decisions by communities as to how they want to use the fuel and disperse the benefit.

Table 4: Financial Value of Annual Energy Produced buy One System Expressed as Energy Type (Usual Unit of Purchase) - SD$ (2019)				
	LPG No. of 9kg gas bottles	Diesel Litres	Kerosene Litres	Wood No. of 6kg bundles

Cook Scenarios				
Low (1 cook per day)	$21,095	$11,439	$10,995	$93,572
Medium (2 cooks)	$50,627	$27,452	$26,388	$224,573
High (3 cooks)	$88,598	$48,042	$46,179	$393,002

Benefits are potentially greater in rural locations due to the higher cost of fuel.

This has the potential to be used as a proxy for calculating direct financial return on investment. (NB It does not include any multiplier effect from the energy use – e.g. use in small business development.)

It also indicates a significant financial incentive for people to be involved in collecting and processing waste – which would also avoid the need for a collect and transport system.

2.8 Usefulness in Outer Islands

The central idea of this concept and programme is that small local and remote communities are self-sufficient in converting their plastic, used oil, tyres (if any), and biomass to usable energy locally. (Nufuels is passionate about the idea of dispersed waste recycling and resource recovery systems which avoid collection and transportation costs and complexities.

The units can be used locally with the benefits going back to the local communities. For example, the heat from a system could be used to melt tin cans and even create new objects from them, or to process food, or reduce the energy costs of the local Rural Training Centre, or produce electricity on a small scale.

The idea is to avoid the need to collect and transport the waste over any distance. The systems themselves can be transported on the back of a truck or by small boat to other communities so that any local village-based waste can be processed. They can also be transported to areas where there is significant marine pollution.

The model we were working to before Covid 19 was to get local businesses (e.g. tourism businesses at Munda) to help with the transportation of the system between communities, but there are other ways of making this happen.

The key thing for each remote community or grouping of communities is to have a waste stream size that makes processing on a regular basis worthwhile. Other waste streams can also be included. Very small communities who produce little plastic or other waste may not benefit to the same degree from systems of the size designed here. However, building smaller systems – as small as a large cooking pot, may be useful.

3.0 UNDP Small Projects Fund Initiative 2021-2022 Solomon Islands

3.1 Project Description

The project provides:

- the build of three community scale systems in a Nufuels partnership with the Design and Technology Centre, Henderson. Nufuels supplies some materials not obtainable in Honiara and works with the Centre to develop other waste minimisation and recycling initiatives.
- three systems being deployed to:
    - St Martin's Rural Training Centre (RTC) Honiara,
    - Kaotave RTC, Guadalcanal
    - Divit RTC, Visale, Guadalcanal
- 6-9 months of training and community liaison to embed the systems in community management and optimise the energy returns and benefits for each community.
- working with St Martin's and Kaotave trade skills teachers and students to have them build the simple rocket burners and ovens/ water heating system which can use the waxy crude created by the cooks.

3.2 The Concept

- create a simple technology which can recover usable energy from the waste plastic using a process called pyrolysis (see background sheet)
- design the technology so it can be used by women as well as men and is easily moved
- provide communities with this technology to extract the energy from the plastic
- help combat poverty by households/ organisations substituting this recovered energy for purchased fuels
- help create local jobs building the systems and using the recovered energy – e.g. food drying for sale
- help reduce green-house gas emissions by using this recovered energy (20% reduction over standard fuels due to fuel substitution

3.3 How the Project is Organised and Funded

The project is funded by the UNDP Small Projects Fund and delivered via a partnership between Nufuels Ltd (technology developers and project management) and the Solomon Island Association of Vocational and Rural Training Centres (SIAVRTC – financial administration and liaison with key stakeholders)

- build of systems in Honiara undertaken by the Design and Technology Centre, Henderson, Honiara (delivery partner with Nufuels Ltd)
- three days intensive training for each community delivered by Lindsay Teobasi, previous coordinator in 2018 pilot project.
- on-going community engagement, monitoring and training via contracted community coordinators based in Honiara and Munda working with three communities and two other communities with existing systems.

3.4 Progress to Date

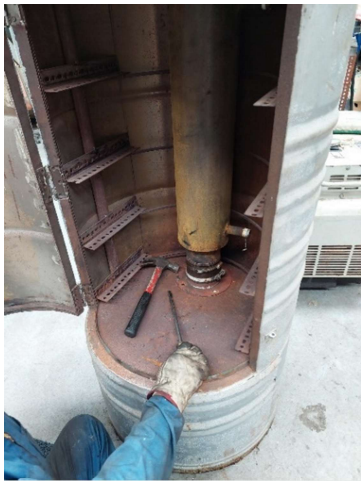
The project started in July 2021 and since then:

- there have been some delays due to Honiara riots and subsequent impacts of Covid 19
- the build of systems completed and systems tested and commissioned by early April 2022

- training and roll-out to RTCs are completed, co-ordination and liaison on-going.

The photos below are taken of the Solomon Islands work.





4.0 Visit to NuFuels in New Zealand on 7 Sep 22

4.1 Visit Description

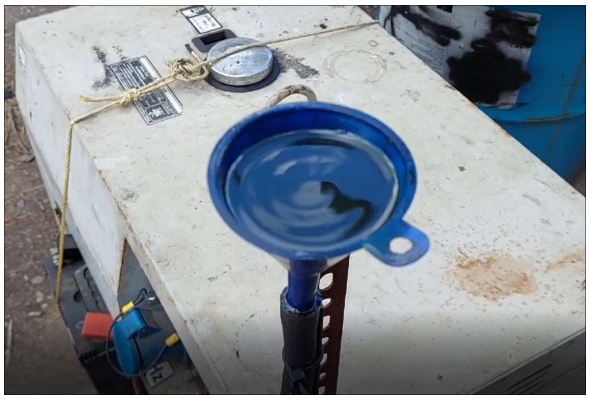
The visit on 7 Sep 22 to the Nufuels operational site at Foxton (by John O'Grady and others) was to assess the technology for processing Used Lube Oil (ULO). A "cook" of used oil was carried out over a two-hour period as demonstrated by the following photos. A small amount of a gaseous product was also produced that was burnt on a cooking ring. As with the plastic, the incorporation of a reflux column and more control in trials has shown Nufuels can gasify the ULO into usable petroleum gas which can be used for heat (flame) and used for spark ignition generators.
The photos below were taken from the visit on 7 Sep 22.

Used Oil Poured into the Pyrolysis Unit

Lid Placed on Pyrolysis Unit

Liquid Fuel (diesel type distillate) Product from the Cook

Residual Ash after Cook (approx. handful)



Liquid Fuel Product Operating Generator

Gas hob burning gas produced

Nufuels also demonstracted straight ULO being used as an input energy to the pyrolysis process, and also input into a water heater

4.2 Matters Demonstrated in Visit

The visit thus proved that:

- Used oil can be converted by the pyrolysis process into a usable fuel. The fuel (unfiltered) looked like diesel – darker than diesel but perhaps a little lighter in viscosity.
- The diesel ran a small generator for quite a while with no obvious problems. It could run other diesel engines like tractors and excavators with older style injection systems.
- A useful gas was also produced that can be stored under low water pressure for a few hours and used to cook meals or heat water, or gas generator
- A small amount of ash was produced that could be landfilled.
- The scale of demonstration was quite small – about 8 litres of used oil. This was simply transferring the same kgs of plastics as a starting point for ULO as a relative comparison. The Nufuels team advised, however, that they will be upping the volumes in stages to 20-30 litres per cook batch.
- There is potential to increase the overall retort capacity with R & D with a goal of increments of 50, 100, 150, to 200 litres capacity for a similarly simple system.
- Nufuels also has expertise in ULO collection, storage, processing and safe efficient combustion of ULO for heat for larger volumes.

4.3 Conclusions from Visit

a) Based on the findings above, the Nufuels process can readily convert used oil into two very usable fuels – one liquid and one gas.
b) The process can also be set up locally without too much difficulty, and the liquid and gas products can also be easily used locally, allowing for significant cost savings although some fuel is needed to fire the pyrolysis unit. ULO can be used as an input energy to run the initial process.
c) More investigation is needed to establish the fuel use and the costs of local set-up, and also the training needed, for the conversion of used oil. Costs of a system, building, training and roll out will be very similar to the cost of a system for plastics processing and data can be provided.

d) More information is also needed on the feasibility of scaling up the process so that much larger quantities of used oil can be converted using the pyrolysis process.