Analysis Report Solomon Islands

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

SPREP
Secretariat of the Pacific Regional Environment Programme

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

Analysis Report
Solomon Islands

July 2022

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Executive Summary

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 particular 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.

Each project will be done in five stages:

- Inception – introductory meetings and desktop study of available information
- Analysis – gathering current data and discussions with stakeholders
- Feasibility Study – preparation of a feasibility study report for consultation
- Draft Used Oil Management Plan – the plan will be based on the feasibility study and consultation
- Final Used Oil Management Plan – finalisation of the plan after further consultation and feedback.

This report is the Analysis Report for the Solomon Islands component of the work. This phase of work was essentially local data gathering and Gaylyn Puairana interviewed a large number of people to gather the data, both in person and by phone.

The following conclusions were drawn as a result of the data gathering work:

a) Based on information supplied by the Solomon Islands National Statistics Office, there was about 100,000 litres of oil products imported in 2021. This figure is considered, however, to be very low. A more realistic estimate of oil products imported, based on data gathering from importers, is probably about 1.25M litres.
b) It has been calculated, taking into account used oil generation from all relevant oil products, and an increase in economic activity in 2022, that the volume of used oil generated is probably about 600,000 litres plus/minus 10%.
c) There is very limited storage capacity for used oil in the Solomon Islands. South Pacific Oil have significant product storage capacity and have indicated their willingness to discuss the possibility of providing a portion of their site for a

national used oil collection and storage depot. South Pacific Oil currently provides a used oil take-back service for their main clients.

d) The National Fisheries Development Company have a large used oil storage tank on their site at Noro (30,000 litres).
e) There are two local reuse options in industrial processes, namely Soltuna (fish processing) and Islands Own (coconuts). These are being used to capacity now.
f) A large amount of used oil is being used for timber rot control, dust suppression, corrosion control, as chainsaw bar oil, or in other ways that could generally be deemed to cause environmental and health risks.
g) The remainder of the used oil is just being disposed of to land (including landfills) or to waterways.
h) There are some potential additional local reuse /disposal options available that may be satisfactory, including hospital incineration, Solomon Islands Brewing Company and Guadacanal Plains Palm Oil Ltd.
i) The NuFuels process currently under trial in the Solomon Islands for plastics processing and reuse may also offer a potential used oil processing and reuse option.
j) There are stated government priorities for the management of used oil that require effective management to protect human health and the environment.
k) This data gathering phase of the project has been difficult due to pandemic restrictions and the reluctance of some stakeholders to engage, but it is considered that sufficient information has been gathered to move on with some confidence to the next stage of the project, i.e. the Feasibility Study.
l) The Feasibility Study will aim to come up with a clear direction, backed with supporting evidence, for the preparation of a detailed National Used Oil Management Plan.

Abbreviations

AFD	Agence Française de Développement
BPS	Bluescope Pacific Steel
CBSI	Central Bank of the Solomon Islands
COP	Code of Practice
DTC	Design and Technology Centre
ECD	Environment and Conservation Division
EH	Environmental Health (part of the Ministry of Health)
GDP	Gross Domestic Product
GEFPAS	Global Environment Facility - Pacific Alliance for Sustainability
GPPOL	Guadalcanal Plains Palm Oil Ltd
HCC	Honiara City Council
ISPS	International Ship & Port Security
KFPL	Kolombangara Forest Products Ltd
MECDM	Ministry of Climate Change, Disaster Management & Meteorology
MMERE	Ministry of Mines, Energy and Rural Electrification
NDMO	National Disaster Management Office
NFD	National Fisheries Development Company
PAWES	Pacific Adoption of Waste-to-Energy Solutions
PE	Pacific Energy
PE	Polyethylene
PET	Polyethylene Terephthalate
PP	Polypropylene
PIC	Pacific Island Country
PPE	Personal Protective Equipment
SIMA	Solomon Islands Maritime Administration
SINSO	Solomon Islands National Statistics Office
SINU	Solomon Islands National University
SIPA	Solomon Islands Port Authority
SIRWMA	Solomon Islands Recycling and Waste Management Association
SolPower	Solomon Power
SPC	The Pacific Community (Secretariat of the Pacific Community)
SPO	South Pacific Oil
SPREP	Secretariat for the Pacific Regional Environment Programme
SWAP	Committing to Sustainable Waste Actions in the Pacific
TEU	Twenty Foot Equivalent Unit
TT	Tanktainer
UNEP	United Nations Environment Programme

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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) offer some of the richest areas of biodiversity on the planet. These areas, and their island communities, 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, production, and waste generation. Much of the waste generated through these imported products cannot economically be 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. Polluted and degraded environments therefore pose a significant threat to PICTs.

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As part of this process, in December 2021, *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 9-month contract by SPREP/AFD to develop used oil management plans for Samoa, Solomon Islands, Tonga and Vanuatu.

The 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 will be a National Used Oil Management Plan for each country. This Analysis Report focuses on the Solomon Islands.

1.2 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
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

1.2 Used Oil Background

Used oil is defined as any petroleum-based or synthetic oil or fluid used as an oil that, through contamination, has become unsuitable for its original purpose due to the presence of impurities or loss of original properties. This covers all used oil consistent with the classification of hazardous waste under the Waigani[1] and Basel Conventions[2]. This 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.

1.4 Analysis Report

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

- **Document** used oil production and existing used oil collection, storage, treatment, disposal and export services to determine logistical issues and opportunities related to national used oil management; and to

[1] *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).
[2] Basel Convention on the control of transboundary movements of hazardous wastes and their disposal and Annexes and Amendments (1998)

- **Analyse** these findings with respect to government and stakeholder priorities determined at the inception stage of the project.
- **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.

1.5 Assistance Provided

The writers hereby acknowledge and thank the Ministry of Environment, Climate Change, Disaster Management & Meteorology (MECDM) for their assistance with the scheduling of meetings and interviews with key stakeholders and other stakeholders. Particular thanks is due to Wendy Beti and Debra Kereseka.

The writers also thank all stakeholders interviewed for their time and information provided during interviews.

2.0 Relevant Issues, and Procedures Used for Data Gathering

2.1 Summary

Due to Covid restrictions, data gathering has been restricted mostly to the use of Zoom meetings to interview key stakeholders and gather data. This process while necessary to keep the project moving forward, has been less than ideal and has not always allowed key functions such as site inspections to happen. The project lead consultant Boyne Drummond was not able to travel to Solomon Islands to conduct face to face interviews and inspections on site, although the local consultant Gaylyn Puairana has worked diligently with Boyne Drummond remotely to collect as much data as practicable.

Data gathering has been achieved by asking stakeholders specific questions about oil volumes purchased, and used oil volumes generated and disposed. Where possible these questions were provided to stakeholders before the interview. Many key stakeholders have undertaken to reply later with this information, which has required further follow-ups.

The questions were supplemented by more general discussion about company and site activities. There is evidence based on replies to questions that data record keeping is not always done well, and that data is in some cases either not recorded or there is difficulty recovering pertinent information from databases.

Again due to Covid restrictions, it has not been possible for the local consultant to visit all remote districts, due to the disruption of transport services caused by Covid. Gaylyn Puairana and Wendy Beti of MECDM did, however, visit Western Province.

In addition, due to the need to complete the project in a reasonable time, not all stakeholders have been interviewed. Therefore the emphasis has been on interviewing all key stakeholders and a cross-section of other stakeholders in order to establish a credible assessment of the used oil situation in Solomon Islands.

2.2 Used Oil Sources

Used oil can originate from many sources and the following sources were explored:

- Engine oil – typically includes crankcase oils from gasoline, diesel and LPG/CNG engines (often the main sources)
- Engine Oil Filters and how they are managed
- Brake fluids
- Gear oils

- Transmission fluids
- Hydraulic oils and fluids
- Compressor oils
- Refrigeration oils
- Industrial process oils
- Electrical insulating oil (Care must be taken to exclude oil likely to contain PCBs)
- Heat transfer oils as used in electrical transformers
- 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.

2.3 Sources of Used Oil Contamination

Some potential sources of contaminated used oil can require special management, mainly for safety reasons, especially flammability and toxicity. These include:

- Petroleum distillates used as solvents, such as turpentine, kerosene, parts-washing solvents
- Petrol and/or diesel (including biofuels) – including mixtures from refueling errors

The most likely source is retail fuel outlets where mixtures can arise from fueling errors, ie a diesel powered vehicle is filled with petrol. Usually the most convenient solution is to dump the pumped out petrol into the used oil collection drum. This results in a flammable mixture which then requires special handling and placarding. The mixture can be can be diluted with other used oil collections at a consolidation depot, thereby mitigating the problem. This issue will be addressed in the draft Used Oil Management Plan under special provisions for retail fuel outlets.

Other similar waste streams that are not compatible with used oil, must be segregated out of the collections. These include:

- Antifreeze, radiator flushing, or other inhibitor packages
- 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)
- Water soluble cutting fluids

Any used oil suspected of containing PCBs will need to be tested. Testing can be carried out with test kits but the test kits contain sodium and cannot be imported by air freight. The alternative is to send samples to New Zealand or Australia for testing. PCB contamination arises from old transformer oils and most of this old transformer oil was removed as part of a SPREP Persistent Organic Pollutants (POPs) removal project in 2005. It is possible, however, that some may still remain as only out-of-service transformers were dealt with in 2005.

The used oil analysis activity did not address or seek out these incompatible waste streams.

2.4 Inappropriate Uses of Used Oil

There are several methods for disposing of used oil that are inappropriate. The following examples were identified and discussed during interviews with stakeholders:

- disposal on the ground, or into watercourses, sewers or drainage systems
- 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
- open-air burning
- combustion in, for example, kerosene burners .

There may be other practices that were not specifically identified, in which the used oil may cause contamination of the environment, ground and groundwater, migration to watercourses, contamination of air or have negative impacts on humans, plants, animals or other organisms.

2.5 Methods of Used Oil Management

Existing methods of used oil management in the Solomon Islands, including collection and storage, were investigated by questioning key stakeholders and a selection of other stakeholders. The following issues were identified:

- A mixture of 205 litre steel drums and IBCs (intermediate bulk containers) are used on most sites for the collection and storage of used oil. These should be sound and of good quality, however it is clear that is not always the case.
- Steel drums will corrode and leak, especially where the used oil is mixed with water. Storing drums on their sides can help to stop rusting of the seams.

- Plastic will deteriorate, especially if left in the sun. Plastic drums and IBCs left in the sun are susceptible to UV light which will break down the plastic. It is clear that many drums and IBCs are not under cover which may create leakage problems.
- Bulk storage facilities must be maintained in good condition, regularly inspected and have good secondary containment (bunding). They need to have proper spill control equipment, fire extinguishers and emergency response procedures in place.
- Long term storage may result in the accumulation of sludges due to settlement of solid fractions that are difficult to remove by pumping.

2.6 Methods of Data Collection

Data gathering has been achieved by asking stakeholders specific questions about oil volumes purchased, and used oil volumes generated and disposed. Where possible these questions were provided to stakeholders before the interview.

Many key stakeholders have undertaken to reply later with this information, which has required further follow-ups. The questions were supplemented by more general discussion about company and site activities. There is clear evidence based on replies to questions that data record keeping is not always done well, and data is either not recorded or there is difficulty recovering information from databases.

The list of questions asked is contained in Appendix 1.

3.0 Previous Used Oil Reports.

3.1 Issues identified by Used Oil Audit 2014

The report was written by Golder Associates for SPREP. It presented the findings of the audit based on in-country visits, interviews and data collection undertaken by Golder in July 2014. The main issues from the report are listed below:

- Two major importers supply lubricating and hydraulic oil (South Pacific Oil & Markwarth)
- Solomon Power is a major oil consumer. Others are motor companies & the timber industry.
- In 2015, oil imports averaged 1.6 million litres per year between 2011 & 2013.
- The report estimated that there should be 800,000 litres of used oil per year recoverable for recycling. No data was offered to verify how much used oil was collected or what volume was exported for recycling.
- There was a major need for stakeholders to see used oil management in a more transparent and accountable way.
- The report did not include a mass balance inventory that examines sources of used oil, quantities of used oil generated, stockpiles of used oil and estimated losses to enable an assessment of the level of used oil mismanagement.

3.2 Report on the Cost Benefit Analysis of Used Oil Management Options for the Solomon Island 2015.

The objective of the report was to compare the environmental impacts and benefits in a product end-of-life scenario for certain management systems of waste oil disposal that were identified as specific to the Solomon Islands.

The rationale was to have a collection and management system established for used oil that was environmentally preferred; hence other management methods such as for dust control on roads, logging industry chainsaw blade lubricants, or dumping in the environment, were then not considered.

The outcomes of a sustainable used oil management system were:

- Assured compliance with legal requirements and national regulations.
- To minimize/eliminate adverse effects of used oil on the environment and the health of people.
- Implementation of a fair user pays concept with used oil generators using the preferred disposal method put in place by legislation and the imposition of levies.

- To encourage recycling where appropriate and cost-effective disposal of used oils.

The report noted the total imported lubricants per year into Solomon Islands at 1.6 million litres (2015). Identified volumes of used oil constituted about 38% of the total, were estimated to be about 608,000 litres. At the time of the report there were no formal collection systems in place, for used oil generators.

The in-country options identified in the report were:

- Recycling – requiring capital investment to set up micro recycling plant, producing a refined bi-product to be blended with diesel or for use as industrial or heating fuel.
- BlackDiesel – blending used oil with diesel to reduce diesel fuel requirements.
- Batch Incineration – Units can be portable and clean burning due to multi-chamber combustion design, units can dispose a variety of general and industrial wastes including those contaminated with hydrocarbons.
- Offshore shipping for disposal was considered expensive and not sustainable in the long term.

The report included a cost analysis of the options, including the cost of specialised equipment, collection, shipping and operating expenses. These costings, when updated, can provide useful guidance for the current project.

A comparative cost/benefit summary for the options was presented with recommendations indicating that the most practical disposal/treatment methods were a combination of recycling and incineration.

4.0 Organisations and Personnel Interviewed.

4.1 Status of key stakeholders consultations undertaken

Table 2 below presents the status of the key stakeholder consultations undertaken.

Table 2 – Schedule of Stakeholder Consultations

Ref	Stakeholders	Status of Consultation
1	Solomon Islands Maritime Authority	Done
2	Kosol/Hyundai	Done
3	Soltuna	Done
4	Solomon Power	Done
5	HCC Waste Management	Done
6	Petroleum Division	Done
7	Energy Division	Done
8	Ela Motors Ltd	Done
9	Solbrew Ltd	Done
10	National Fisheries Development	Done
11	GPPOL ltd	Done
12	Ministry of Forestry	Done
13	Customs & Excise Division	Done
14	National Statistics Office	Done
15	Mines Division	Done
16	Solomon Islands Ports Authority	Done
17	South Pacific Oil	Done
18	Markwarth Ltd	Done
19	Solomon Islands Tobacco	Done
20	Win Win Mining Campany	Done
21	United Auto (Tongs)	Done
22	Gafung	Done
23	Motor Coorporation	Done
24	Ministry of Forestry	Done
25	GTL	Done
26	SINU	Done
27	SI Recycling & Waste Management Association	Done
28	Environmental Health Division-Ministry of Health & Medical Services	Done
29	Solomon Motors	Done

Ref	Stakeholders	Status of Consultation
30	Goldridge	Done
31	Environment Division -MECDM	Done
32	Guadalcanal Plains Palm Oil Co (GPPOL)	Done
33	Islands Own	Done

4.2 Status of Other Stakeholder Consultations

Table 3 below presents the status of the remaining stakeholder consultations.

Table 3 – Status of Other Consultations

Ref	Stakeholders	Organization	Status of Consultation
1	Waste Management	Gizo Town Council	Done
2	Waste Management	Malaita Provincial Government	Not Yet
3	Environmental Health Division	Central Provincial Government	Done
4	Works Division	Isabel Provincial Government	Not Yet
5	Environmental Health Division	Makira Ulawa Province	Not Yet
6	Environmental Health Division	Temotu Province	Not Yet
7	Solomon Soaps Ltd		Not yet
8	KFPL		Done
9	Didds Service Station		Done
10	Solomon Telekom		Not yet
11	Douglas Salvage & Towage		Not yet
12	Tradco Shipping		Not yet
13	Solo Gas		Not yet
14	Quan Chee Motors		Not yet

4.3 Stakeholder Interviews – Government

4.3.1 Ministry of Health – Environmental Health

EH manages operating approval licenses for business and industries. There are no formal audit procedures, specific rules or record keeping systems in place to monitor business operators that could be extended to cover used oil management practices. EH responds to complaints from the public. They receive up to 20 complaints per day.

EH acknowledge there is a need for a system to record complaints and strengthen monitoring. There have been instances of oil spills going into stormwater drains. EH have some information about the marine oil spill from the MV Solomon Trader on Rennell Island in February 2019.

4.3.2 MMERE Petroleum Division

This Division advises the Minister on Petroleum exploration and development. There is the possibility of an offshore exploration site in the future which could generate wastes including used oil. Data collection and sharing on fuel imports is an issue.

There are currently no offshore exploration or drilling activities. There is a plan in the near future to consider construction of a refinery, however significant survey work and studies would have to be undertaken beforehand.

4.3.3 MMERE Energy Division

This Division is working on the PAWES project, a SPREP/SPC partnership to develop waste to energy projects using solid waste. Used oil could be incorporated into the solid fuel. The Division is responsible for compliance and inspections in accordance with the Petroleum Act. The need to improve capacity and resources to manage fuel and oil supplies was identified. The Environment Act is under review, and should include a section on managing used oil.

4.3.4 Solomon Power

Solomon Power (Solpower) purchases lubricating oil from South Pacific Oil (SPO). The volume has averaged 82,592 litres per year since 2012. In 2021 90,649 litres were purchased. Used oil volumes have been recorded since 2019 (920 litres) and were 2,920 litres in 2020 and 2,740 litres in 2021. Used oil is stored in 200 litre drums.

Solpower have a used oil take back arrangement with SPO. Solpower Honiara do not have a bunded store for used oil.

Solpower also purchases on average 1,000 litres of transformer oil per year. A ready use stock or 2,000 litres is held for topping up low oil levels in transformers and emergency requirements. Used transformer oil is mixed with other used oil for return to SPO.

4.3.5 Honiara City Council

HCC acts on instructions or recommendations received from Environmental Health (EH). EH has the statutory responsibility. Working together is a continuing challenge. HCC have well qualified officers who can serve litter notices but are limited by the Act and have no enforcement powers. Business licenses are issued by HCC, only with approval from EH. There appears to be no record keeping of compliance and inspections.

4.3.6 Solomon Islands Port Authority. (SIPA)

SIPA does not accept used oil from ships as the equipment to deal with it is not readily available. SIPA officers operate in accordance with the International Ship & Port Security (ISPS) Code. SIPA officers work closely with the National Disaster Management Office (NDMO) to deal with any oil spills. ISPS Inspection teams conduct annual audits of SIPA.

SIPA does not deal with used oil from international or domestic vessels unless there is an oil spill. Since 2006 SIPA co-ordinates with SIMA and South Pacific Oil (SPO) to manage oil spills. SPO provides the oil booms.

SIPA generates small quantities of used oil from workshop activities. Used oil is stored in 205 litre steel drums, and distributed to staff to take home for personal use.
SIPA operates an incinerator which uses on average 100 litres of diesel per burn. Potentially diesel could be replaced with treated used oil.

4.3.7 Solomon Islands Maritime Administration (SIMA)

SIMA stated that used oil from vessels is not properly managed or monitored, and consequently becomes an issue for SIMA. SIMA is unable to provide any data on volumes of oil removed from vessels and disposed onshore, this is not checked or monitored. SIMA is not aware of any policy on used oil management.

SIMA would like to see a monitoring programme to give SIPA more powers to undertake pre-departure inspections on board vessels to strengthen compliance with regulations including used oil management.

4.3.8 Ministry of Forests

The ministry is responsible for implementing:

- Forest Resources and Timber Utilization Act 1969 Amended applied from Western to Temotu Province.
- North New Georgia Forest is managed under North New Georgia Timber Cooperation Act 1984.

These Acts provide the basis for the Forest Regulations 2005 and a National Forestry Policy, September 2020. Total land mass of Forests in the Solomon Islands is 28,000 square Kilometers. 90% of Solomon Islands land area is covered with forest – 6 different types of forest. 22% of the total mass is currently logged – 17% of 22% is already logged out and only 5% is virgin forest that will probably be logged out in the next 10 years.

Solomon Islands will depend on regrowth to harvest after the next 10 years and 68% is protected forest under the Protected Areas Act. Waste management and generation of used oil is mainly around the area of logging operations where numerous heavy machines are used. Used oil contamination is mainly associated with logging operations.

Logging contractors: there are 301 Valid licenses. There are 144 active licensed contractors in 9 provinces.

Milling operations: There are 127 milling licenses in 8 provinces. Directly interviewing all license holders for this project was not practical.

A questionnaire was sent to Ministry of Forests provincial offices requesting information on used oil volumes generated and used. So far 6 replies have been received. Purchases are typically less than 150 litres per year, for use on plant and vehicles maintenance. However given that a very small percentage of the industry was interviewed or replied to the survey, this figure is not reliable and the overall industry usage could be significantly higher than 150 litres per year per company.

Used oil is stored in drums and taken by the local community for domestic use and chainsaw blade lubricant.

4.3.9 Solomon Islands National University (SINU)

SINU delivers educational programmes to automotive engineering students, and programmes include teaching best practices for use, storage and re-use of oil based products.

Specifically two courses apply: SIAUE4008 – Diagnosis and Repair of light vehicles with hydraulic braking systems; and SIGEN3003 - Apply environmentally sustainable work practices. Also there are automotive engineering certificate courses for light and heavy vehicles including modules for use and disposal of oil products.

SINU has a large fleet of light vehicles, and uses Ela Motors (Toyota) and Kosol Corporation (Hyundai) for vehicle servicing. Therefore SINU is not classified as a generator of used oil. SINU has limited research capabilities and consequently no research has been done on oil usage and disposal.
SINU has no documented research on oil pollution issues associated with WWII sunken vessels.

SINU has no policy or plan for the use and disposal of oil products.

SINU has the capability to make a meaningful contribution to the education and delivering of training to urban populations and remote communities.

4.3.10 Design & Technology Centre

DTC is the base for the Solomon Islands Recycling and Waste Management Association (SIRWMA). The association was formed to promote best waste management and recycling (4R) practices in Solomon Islands. The association provides a link between government departments, industry and privately owned businesses that have an environmental focus.

DTC is being used to develop a waste management hub in Honiara that focuses on recycling aluminium cans and batteries. Used oil can be included. This initiative will be expanded into the provinces.

SIRWMA has been working with the New Zealand Company NuFuels who have developed a small scale pyrolysis plant that can dispose of plastic wastes. Further information on NuFuels is provided in Section 6.4 below.

4.4 Stakeholder Interviews - Motor Industry

4.4.1 United Autos – Tongs Corporation

Tongs is a major automotive group in Honiara, and a sales, service and parts dealer. Tongs imports one x 20 ft shipping container of oil per month, estimated 96,000 litres per year, mainly for workshop activities and retail sales. Oil types include lubricating, hydraulic and outboard motor oils. A breakdown of retail sales by oil type was requested but this data is not available.

Used oil is stored in the warehouse, with no special bunding. An average of 4 x 200 litre drums of used oil are taken each month by a company who burn the oil in a coconut drying operation (Islands Own Co - see Section 4.5.6 below). Tongs retail customers are electric power generation, shipping, construction, public transport, haulage, and commercial vehicle fleets. Tongs include a levy in their retail sales price to cover recycling costs. Tongs would be willing to partake in a used oil collection and recycling programme.

4.4.2 Ela Motors

Ela Motors is a Toyota Franchise dealer and sister company to ASCO Motors in Vanuatu. Ela is a major automotive group in Honiara, and a sales, service and parts dealer. Their workshop purchases 300 litres per month from South Pacific Oil.

The workshop area has interceptor tanks for spill containment. Used oil generation figures are not known and used oil is supplied to timber companies at no charge. Engine filters are crushed to recover oil then landfilled. There are spill kits on site. Head Office has suggested using a burner to dispose used oil, this idea was rejected by local management.

4.4.3 GTL Autos

Retail fuel station, supplying the public, local business and transport. Used oil generating quantities are not known, but it is confirmed as a problem for them. There are no existing arrangements for managing used oil.

4.4.4 D–Motors

Automotive service and repair workshop with two branches in Honiara. Does not sell new oil to the public. Workshop generates used oil at the rate of about 100-200 litres per month. Used oil is given away to customers for use as a wood preservative.

4.4.5 Didds Motors.

Fuel retailer – petrol station in Honiara. Not interviewed as they do not provide mechanical services.

4.4.6 Solomon Motors Ltd (SML)

Fuel retailer in Honiara selling petrol, diesel, kerosene and outboard motor 2 stroke pre-mix to the public. SPO is a supplier to SML and provides spill clean-up services. SML generates minimal used oil, less that one x 200 litre drum per year which is given to the public for chain saw lubricant. SML are not able to provide any data for lubricating oil or fuel sales. SML do not provide mechanical services.

4.5 Stakeholder Interviews - Industrial & Manufacturing Organizations

4.5.1 National Fisheries Development Co. (NFD).

This Government owned company operates 9 fishing vessels and one supply vessel. Also shore side a fleet of heavy machines and a side lifter. A fleet of five Seine fishing vessels generate 800 litres of used oil every 3 week trip, with 17 trips per year, say 13,600 litres per vessel per year totals 68,000 litres per year. Smaller vessels generate

less, estimated at 35,000 litres per year. The amount of lubricating oil NFD purchases is unknown but could be around 200,000 litres per year based on the used oil they generate. Their used oil stockpile size is unknown but it is known that it needs urgent attention.

NFD imported incinerators two years ago to dispose of used oil. The units are currently non-operational and technical assistance would be required to get them operational and train NFD staff.

NFD has also considered using the used oil to generate electricity although the quality of oil from the vessels may be an issue (seawater content). NFD have a 3 million litre diesel fuel tank. A Maersk vessel calls 3 weekly, heading for Singapore, but export to Singapore is not an option for used oil until Solomons sign the Basel Convention.

NFD has no spill kits but understand the need. Also they need assistance to prepare Health, Safety and Environmental Management Plans.

4.5.2 Soltuna.

Soltuna works together with NFD to process Tuna, producing canned tuna and loins for export. 1,000 litres per month of used oil is generated from vehicles, vessels and factory plant maintenance. Soltuna use their used oil and also take used oil from NFD stockpiles to operate their boiler.

The primary fuel source for the boiler is diesel with used oil mixed in. Soltuna purchase 1650 litres of diesel per month for the boiler and take 5,000 litres of used oil per month from NFD and others plus their own used oil to use in the boiler. Used oil is heated to around 100degC to remove water before use as boiler fuel.

4.5.3 Solomon Breweries Ltd. (Solbrew).

Solbrew is a local brewer of premium beer. They operate boilers powered by diesel as part of the manufacturing process. Diesel supplied by SPO. Their processes generate some used oil, which is stored in the fuel tank bund.

Used oil sold to staff and the public for domestic use and for chainsaw lubricant. Vehicle maintenance is sub-contracted so no used oil is generated.

Solbrew has spill kits on site and has an arrangement with SPO who contract to clean up any spills on site.

4.5.4 Solomon Tobacco Ltd.

In the past the company was a primary producer of tobacco products. It is now a secondary producer using imported processed leaf to make and pack cigarettes. It previously used diesel to generate heat for the manufacturing process, and the process is now fully electrical. There is a standby electrical generator which is diesel powered.

The factory purchases about 100 litres of oil per year for machinery and vehicles. Used oil is sold to staff for domestic use in villages and for chainsaw lubricant. There is currently a used oil stockpile of 6 x 25 litre drums.

As a multi-national company (part of British American Tobacco) the site is audited regularly. Spill kits are required on site, and there is a Health & Safety Plan in place which includes procedures for avoiding spills, and clean up procedures if spills occur.

4.5.5 Guadalcanal Plains Palm Oil Ltd. (GPPOL).

GPPOL operates a palm oil mill and about 7,500 Ha of oil palm plantations on the north coast of Guadalcanal. The mill processed about 160,000 tonnes of Fresh Fruit Bunch in 2021 which produces about 32,000 tonnes of palm oil product. GPPOL is a member of the Roundtable on Sustainable Palm Oil (RSPO) which requires proper facilities for storage of used oil. Interceptor tanks are used to ensure no spillage from wash bays.

GPPOL does the maintenance on its fleet of vehicles, tractors, motorcycles and generator sets, thereby generating used oil. They import about 55,000 litres of various oils per year. The amount of used oil they generate is unknown but could be about 25,000 litres per year.

In 2018 GPPOL commissioned a plant to burn used oil and acquired a permit from Environmental Health to do so. The plant had issues and is no longer in use. GPPOL have a current stockpile of used oil of unknown size. The mill operates steam boilers for the production process and uses steam to generate electricity.

4.5.6 Islands Own Ltd.

Islands Own Ltd Processes coconuts and produces coconut products. They process between 5,000 and 10,000 coconuts per month, depending on supplies. They take about 4 drums of used oil each 3 months from Tongs United Auto. The used oil is used as fuel for the heaters for the dryer units that dry the white coconut flesh. Usage is about 1.3 drums per month.

The plant generates its own power, using 1,000 litres of diesel per month. They would be very happy to receive used oil that is processed and with contaminants removed to provide a better quality fuel for the dryers and possibly to blend with diesel for the generators.

4.6 Stakeholder Interviews - Mining Industries.

4.6.1 General

There are currently two active mining permits where the permit holders are operational. They are Win Win mining who are operating and Goldridge mining who are undergoing commissioning. There are four permits that are non- operational. They are APID/Bintang, WLR Rennell, Solomon Bauxite & Axiom KB. For the non- operational permits, most are under judicial review and therefore, unless a court decision is forthcoming, it is not possible to speculate as to whether they will become operational in the next 5 years.

4.6.2 Win Win Mine

Win Win Mine operate an aluvial gold mining operation in the Taurarana area. They have a fleet of heavy machinery, drilling & processing rigs and utility vehicles. They have a pool of maintenance engineers and mechanics for servicing plant machinery and vehicles.

Purchases of fuels, hydraulic oils & lubricants are made from SPO monthly. Used oil is supplied to villages and landowners for domestic use as fuel and for chainsaw lubricants.

4.6.3 Goldridge.

The Goldridge operation is in the commissioning/set up phase, and is scheduled to begin production in September 2022. The site operates a fleet of 25 trucks, 32 units of plant and machinery, and 16 utility vehicles.

New oil purchases per year are lubricating oil 72,000 litres, hydraulic oil 4,800 litres and gear oil 2,400 litres. Oil is sourced from an overseas supplier, possibly China. There is no take-back deal in place with the supplier. The current used oil stockpile is 16 drums and 2 IBCs, estimated 5,000 litres. There is an Environmental Management Plan in place on the site.

4.7 Stakeholder Interviews Western Province.

4.7.1 Gizo Town Council.

In an interview with the Town Clerk, it was noted that there is no mention of used oil in the current ordinance which is dated 1994. There is a Gizo Town council Ordinance Act but the contents are very vague. Western Province needs a new policy to manage used oil and spills. There are numerous oil spills, mainly marine, from ships in the sea and small boat outboard motors.

There are no workshops or facilities in Gizo for maintenance and repair of motor vehicles. Individuals who undertake maintenance and oil changes usually dump the used oil in the environment or use the oil for other purposes such as those mentioned in Section 2.4. There is a critical need for a focal point and collection site where locals can bring their used oil, as no such site currently exists. The Waste Management Officer is focused on landfill management issues, and more focus on used oil issues is required.

There is no ordinance for shipwrecks, this needs priority action.

Complaints received on nuisance or waste are raised with the environmental health team under the Environmental Health Act and the team are supported by Police to enforce remedial action and compliance.

4.7.2 Western Province Government - Environment Office.

This visit confirmed that there is no Act or policy in place to manage used oil or oil spills. There are, however, many issues with waste oil and problems with spills on land and sea. This includes many spills in the sea from ships. There is a need to properly monitor the ships that berth at different wharfs and ports in Western Province in order to be aware of which ships spill oils into the sea. For example in one case where a ship spilled oil at Gizo wharf, due to many ships being berthed at the wharf and no-one monitoring activities, it was not possible for authorities to determine which ship had spilled oil into the harbour.

On land, there are some used oil management issues especially from logging activities. There is no formal complaints mechanism in place. There is an ad hoc system whereby the provincial government is supposed to report oil spill incidents or oil issues to the national government. However the system is not efficient and as a result nothing happens and there are no compliance activities. This emphasises the need to strengthen linkages between the provincial and national government in terms of used oil management.

Currently there is nothing included in the licensing conditions in relation to waste management for businesses who get a business license to operate ships, logging and other business.

In summary the current capacity to manage waste in the Western Province is inadequate. The provincial government has previously discussed with the Ministry of Environment to get a seconded staff person in Gizo but the appointment is still pending. The Provincial Environment Officer is mainly engaged in coordinating the Western Province Network for Sustainable Environment stakeholders, the plastics wise and can collection programme, and the positive change for marine life programme, which is funded by the Australian government through the "Strongim Bisnis" programme. Due to the lack of delegated powers under the Environment Act to provincial government staff, there is an inability to carry out used oil management work in the province and no power to enforce compliance on waste management issues.

4.7.3 Kolombangara Forest Products Ltd (KFPL).

KFPL imports lubricating oil directly from Singapore & Australia, one shipping container per month with about 10,000 litres per container. Additionally a small percentage is sourced from SPO if there is a shortage whilst waiting for shipment

KPFL purchases about 40,000 litres per month of diesel for use in heavy equipment, generators, tug boat and all vehicles. In Noro KFPL has 1 x 160klitre and 2 x 60klitre Diesel fuel storage tanks. In Poitete, there is are 2 storage tank with capacity of around 80 klitres and 60 klitres.

They store coolants in IBCs. Lubricating oil, hydraulic oil, transmission oil, chainsaw oil, engine oil, gear oil, dextrone oil, 2 stroke oil for chainsaw, chain bar oil, brake fluid oil are all stored in 200L drums. Used dirty diesel is stored in 200L drums. Mixed petrol, chainsaw fuel, kerosene, and pure petrol is stored in 200 litres drums. At present KPFL have a stockpile of 600 litres of used oil.

The oil usage depends on their timber orders. KPFL have a fleet of loaders, excavators, skidders, dump trucks, mold trucks, graders and light motor vehicles totaling about 44 units. Maintenance is undertaken in the KFPL workshop, and used oil is collected into 200L drums. Any oil spills in the workshop or storage facility are collected using saw dust and taken to dumpsite to burn with other general wastes. Staff are trained to manage oil spills. Used oil is given away to the local population for use on timber as pesticides control and for chainsaw lubricant.

KPFL cannot use treated oil in their machines. Also blending treated oil with diesel is not acceptable, so the only options available for KPFL are pesticides control and chainsaw lubricant. Storage tanks for fuel have bunding around tanks. KFPL has a Forest Steward Certificate which is audited by Australian and Solomon Island auditors to meet international standards.

4.7.4 Solomon Power Gizo.

Solpower Gizo have nine generation sites in the provinces. Data on used oil generation and collection is not available for individual sites. Honiara site has a generation capacity of 16.09MW. The nine provincial sites collectively have a generation capacity of 7.87 MW.

On a pro-rata basis the volume of used oil generated at the nine provincial sites can be assessed as 48.9% (7.87/16.09) of 2,740 Litres, ie 1,340 litres per year. SPO collect used oil from provincial sites annually.

The main fuel for the Solomon Power electricity generator is diesel fuel. Each month SPO supplies 55Klitres of diesel and usage is 1,800 to 2,000 litres per day. There are 2 main storage tanks for fuel from SPO. Oil is supplied by SPO in 200 litre drums. The empty drums are taken by the villagers to use for water storage, septic usages, and ovens for baking.

One generator engine uses 60 litres of oil per month and 60 litres of used oil is created. The villagers use the used oil for termite treatments and chain saws.

Currently there is no proper way of storage of the wastes from oil spills but there are procedures to ensure that there are no spills into the environment. Used oil filters are stored at the power station storage facility. Personal Protective Equipment (PPE) is available at the power station and staff are trained to use it.

A total of 3,747 litres of waste oils were generated over 4 years from 2017-2021 which is generally in line with the estimate based on comparing generation capacity.

Maintenance of the vehicle fleet is managed by a service team from Honiara.

5.0 Used Oil Import and Generation Information Obtained

5.1 Oil Import Data

Table 4 below presents the information obtained from the Solomon Islands National Statistics Office (SINSO).

Table 4 - Oil import data (litres & Solomon Island Dollars)

Oil Type	Customs Tariff Code	2017 litres	2017 SI$	2018 litres	2018 SI$	2019 litres	2019 SI$	2020 litres	2020 SI$
Oils	27079900		11		35		455		24
Petroleum Oils	27090000		1730	2	73		836	1	34
Petroleum Oils	27101220			272,630	42,327	22,808	86,357	18711	7185
Petroleum Oils	27101240			16	257		241		
Petroleum Oils	27101250			233,222	9,452				
Petroleum Oils	27101260			2,466	12,451				
Petroleum Oils	27101270			1,840,273	142,108				
Petroleum Oils	27101280		1		1	46	218		
Petroleum Oils	27101290		4	3700	20,410		331		134
Lubricating Grease	27101900					1249	11,462	251	6,640
Lubricating Oil	27101910	1432	22,979	13,274	26,589	16,929	86,495	30,268	90,300
Petroleum Oils	27101920		2,194		2,094	25	2,637		158
Lubricating Grease	27101940							199	5,092
Transmission Oils	27101950							17	552
Petroleum Oils	27101990		3,316		2,898				2,629
Petroleum Oils	27102000		1,629		1,250		1,199		3,650
	Totals	1432	30,123	2,365,581	259,837	41,057	188,722	49,446	109,155
Waste Oils	27109100		8				479		243
Waste Oils	27109900		12,445		15,700		12,093		3,552
Total		**2864**	**74440**	**4731164**	**535482**	**82114**	**391525**	**98893**	**229348**

The data extracted is presented in litres and Solomon Island Dollars (SI$).

All entries in the data provided include the SI$ amount but the litre amounts are not included for the majority of entries. There is insufficient and/or conflicting data to enable an accurate picture to be formed for volume of imports in litres for the years 2017 to 2020. The volume of imports in litres does not equate at all with information provided by importers, as shown in Table 5 below.

Comparing the litres imported against the values shown in the data to calculate the average price per litre from year to year, there is a wide variance in the calculated averages. For example referring to tariff code 27101910 where there is volume and price data for all years: the average prices per litre are 2017 – 16.05/lt, 2018 – 12.70/lt, 2019 – 5.10/lt, 2020 – 2.98/lt. Further comparisons with the retail prices of lubricating oils in Australia and New Zealand show that there is a wide variation in prices of various lubricating oils, according to quality, viscosity and differing end uses. Median retail prices are around NZ$ 9.85/litre and Au$12.80/litre. Import base prices per litre are likely to be less than half these rates. The conclusion is that the information provided on Customs Entry documents generated by importers is not consistent and in many cases may be inaccurate.

5.2 Importers of Lubricating and Other Oils.

5.2.1 Overall Quantities

Table 5 below shows the information on imports that have been gathered from various sources, including confidential sources.

The data in Table 5 does not reconcile with the data in Table 4, which shows a much smaller quantity being imported (98893 litres in 2020 in Table 4 compared with 1,247,000 litres in 2021 in Table 5).

The Table 5 data also does not agree with the data in the Golder report 2014 (Clause 3.1) or the Used Oil Management report 2015 (Clause 3.2), which both gave a figure of 1.6 million litres per year of all oils imported. There may have been more economic activity in 2014-2015, than 2021, however, given the impact of the Covid 19 pandemic.

Table 5 - Oil Import data provided by importers (litres)

Importer	Oil type	Supplier	2020 litres	2021 litres
South Pacific Oils	All types	Singapore	350,000	350,000
Markwarth	Not Specified	Singapore		66,000

Importer	Oil type	Supplier	2020 litres	2021 litres
National Fishing NFD		Clipper USA		200,000
Tongs United Autos	All types	Singapore	96,000	96,000
KFPL Forests	Not specified			120,000
Goldridge Mining		Ex China		80,000
GPPOL	Lubricating Oil	Islands Petroleum (PNG)		55,000
Unknown Customers	All types	East Coast Lubes, Queensland		160,000
Confidential Sources	All types	Confidential		120,000
Total				1,247,000

5.2.2 South Pacific Oil Ltd. (SPO).

SPO is a major importer of fuels and lubricants. They import between 300,000 and 400,000 litres of oil per annum, including engine oils, hydraulic oils, brake fluids, outboard motor oils & greases.

SPO estimate their customers would generate 70,000 – 100,000 litres of used oil per year. Sales volumes for the various types of oil are not available. SPO are willing to provide a collection system for their customers provided that there is a programme in place to manage the recycling/ re-use or disposal of the used oil. Information detailing a breakdown of oil by types is not available

5.2.3 Markwarth

Markwarth are importers and retailers of lubricating oil and associated products. All their imports are from Singapore. In 2021 the total imported was 66,000 litres. Their client base is generally small to medium businesses and the public.

In the past they have supplied all sectors including mining, logging, electricity generators and government. Now, however, large users will often import their requirements themselves. Markwarth do not have any arrangements in place to take back used oil from customers, but they have in the past assisted large mining companies with advice on how to manage their stockpiles.

5.2.4 Gafung Solomon Islands Ltd.

Gafung are bulk importers of Diesel, and they do not import petrol or lubricating oils. They operate a bulk storage depot at Lunga with 14 x 25,000 litre and 17 x 17,000 litre

skid mounted storage tanks. They supply diesel to the marine industry, cargo & fishing vessels. They commented that some vessels operate oily water separators.

6.0 Used Oil Management Information Obtained

6.1 Used Oil Generation

The 2021 estimate of used oil imported, as presented in Table 5 above, is about 1.25M litres. This is much less than the $1.6M litres in both the previous used oil reports in 2014 and 2015. It is also much more than the SINSO data for 2020 of around 100,000 litres. It is considered that the 2021 estimate of 1.25M litres is quite reasonable, and possibly erring on the low side, considering the 2013 and 2014 figures. Also, economic activity may be picking up in 2022. A figure of 1.3M litres for 2022 could therefore be chosen.

The 2013 report used a common "rule of thumb" estimate of 50% for the ratios of used oil generated to new oil imported. The 2014 report used a 38% ratio. Neither calculation was referenced. As a rough check, an average figure of 44% could be taken, which would give about 570,000 litres of used oil, based on the 1.3M litre oil import figure. Based on the data that was gathered for the Analysis Report, even though much of it was very useful, it is very difficult to provide an accurate 2021 used oil generation figure. **Probably about 600,000 litres plus/minus 10% would be quite reasonable.**

Table 6 below presents some of the used oil generation data that was gathered. The total comes to 400,000 litres and does not cover all generators. This offers some validation of the total used oil generation estimate given above. Table 6 also shows some stockpile and disposal information.

Table 6 - Used oil generation data (Lts) Major generators and stockpiles

Generator	Estimated Litres Generated per Year 2021	Current Stockpile (lt)	Disposal
SPO Customers	100,000	40,000	Export pending
Markwarth Customers	30,000	Nil	Various
Solomon Power	5000	Nil	Return to SPO
Soltuna	12,000	Nil	Used in their boiler
National Fishing NFD	103,000	Unknown	Some taken by Soltuna
KFPL Forests	50,000	600	Chainsaws & pesticides
GPPOL	25,000	Unknown	Various
Goldridge	30,000	5000	Various

Generator	Estimated Litres Generated per Year 2021	Current Stockpile (lt)	Disposal
Tongs	40,000	800	Some taken by Islands Own
Fuel Retailers & Mechanical Services Honiara	5000	Various reported	Distributed to the public
Total	**400,000**		

6.2 Used Oil Storage Facilities

There are currently no national storage facilities available for used oil in the Solomon Islands. The largest fuel and oil importers do have their own storage sites near the port in Honiara. SPO have indicated their willingness to discuss the possibility of providing a portion of their site for a national collection and storage depot.

National Fisheries Development have a large used oil storage tank on their site at Noro (30,000 litres).

6.3 Local Used Oil Disposal Options.

6.3.1 General

Establishing a viable and cost effective local solution to manage used oil depends on there being a local organization that can receive and use the treated oil in a safe and environmentally sound manner. There are three key elements to implementing a local management option, they are:

- A collection system that covers the main towns plus the provinces
- Sourcing and establishing a cost-effective used oil recycling plant that can process the used oil collected
- One or more industrial sites, suitably located, that can use processed oil to power their plant and machinery in a safe and sustainable operation.

The third key element is the most important. There is no point in local processing unless there is a local outlet for the product. Interviews with key stakeholders have identified those local industrial sites who operate heating plants which use a combination of diesel and untreated or partly treated used oil to fuel their boilers. Those sites are:

- Solomon Islands Brewing Co., located in Honiara, brewing beer.
- Soltuna Canning plant, located in Noro, processing tuna fish.
- Islands Own Ltd, located in Honiara , processing coconuts

- Guadalcanal Plains Palm Oil Ltd, located at Tetere North Guadalcanal , processing palm oil

Product from a suitably sized used oil recycling plant may be able to largely replace diesel as a fuel source, and at a more competitive price than diesel.

Table 6 above presents some current disposal practices.

6.3.2 NuFuels Option for Remote Communities.

In 2018 the NZ Government (Ministry of Foreign Affairs and Trade) 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 undertook the work in the Solomon Islands during 2018-2020. The full project report is included, refer Appendix 2. The objectives of the project were to:

- create an incentive/ value for people to collect plastic waste by offering an opportunity to easily process the plastics into usable energy in a way that saved money.
- allow use the energy recovered from the plastics to substitute for the purchase of gas, diesel or burner fuel.
- use the energy produced in homes or cooking huts, or 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 would be local (either Don Bosco Technical Institute or others) with idea that a small business in partnership with Nufuels in NZ could be created.

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 fuelled by wood. The process waste can be biomass and tyres, used oil, plastics coated in aluminium, and a mixture of those wastes. 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 and turned into gas. It is not 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. Or if more liquid fuel is wanted rather than mainly gas, the system can produce more of that.

Gas with a similar profile to LPG or natural gas is produced, and also a liquid fuel and a very small amount of solid fuel. There are currently two systems in the Solomon Islands that 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 the moment the gas would be used virtually real time alongside the retort 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.

The unit was developed by Nufuels to provide options for using the energy produced for households' end use, or small businesses. The units can be built locally by training organizations such as Don Bosco . The unit is designed to be easily transportable, including by smaller boat, and for easy use by women as well as men.

The NZ government who part funded the project for the two systems at Henderson and Munda, was particularly interested in the fact that the systems around Munda and places like Gizo be used to keep the lagoon water clean and free from plastic debris.

The pilot project has been well received by local communities and the results indicate that the NuFuels process offers a viable option for rural and small communities in the Solomon Islands.

6.3.3 Honiara Hospital incineration.

A medical waste incinerator (Advanced Combustion Engineering ACE Model CA-30) is installed at the Honiara Hospital. The unit has been commissioned but is non-operational.[3]

A baseline Healthcare Survey in July 2014[4] indicated that generation of medical waste at the Honiara Hospital was about 2,500 kgs per week (130,000 kgs /annum). Data on fuel consumption is not available, however, based on data available on-line[5], fuel effectiveness of large scale medical waste incinerators of this type is in the order of 2-3 litres of fuel per kg of waste. On that basis it is possible that the incinerator at Honiara Hospital, if operating and configured to accept treated used oil, could use up to 325,000

[3] SPREP Draft Healthcare Medical Waste investment Plan WP 8.3.2 Annex 1 dated 04.06.2021.
[4] SPREP Baseline Study for Healthcare Waste July 2014 Project AS140211
[5] www.scrip.org/journal/paperinformation.aspx?paperid=60826

litres of treated used oil per annum (based on 2.5 litres/kg). The used oil would be fed to the burners directly as the main fuel or a supplementary fuel.

There are other medical waste incinerators in the Solomon Islands that could possibly be used. The baseline Healthcare Study in July 2014 indicated that Honiara generates about 70% on the medical waste in the Solomon Islands, therefore will have a greater potential to use treated used oil than most other hospital sites.

6.4 Used Oil Export Options

6.4.1 Summary

When overseas export of waste is being considered or undertaken, is should be noted that shipping services and shipping routes vary from country to country. Different companies service different countries and there is no one company that can provide a common service to all destinations There are currently three companies providing services to the Solomon Islands, Sofrana ANL, NPDL and Swires.

New Zealand is a common destination and for this reason many PICs have traditionally sent their used oil to NZ for recycling. Swires operate the Moana Taka Programme which offers countries free shipping for wastes, but this only assists countries that are on the Swires routes. In addition Swires impose conditions that may restrict shipments to one per country, and also they do not cover insurance.

As a Waigani or Basel transboundary permit is required for shipments, the objective is to find the most direct route to the disposal location, as then less transit permits are required.

There are currently a number of recyclers that offer recycling/disposal services for used oil, including:

- Cleanaway Brisbane Australia
- Waste Management New Zealand Auckland & Tauranga NZ
- Salters Cartage Ltd Auckland NZ
- Waste Petroleum Combustion Ltd Auckland NZ
- Bluescope Pacific Steel Ltd Suva Fiji.

6.4.2 New Zealand

There are three disposal options as detailed above, all based in the Auckland metropolitan area. All three companies operate within the permitting regulations set by the Auckland Council, and can provide competent services to manage shipments from the Solomon Islands.

Salters Cartage Ltd regularly import shipments from New Caledonia and Tahiti, and have in the past accepted shipments from Solomon Islands (Goldridge) and other Pacific Island Countries.

Waste Management regularly imports shipments from New Caledonia. Waste Management accepts imports in Auckland which are transferred to Tauranga for treatment.

6.4.3 Australia

Cleanaway Services operates a recycling facility for used oil at Narangba in Brisbane. The company services the South East Queensland region, and additionally holds permits to import used oil from Papua New Guinea.

A major barrier to shipping into Australia is the Australian Government fees for Waigani Convention permits. This fee increases the costs by 300% compared to other export options. Refer to 8.3.6 for cost comparisons.

6.4.4 Fiji.

Bluescope Steel Ltd in Suva receives used oil which is used as fuel for its furnace which produces rebar steel products. Bluescope is able to process a large proportion of the used oil generated and collected in Fiji, and the volumes it receives from local sources generally meet their needs.

Bluescope may on some occasions agree to receive shipments from other Pacific Island Countries, on the basis that the there is no cost to Bluescope. Bluescope do not pay or charge for used oil and additionally all documentation and Waigani permits are the responsibility of the shipper.

6.4.5 United Arab Emirates

Synergy Petrochem FZC imports 3,000 – 4,000 tonnes per month of Petroleum and Petrochemical by-products and waste streams. Synergy receive all kinds including used Lubricating oils, waste marine oils, hydraulic oils, gear oils, and transformer oils.

Synergy pay up to NZ$ 250 per tonne for used oil and the shipper pays the shipping costs. Synergy have in the past imported used oils from Vanuatu, Tonga, & Kiribati. Export to UAE would require a Basel Convention permit approval, and while some Pacific Island Countries are parties to the Basel, Solomon Islands are not a party, therefore UAE is not an option at present for Solomon Islands.

6.4.6 Papua New Guinea

At the Third Clean Pacific Roundtable this year, it was announced that the TWM Roku Integrated Waste Management Facility in Papua New Guinea have received from 2017-2021 over 617 thousand litres of waste oil and over 34,000 litres of oily water from across Papua New Guinea. It has also exported over 550 thousand litres of waste oil and more than 47,000 litres of oily water from Papua New Guinea across the same period through permits held under the Basel Convention.

It was also reported at the Third Clean Pacific Roundtable that TWM have now set up a Waste Oil processing unit and that under optimum operating conditions, the TWM Waste Oil Processing Unit can process up to 7000 litres of waste oil a day with a yield of eighty-four percent. The processed fuel oil is then blended with diesel to operate the TWM industrial high temperature incinerator at their Roku Integrated Waste Management Facility.

TWM is interested in receiving used oil from other locations in the Pacific besides PNG, for processing and subsequent use in their high temperature incinerator. This option now needs to be explored further.

6.4.7 Export Costs.

A summary of shipping and disposal costs is set out in Table 7 below:

Table 7 – Used Oil Shipping Costs Analysis for Solomon Islands (All Costs in NZD)

Summary of Costs	Auckland		Brisbane		Suva	
	TEU	IsoTank	TEU	IsoTank	TEU	IsoTank
Isotank Lease 4 mths		5,500		5500		5500
Honiara local costs	1400	1400	1400	1400	1400	1400
SeaFreight						
See Spreadsheet below	3210	3210	3096	3096	4150	4150
DG Surcharge	200					
Import Costs						
NZ Waigani documents	1500	1500			1150	1150
AKL/TGA Import Costs	2250	2250				
Brisbane Import Costs			4135	4135		

Summary of Costs	Auckland		Brisbane		Suva	
	TEU	IsoTank	TEU	IsoTank	TEU	IsoTank
Australia Waigani Permit			13840	13840		
Suva Import Costs						
Disposal Cost AKL						
Drums 16,000 at 25c/L	4000					
IsoTank 23,000 at 15c/L		3450				
Disposal Cost Brisbane						
Drums 16,000 at 33c/L			5280			
IsoTank 23,000 at 47c/L				10810		
Disposal Cost Suva						
Drums 16,000 at c/L						
IsoTank 23,000 at c/L						
Total Costs	12560	17,310	27751	38781	6700	12200
Per Litre Costs						
ISOTank 23,000L		0.753		1.686		0.763
80 Drums - 16,000L	0.785		1.734		0.419	

NB: Brisbane Import Costs includes Waigani Permit Fee. AUD 12,487 = NZD 13,840

Table 8 below shows the costs per shipping company.

Table 8 – Costs per Shipping Company

Destination	NPDL		Swire		Sofrana ANL	
	TEU	ISOTank	TEU	ISOTank	TEU	ISOTank
AKL/TGA	12000	9000	3210	3210	3340	3340
Brisbane	No Service	No Service	3096	3096	3458	3458
Suva	12200	13220	4150	4150	4930	4930

NB: Suva is via Auckland

6.5 Export Data from Dept of Statistics.

The following limited oil export data was obtained from SINSO.

Table 9 - Oil Export Data (litres & SI$)

Oil Type	Customs Tariff Code	2017 lt	2017 SI$	2018 lt	2018 SI$	2019 lt	2019 SI$	2020 lt	2020 SI$
Petroleum Oils	27101230		0			12	102		
Petroleum Oils	27101990		0						
Petroleum Oils	27102000						165		
Petroleum Oils	27109100						223		
Waste Oils	27109900						20		892

The data in Table 9 is taken from extracts of Customs records provided by the SINSO. The data extracted is presented in litres and Solomon Dollars (SI$).

The data provided is very limited and indicates that there were no significant export shipments of used oil recorded during the period for which records were provided.

On the other hand according to the information gathered for used oil in Vanuatu, it is reported that the oil recovered from the Solomon Trader marine spill on Rennell Island in 2019, was shipped to Vanuatu for disposal. It would appear that this shipment was not processed by the Customs Dept, and recorded in the statistics.

6.6 Western Province Photos

The following used oil photos were taken by Gaylyn Puairana and Wendy Beti when they visited Western Province. The locations of the photos were not supplied. They show used oil stored with no bunding, and also used oil reaching waterways and causing severe pollution.


NO SMOKING

7.0 Known Government Data and Key Stakeholder Priorities.

7.1 Economic Situation

The Central Bank of Solomon Islands Quarterly Review for December 2021 provides current data on the domestic economy in 2021. The economy contracted further in 2021, following a modest fall in 2020. The contraction reflected the continuing impact of Covid-19 plus the unexpected civil unrest in November. Inflation was impacted by the surge in the international price for crude oil. GDP contracted by minus 0.6% to December 2021 following minus 4.3% recorded in 2020.

The CBSI production index remained muted in 2021. The weak outcome was attributed to a fall in round log, palm oil and cocoa productions due to supply factors and climate change variations. Solomon Islands' goods exports are heavily concentrated in logs (70 per cent), fish (11 per cent) and palm oil and kernels (six per cent), which are vulnerable to natural disasters and external price shocks.

The forestry and logging sector, which has for decades relied on unsustainable harvesting practices, accounts for 13 per cent of GDP. There was an increase in the fish catch and copra production in 2021, and both sectors outperformed their previous year's production.

Comments in the CBSI report specific to key industries are included below. In summary considering the CBSI assessment of the domestic economy in 2021 it is considered unlikely that there will be a significant increase in the volume of used oil generated in the short term future.

7.2 Forestry

Ministry of Forests is responsible for implementing:

- Forest Resources and Timber Utilization Act 1969 Amended applied from Western to Temotu Province.
- North New Georgia Forest is managed under North New Georgia Timber Cooperation Act 1984.

These Acts provides for the Forest regulations 2005 and a National Forestry Policy, September 2020.

Total land mass of Forests in the Solomon Islands is 28,000 square Kilometers
90% of Solomon Islands land area is covered with forest – 6 different types of forest.
22% of the total mass is currently logged – 17% of 22% is already logged and only 5% is

virgin forest that will probably be logged out in the next 10 years. Solomon Islands will depend on regrowth to harvest after the next 10 years. 68% is protected forest and Protected Areas Act must protect the 68% protected forest.

In 2022 round log production dropped by 14% from 2020 to 2.02 million cubic metres. Plantation log production dropped by 6% from 2020 to 135,000 cubic metres.
Waste management and generation of used oil is mainly around the area of logging operations where a lot of heavy machinery is used. Waste oil contamination events are considered to be mainly on logging operations.

Logging contractors: there are 301 valid licenses. There are 144 active licensed contractors in 9 provinces. Milling operations: There are 127 milling licenses in 8 provinces. Directly interviewing all license holders for this project was not practical. A questionnaire was sent to Ministry of Forests provincial offices requesting information on used oil volumes generated and used.

7.3 Fishing

Fishing activity rebounded in 2021 after a significant decline in 2020. The two major players in the fishing industry are National Fisheries Development Ltd and Soltuna. Both have been interviewed for this project and both have a significant involvement in the generation of used oil and possible local treatment and disposal options.

7.4 Palm Oil and Kernels

Palm oil production has remained muted in 2021 due to reduced harvest of fresh fruit bunches. Guadalcanal Plains Palm Oil Ltd have achieved above average global prices for both crude palm oil and palm kernel in 2021. GPPOL has been interviewed for this project and may present an opportunity for disposal of locally treated used oil.

7.5 National Waste Management and Pollution Control Strategy - 2017 – 2026

The strategic actions applicable to used oil management are:

- 9.1.2 - Establish a national waste and pollution committee with sub-committees on specific wastes such as chemicals, E-waste, used oil, healthcare wastes and waste water.
- 9.1.3 - Undertake a national stocktake of all prescribed premises for Honiara, Gizo, and Auki followed by other provincial centres and towns.
- 9.1.5 – Undertake a waste management capacity assessment for all major provincial centres starting with Honiara.

This strategy was published in 2017. A function of the Analysis Report for this project is to investigate and report on progress with the above strategic actions and any outcomes that apply to the management of used oil and associated wastestreams. The responses of the MECDM, updating the action plan, are as follows:

9.1.2 - Establish a national waste and pollution committee with sub-committees on specific wastes such as chemicals, E-Waste, Used oil, Healthcare waste & wastewater

Current practice is whenever there is any project or issue related to any of the specific wastes highlighted , relevant representatives from government departments, private sectors & others are called to be part of the project committee or to come together to discuss on the issue. MECDM through the Environment & Conservation Division (ECD) usually plays a key coordinating role in addressing matters related to these specific wastes.

9.1.3 - Undertake a national stocktake of all prescribed premises for Honiara, Gizo, and Auki followed by other provincial centres and towns.

Currently, this is an ongoing core responsibility of the ECD to follow-up with all prescribed premises in terms of their applications for waste discharge licenses, renewal of waste discharge license application, etc. The challenge is lack of capacity in terms of human resources to carry out the task. There is a need for a national stock-take of all prescribed premises in the country.

9.1.5 - Undertake a waste management capacity assessment for all major provincial centres starting with Honiara.

During the development of the National Waste Management & Pollution Control strategy in 2017, MECDM have invited provincial and Honiara City Council representatives to present on what are the issues and challenges related to managing wastes in their respective provinces. Most of the provincial representatives have highlighted that the major issues faced is land for landfill or a disposal site. However, a proper stock-take of the current waste management capacity assessment for all major provincial centres is required to be done.

7.6 Potential Future Environmental Liabilities.

During World War II many warships and non-combatant vessels were sunk in the waters around the Solomon Islands, many of them in the area between Guadalcanal and Nggela Islands now known as Ironbottom Sound. Many wrecks in shallower waters have since become recreational diving sites and this business is now an important part of the tourist industry. However these wrecks also represent an environmental liability as fuel oil starts to leak from rusting fuel tanks as time goes on.

A brief non-exhaustive survey was taken of US Navy vessels sunk, the survey covered 15 destroyer escorts of various classes and 5 cruisers. The rationale for selecting these vessels was that data on fuel capacity was readily available[6]. The destroyers' fuel capacity was on average 525 tonnes and the cruisers' fuel capacity was on average 1,650 tonnes. The total capacity of the 20 vessels was around 16,125 tonnes, and assuming the vessels were on average carrying about 60% capacity, the fuel oil remaining in these vessels could be 10,000 tonnes. There is evidence of at least 200 vessels of various sizes and types being sunk, and extrapolating these quantities from 20 vessels to 200 vessels, the potential future liability is very clear and significant.

By comparison the fuel oil reported to have been spilled by the Solomon Trader grounding in 2019 at Rennell Island was 80 tonnes.

It should also be remembered that these vessels are "war graves" so the oil recovery process needs to take that into account.

[6] www.ibiblio.org/hyperwar

8.0 The Feasibility Study

The next stage of work is the Feasibility Study. 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).
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.

There are clear gaps in the information gathered at the Analysis Report stage and described above. It is believed, however, that these gaps can be filled at the Feasibility Study stage and that there is now enough information to move to this stage.

Important inputs into this stage will be:

- The report prepared by MRA Consulting Group for SPREP/ADF on Technology Options for Used Oil.[7]
- The upcoming used oil SWAP pilot project whose activities include piloting proper storage of used oil from major waste generators by constructing a proper storage facility, monitoring of activities, awareness & education, and training of staff in-country.
- A further assessment of local disposal options, with a focus on their environmental acceptability.
- Further analysis of the options for exporting used oil from Pacific countries to other countries where it can be properly reused. This needs to include further consideration of costs and logistics.

[7] "Used Oil Management Technology Options Report" April 2022. MRA Consulting Group

- Assessment of the potential for imposing an Advanced Disposal Fee on imported lubricating oil. This analysis will be conducted by Consultant Team member Alice Leney.

9.0 Conclusions

a. Based on information supplied by SINSO, there was about 100,000 litres of oil products imported in 2021. This figure is considered, however, to be very low. A more realistic estimate of oil products imported, based on data gathering from importers, is probably about 1.25M litres.
b. It has been calculated, taking into account used oil generation from all relevant oil products, and an increase in economic activity in 2022, that the volume of used oil generated is probably about 600,000 litres plus/minus 10%.
c. There is very limited storage capacity for used oil in the Solomon Islands. SPO have significant product storage capacity and have indicated their willingness to discuss the possibility of providing a portion of their site for a national used oil collection and storage depot. SPO currently provides a used oil take-back service for their main clients.
d. The National Fisheries Development Company have a large used oil storage tank on their site at Noro (30,000 litres).
e. There are two local reuse options in industrial processes, namely Soltuna (fish processing) and Islands Own (coconuts). These are being used to capacity now.
f. A large amount of used oil is being used for timber rot control, dust suppression, corrosion control, as chainsaw bar oil, or in other ways that could generally be deemed to cause environmental and health risks.
g. The remainder of the used oil is just being disposed of to land (including landfills) or to waterways.
h. There are some potential additional local reuse /disposal options available that may be satisfactory, including hospital incineration, Solomon Islands Brewing Company and Guadacanal Plains Palm Oil Ltd.
i. The NuFuels process currently under trial in the Solomon Islands for plastics processing and reuse may also offer a potential used oil processing and reuse option.
j. There are stated government priorities for the management of used oil that require effective management to protect human health and the environment.
k. This data gathering phase of the project has been difficult due to pandemic restrictions and the reluctance of some stakeholders to engage, but it is considered that sufficient information has been gathered to move on with some confidence to the next stage of the project, i.e. the Feasibility Study.
l. The Feasibility Study will aim to come up with a clear direction, backed with supporting evidence, for the preparation of a detailed National Used Oil Management Plan.

Appendix 1: List of Questions

1. **National Government**

- What are the government priorities for national used oil management?
- Is there a Government Policy on used oil management?
- What are the regulatory considerations for used oil management?
- What is the current government capacity to manage used oil and what assistance is needed?
- What are the government responsibilities for used oil management?
- Who are the National used oil management stakeholders?
- How would used oil carriers be licenced?
- How would used oil storage facilities be licenced?
- Who would train used oil handlers/carriers?
- How would the government set up and manage an advanced recycling fee for used oil management?
- What sort of monitoring and evaluation programme would be required?
- How would International Convention requirements be managed and what, if any, additional assistance would be required by Government to ensure requirements were met?
- Is improved community education needed? (What is done now)?
- Is improved data collection needed? (What is done now)?

2. **Customs**

- What volume of different oil (lubricant) types (litres/kg) is imported annually into Solomon Islands (2018-2021)?
- What categories of lubrication oils are separated out in Customs records?
- Are they reported in kg or lts?
- Is this data available for 2018-2021 inclusive?
- Could the data be supplied in an electronic spreadsheet?

3. **Oil Importers**

- If not commercial in confidence, what volume of different oil types (litres) is imported annually into Solomon Islands (2018-2021)?
  - Engine oil
  - Brake fluids
  - Gear oils
  - Transmission fluids
  - Hydraulic oils and fluids
  - Compressor oils
  - Refrigeration oils
  - Industrial process oils
  - Electrical insulating oil (Care must be taken to exclude oil likely to contain PCBs)
  - Metalworking fluids and oils
  - Heat transfer oils
  - Machining oils

- Who are the lubricants sold to and in what annual quantities (ie who are the end users)?
- Where are the different lubricating oils sourced from (ie Singapore, USA, Aust, NZ etc)?

4. Oil Retailers

- What volume of each oil type is sold annually?
- What are the major user groups and volumes purchased?
  - Power generation (EPC)
  - Shipping
  - Construction companies
  - Bus and haulage operators
  - Car fleets (including service stations and taxis)
- How are the different oil types retailed (in what volume and in what type of container)?
- Do you have a take back scheme for used oil and/or oil containers?
- What % of oil (what annual volume) is sold to customers for home DIY oil changes?

5. Used oil generators

- What volume of each used oil type is generated annually at your business?
- How is the used oil collected and stored (ie drums, IBCs, bulk storage etc)?
- Please specify the short term storage type and capacity, long term storage type and capacity, how long is the used oil is usually stored for before disposal?
- How are other chemicals (petrol, paint, antifreeze) stopped from contaminating the used oil?
- How much used oil is currently stored on site (and how long approximately has it been stored for)?
- How are used oil filters managed?
- How have you disposed of used oil in the past?
- What is the cost to dispose of the used oil?
- How is the used oil disposed of now?
- Are there any other (unsatisfactory) oil disposal practices still carried out and what might be required to prevent this in the future?
- Is there any treatment of the used oil on site (eg water separation….)?
- How are oil spills managed?
- Is there any training in oil spill management?
- Are storage areas bunded?
- Is there any practical use for used oil in Solomon Islands?
- Are there any options for a local recycling oil processing plant for Solomon Islands?
- What government regulations are in place for used for used oil management?
- What is the stakeholders' priority actions for a national used oil management scheme?
- What can the used oil generator commit to doing under a national used oil management scheme?
- What assistance is required (training, funding, and equipment) to enable this to occur?

6. Car Registration

- How many registered cars in Solomon Islands (private and commercial users)?
- How many registered trucks (private and commercial users)?
- How many registered buses (private and commercial users)?

7. Used oil Transporters

- Annual used oil volumes transported per year?
- Major sources of used oil transported by the carrier?
- Transport container and truck description?
- Details of spill response equipment and training?
- Details of national licence/certification for used oil transport?
- Logistical issues connected with used oil transportation?
- What is the stakeholders' priority action for a national used oil management scheme?
- What can the used oil transporter commit to doing in the scheme?
- What assistance is required to enable this to occur?

8. Marine

- How is used oil from boats managed?
- How much used oil from boats is disposed of on shore per year
- How is collection, transport and disposal managed?
- What are the costs incurred/charged

9. Used oil storage

- Landfill has storage capacity?
- Is there storage capacity elsewhere?
- What are the quantities of each existing stockpile of used oil?
- How is the used oil received and stored?
- What is the annual acceptance rate of used oil at the site?
- How is this financed?
- How is the collected used oil disposed of?
- What are some safety measures put in place for the above storage facilities? Are there any OHS tools applied?
- It there spill equipment, training etc at the site?

10. Used oil exporters (SWIRE, Matson, NPDL, Pacific Forum Line)

- What are the export destination options for used oil recycling (eg Fiji BlueScope Steel, New Zealand, Australia, India, Saudi Arabia, South Korea etc)?
- What volume of used oil is exported annually?
- How frequently is the oil shipped?
- Where is the used oil sourced from?
- What containers/systems are used to ship the oil?
- How much does it cost to export the used oil?
- How much is the used oil sold for?
- What International Conventions are used to ship the used oil?
- Is training in international conventions procedures needed?
- Any specific logistical issues?
- OHS issues and training required or currently carried out?
- Site bunding and spill response planning details?

11. Export destination

- Which destination?
- What is known about how the used oil will be managed in the receiving country?

- How much has been exported to the destination over the last 3 years?
- What were the financial details of the export?
- International Convention requirements and training required?
- Cost recovery system details?
- Which Shipping Lines are currently involved in shipping used oil from Solomon Islands

Appendix 2: NuFuels - Solomon Islands Plastic Waste to Energy Programme

A2.1 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

A2.2 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 fuelled by wood. Can process biomass and 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 hydro-carbons are cracked turning it into gas. It is not 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.

A2.3 What is 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 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.

A2.4 Unit Design

He 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.

A2.5 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.

A2.6 Environmental and Health Impacts and Benefits

A2.6.1 Waste Diversion

The current adopted design delivers the following waste diversion results[8]:

- 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.[9]
- 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.[10]
- One system will remove the following waste quantities annually from the environment under low, medium and high use scenarios[11]:

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 [12])	Number of low-income households with full plastic waste diversion[13]
Low	11	9
Medium	23	18

[8] 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.

[9] Measurement by volume can be undertaken but is less useful as compression will vary.

[10] Honiara City Council Waste Characterisation Study 2011 and National Waste and Pollution Control Strategy 2017-2026

[11] Low scenario: 1 cook 5 days a week. Medium scenario: 2 cooks 6 days a week. High scenario 3 cooks 7 days a week.

[12] Based on Solomon Islands average household size – urban areas. Solomon Islands Statistics 2007

[13] Honiara City Council Waste Characterisation Study 2011 – average household size for low income household sample.

High	35	26

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

A2.6.2 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.

A2.6.3 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. We estimate a 20% net reduction.
- 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.

A2.6.4 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

A2.7 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.

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 show the potential income arising from fuel substitution from one system, under the more conservative processing scenarios. Whether this is realised 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 5: 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.

A2.8 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, 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, we can build smaller systems – as small as a large cooking pot, which may be useful.

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