# **Tonga Analysis Report**

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



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## **Tonga Analysis Report**



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This document has been produced with the financial assistance of the AFD. The views expressed herein can in no way be taken to reflect the official opinion of the AFD

## **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. Six countries and territories will benefit from this overall project which include Fiji, 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 finalization of the plan after further consultation and feedback.

This report is the Analysis Report for the Tonga component of the work. This phase of work was essentially local data gathering. John O'Grady interviewed a large number of people in order to gather the data, both in person and by phone. During this data gathering work he was assisted by Department of Environment staff members Sulieti Hufanga, Project Officer PacWaste Plus, and Mele Tuakalau, Conservation Office, whose excellent assistance is gratefully acknowledged.

Mafile'o Masi, Chief Environmentalist, Department of Environment provided the necessary high-level support, and her considerable assistance is also gratefully acknowledged.

The following conclusions have been made as a result of the analysis work:

a) Based on the information supplied by the Department of Customs in 2021, there was 601,285 litres of oil imported into Tonga, 86% of which was lubricating oil and 11% was hydraulic oil. The remainder was two stroke oil.

- b) An estimate has been made of used oil generated at present, taking into account the increase in economic activity since the pandemic and the fact that the Department of Customs may have missed some importers. This estimate is 330,000 – 380,000 litres/year.
- c) A total of 223,200 litres of used oil is being stored on Tongatapu at numerous locations, including 136,000 litres at the Tonga Power Ltd plant at Popua. Much of this storage is unsatisfactory and is posing a serious risk of contamination of soil and water.
- d) Some used oil is being used for a variety of unsatisfactory uses, including timber preservative, chainsaw bar oil, painting vehicles to prevent corrosion, and marking sports fields. These and other uses described have the potential to cause significant environmental and health risks.
- e) The remainder of the used oil is probably just being disposed of to land or to waterways, although no direct evidence of this happening was discovered, except for evidence of spills and leakage in some of the current storage areas.
- f) There are no potential local reuse /disposal options available that may be satisfactory, although some industrial uses have been tried.
- g) There are government priorities for the management of used oil that require effective management to protect human health and the environment.
- h) During the data gathering work for this report, it was evident that numerous used oil generators are keen to find a solution to the current problem of used oil mismanagement in Tonga.
- i) The first stage in finding a solution is to set up an effective collection and storage system. Waste Management Authority is prepared to take this on if funding assistance is provided. They have a suitable location to set up a used oil storage facility.
- j) Disposal will be examined in detail at the next stage of the project, and it is likely that export will be a favoured option, although the NuFuels process is worth investigating further to manage some of the used oil locally.
- k) This data gathering phase of the project was delayed by the pandemic, but it is considered that sufficient information has now been gathered to move on with some confidence to the next stage of the project, i.e. the Feasibility Study.
- 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
ARF	Advanced Recycling Fee
AMP	Asset Management Plan
CBA	Cost Benefit Analysis
CCA	Copper, Chromium, Arsenic
COP	Code of Practice
FISA	Friendly Islands Shipping Agency
GDP	Gross Domestic Product
GEFPAS	Global Environment Facility - Pacific Alliance for Sustainability
GHS7	Globally Harmonised System Rev 7
JICA	Japanese International Cooperation Agency
MEIDECC	Ministry of Energy, Information, Disaster Management, Environment,
	Climate Change and Communications
MIA	Marine Imports Authority
МОН	Ministry of Health
MOI	Ministry of Infrastructure
NIIP	National Infrastructure Investment Plan
ODS	Ozone Depleting Substances
PAHs	Polyaromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
PE	Pacific Energy
PIC	Pacific Island Country
PICTs	Pacific Island Countries and Territories
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment
PPM	Parts per Million
PSF	Pacific Sunrise Fishing
SCL	Salters Cartage Ltd
SPC	Sun Petrochem Corporation
SPREP	Secretariat for the Pacific Regional Environment Programme
SWAP	Committing to Sustainable Waste Actions in the Pacific
TERM	Tonga Energy Roadmap Strategy
TPL	Tonga Power Ltd
ТТ	Tanktainer
TWA	Tonga Waste Authority
UNEP	United Nations Environment Programme
WAL	Waste Authority Ltd
WMA	Waste Management Act

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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, i.e.:

- 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.

The overall work covered in this project is funded by the Agence française de développement (AFD). This work is 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.

There is also an overarching issue covering sustainable financing mechanisms.

Six countries and territories will benefit from this overall project which includes Fiji, 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,

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• Vanuatu.

The main outcome of the project is a National Used Oil Management Plan for each country. This report focuses on the Tonga component of the work.

#### 1.2 Project Deliverables

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

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	<ul> <li>2.1 Host an Inception Workshop with National stakeholders</li> <li>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</li> </ul>	Within 1 month following Inception meeting
3. Analysis Report	<ul> <li>3.1 Undertake an analysis of used oil production and existing used oil collection, storage, treatment, disposal and export services</li> <li>3.2 Analyse findings against government and stakeholder priorities</li> </ul>	Within 2 months following approval of the Inception Report
4. Feasibility Study Report	<ul> <li>4.1 Development of a feasibility study based on all the information gathered and data obtained through the consultations, interviews, and investigations</li> <li>4.2 Feasibility Study Presentation</li> </ul>	Within 2 months following approval of the Analysis Report
5. Draft National Used Oil Management Plans	<ul> <li>5.1 Compile all the gathered information to develop a Draft National Used Oil Management Plan</li> <li>5.2 National Stakeholder Presentation</li> </ul>	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

Table	1:	Project	Deliverables	
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#### 1.3 Used Oil Background

Used oil is defined as any petroleum-based or synthetic oil or fluid that, through contamination or degradation, 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<sup>1</sup> and Basel Conventions<sup>2</sup>.

This definition 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 through water runoff from urbanized areas. Oil spilled on soil also 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 and other contaminants may persist for years.

Ingested oil may adversely impact the ability of animals to digest food and may damage their intestinal tracts. Oil also reduces the insulating capacity of animal furs and the water repellency of bird feathers, thus 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 target organs, including 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.

<sup>&</sup>lt;sup>1</sup>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).

<sup>&</sup>lt;sup>2</sup>Basel Convention on the control of transboundary movements of hazardous wastes and their disposal and Annexes and Amendments (1998)

#### 1.4 Analysis Report

Under the terms of the contract, for the Analysis Report 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.
- **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.

## 2.0 Background for and Procedures Used for Data Gathering

#### 2.1 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)
- Metalworking fluids and oils (Should be kept separate as they may be contaminated with metal fragments.)
- Heat transfer oils
- Machining oils
- Ship's slops, bilge water, tank cleanings produced by vessels during normal shipboard operations
- Bottom clean-out waste from virgin fuel storage tanks, virgin fuel oil spill cleanups, or other oil

#### 2.2 Sources of Used Oil Contamination

It is important to note that some potential components of used oil should be excluded, mainly for safety reasons – flammability and toxicity. Checks were made to assess how these items can be screened out. These potential components included:

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

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• Soluble cutting fluids.

The occurrence of such items were, however, noted, as other hazardous waste disposal solutions will be needed for these items.

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 2020 Tonga NIP Update Report<sup>3</sup> concluded that:

"All transformers used in Tonga since 1980 have been certified as being PCB-free, and all transformer (and other infrastructure) management in Tonga has been contracted out by Tonga Power Ltd (TPL) to Transnet, a New Zealand Company for the last 10 years. This includes replacement of all transformers and transformer oil. Whilst PCBs are unlikely to present any threat to power sector workers, local staff have not been trained to be aware of potential PCB issues in the workplace."

#### 2.3 Inappropriate Uses of Used Oil

There are several methods for disposing of used oil that are inappropriate and examples of these are:

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

<sup>&</sup>lt;sup>3</sup> Tonga National Implementation Plan (NIP) Update for Persistent Organic Pollutants January 2021

#### 2.4 Methods of Used Oil Management

Methods of used oil management, including collection and storage, were examined including considering the following matters:

- Where IBCs (intermediate bulk containers) are used for the collection, storage and transportation of used oil, these must be sound and of good quality. They should not be left in the sun as UV light will break them down.
- Steel drums will corrode and leak, especially where the used oil is mixed with water.
- Plastic drums will deteriorate, especially if left in the sun.
- Bulk storage facilities must be maintained in good condition, regularly inspected and have good secondary containment. They need proper spill control equipment, fire extinguishers and emergency response procedures in place.
- Long term storage may result in the accumulation of sludges that are difficult to remove by pumping.

#### 2.5 Disposal Facilities

Local disposal facilities were assessed for suitability.

Overseas disposal facilities were assessed to some extent, to ensure they were being operated properly. Some were well known, such as BlueScope Pacific Steel in Fiji and Salters Cartage in New Zealand. This assessment will be more detailed in the Feasibility Study stage of the project.

#### 2.6 Methods of Data Collection

John O'Grady of Araspring Ltd made a visit to Tonga from 31 October 2022 to 5 November 2022 in order to carry out visits and inspections and collect data.

Data collection was carried out through personal visits, emails and phone interviews. Phone calls were also made to follow up on personal visits.

It was sometimes difficult to determine the sources and composition of used oil generated and used oil stockpiled. Source, quantities and composition were checked through questioning all parties involved, and care was taken to observe contamination from undesirable sources.

## 3.0 Relevant Legislation

#### 3.1 Overview

Tonga does have some specific waste legislation, namely the following:

- Waste Management Act,
- Regulations under that Act concerning a levy on plastic bags,
- Hazardous Waste and Chemicals Act,
- Environment Act, largely providing the administrative framework to create and enact further environmental legislation.

The Ministry that oversees this legislation is the Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change & Communication (MEIDECC).

Tonga is a party to the Waigani, Basel and Stockholm Conventions, and all three have a bearing on the management of used oils for Tonga, and their potential export for overseas recycling.

Policy documents include the national Infrastructure Investment Plan, developed with assistance from the Pacific Regional Infrastructure Facility (PRIF), and the Tonga National Strategic Development Framework 2015-2025, both of which can having a bearing on expected used oil production resulting from use in power plants and vehicles. These are addressed in Section 4.0 below.

#### 3.2 Waste Management Act (2005)

The Waste Management Act (2005) (WMA) provides a comprehensive legislative base for the effective development and management of the sector. It primarily creates Waste Management Service Areas<sup>4</sup>, in which Approved Waste Management Authorities<sup>5</sup> are responsible to carry out the functions of the Act. The Waste Authority Ltd. (WAL) was created by the Act to manage waste on Tongatapu, whilst that function was taken on by the Ministry of Health in all other islands at the time of the Act passing. Over the last four years, WAL has, however, taken on the function of Approved Waste Management Authority in both Ha'apai and Vava'u.

The WMA contains wise ranging provisions, including:

- the provision of municipal solid waste collection, transfer, and disposal services,
- promotion of waste reduction and recycling programs,
- development of rules and codes of practice,

<sup>&</sup>lt;sup>4</sup> Waste Management Act, Part II

<sup>&</sup>lt;sup>5</sup> ibid, Part III

- monitoring of public health and environmental impacts,
- public awareness raising,
- solid waste management community responsibilities,
- imposition and collection of solid waste management fees,
- and prosecutions for violations.

The Act is specific on operational responsibilities, including the contracting of services to the private sector. It also contains both the power to make regulations (a power of the Minster of Environment) and also the power for the Approved Authorities to levy, at section 27 (e): *special levies on particular goods the disposal of which is likely to have adverse effects on the environment*. The Act charges the Approved Authorities with various functions, including:

- Section 21 Recycling of Wastes an approved Authority shall promote the recycling of wastes;
- Section 13 Fees and Charges an approved Authority may levy and vary the following fees, including for collection and disposal of hazardous wastes.

These various provisions, taken along with some of the provisions of sections 6 and 8 on the Functions and Powers of the Approved Authority, could be seen as potentially creating an existing legal framework to develop an Advance Recycling Fee (ARF) system for used oils. The ARF is seen as one of the keys to successful management of used oils and will be discussed more fully in the Feasibility Study Report. Implementation of an ARF would require at a minimum the development of regulations specific to used oils.

#### 3.3 Waste Management (Plastic Levy) Regulations 2013

These regulations are created under the provisions of the WMA. They require importers of plastic bags to pay a levy of 10% of the customs value of the bags. Certain types of plastic bags are exempted. The Waste Authority Ltd. is designated as the levy collector. There is no specified use for the levies so paid.

These regulations use the powers of the WMA to collect levies for the purposes of waste management, and as such create a precedent that may be useful if some form of Advance Disposal Fee (ADF) or Advance Recycling Fee (ARF) were to be introduced to assist in the management and disposal of used oils.

#### 3.4 Hazardous Wastes and Chemicals Act (2010)

The Hazardous Wastes and Chemicals Act (2010) deals with the national management of the:

- Stockholm Convention,
- Rotterdam Convention,
- Basel Convention,

• Waigani Convention.

The provisions of this Act will therefore be important to consider in any used oil management planning. The Act permits exports of hazardous wastes as long as they comply with the relevant conventions. It also requires that management of hazardous wastes should conform to the National Implementation Plan developed under Tonga's obligations to the Stockholm Convention.

Specifically, under the Act:

- No person may manufacture, produce, import or use any prohibited persistent organic pollutant in Tonga;
- No person may store any prohibited persistent organic pollutant unless the persistent organic pollutants are being stored prior to their lawful disposal in accordance with this Act;
- No person may export any persistent organic pollutant except for the purpose of disposal in an environmentally sound manner in the country of import;
- The Minister may approve a National Implementation Plan, and any amendment to it, for the control and proper management of persistent organic pollutants in the Kingdom, and the implementation of the Stockholm Convention; and
- The Minister may approve regulations made under this Act to make provision for the implementation and enforcement of the National Implementation Plan (NIP) or any particular provision of the Plan.

Part XV (Miscellaneous) of the Act includes the power to regulate, and the most important point in the list of these powers, in relation to used oil, may be:

"(t) the imposition of "user fees" and the "polluter pays" principle".

This provision may potentially be used to develop any ADF.

The Act also cites the Precautionary Principle as a guiding principle of the Act.

#### 3.5 Environment Management Act (2010)

The Environment Management Act (2010) establishes Tonga's Ministry of Meteorology, Energy, Information, Disaster Management, Environment, Climate Change and Communications (MEIDECC) and sets out its functions, and its powers. These include:

- monitoring of environmental impacts;
- control of the movement or disposal of hazardous waste and chemicals;
- protection of coastal areas;
- regulation or prohibition of pollution to air, water, or land refer Part V:

(c) regulating or prohibiting the pollution of the air, water or land, and the depositing or dumping of litter, rubbish, or any substance of a dangerous, noxious or offensive nature;

• regulation of the dumping of litter and rubbish (see 3.6 below),

An objective of the Act is to ensure Tonga observes its international obligations relating to the protection of the environment. To this end, the Ministry is charged with conducting all matters necessary for the observance of the international and regional conventions to which the Kingdom is a party.

#### 3.6 Environment Management (Litter and Waste Control) Regulations 2016.

This regulation is under the Environment Management Act (2010) and Part III of these regulations contain several offences that could be used to control the disposal of used oils, as they prevent burning and pollution associated with hazardous wastes and burning dumpsites.

Section 10 (Offence to Burn Noxious Wastes) specifies 'waste oil' as a noxious waste.

#### 3.7 Marine Pollution Prevention Act (2002)

The Marine Pollution Prevention Act (2002) provides for the response to marine pollution from ships and land-based sources; places restrictions on the dumping and incineration of waste at sea; and gives effect to international marine pollution conventions.

#### 3.8 Seabed Minerals Act (2014)

This is an Act to provide for the management of the Kingdom's seabed minerals, and the regulation of exploration and mining activities within the Kingdom's jurisdiction or under the Kingdom's control outside of national jurisdiction, in line with the Kingdom's responsibilities under international law. The Act has a protective objective to protect and preserve the Marine Environment and to protect the well-being of individuals and communities insofar as may be impacted by or employed in Seabed Mineral Activities.

This Act provides powers and duties to prevent, reduce and control pollution from seabed activities or caused by ships or by dumping of waste and other matters at sea. In addition, title holders have a duty to take the necessary steps to prevent, reduce and control pollution and other hazards to the Marine Environment, including waste material, arising from Seabed Mineral Activities. Title holders are not to dump mineral materials or waste from any vessel except in accordance with international law and the directions of the Authority. This Act allows the Minister responsible with the consent of Cabinet to make Regulations for the operation of this Act. However, to date, no regulations have been made.

#### 3.9 The Public Health Act (2008)

The Public Health Act (2015) provides regulations pertaining to:

- the supply of water of a suitable quality,
- installation and standards related to sanitary facilities,
- sources and standards of air pollutants
- and the management of public health emergencies (such as a dengue outbreak).

Part VI of the Public Health Act empowers the Minister of Health to make arrangements for the collection, transport and disposal of domestic, commercial and trade waste (section 91).

The Minister of Health is also empowered under section 94 to:

- make regulations specifying the types of solid or liquid waste which shall be considered to be toxic or hazardous to health;
- define those sites approved by the Minister as suitable for the storage or controlled disposal of toxic or hazardous waste;
- specify the types and specifications of containers to be used for the storage or disposal of toxic or hazardous waste;
- regulate any other matters relating to the transportation, storage, or controlled disposal of toxic or hazardous waste as the Minister may require.

This Act has been reported<sup>6</sup> as containing provisions relating to waste collection and waste containers, disposal of solid and hazardous wastes, and licensing recyclers. However, it appears that the latest version of the Act has removed those provisions, as they now appear in other legislation.

#### 3.10 Customs Act (2008)

The Customs Act provides for prohibiting or restricting the import or export of goods into and out of the Kingdom. Part I Schedule II of the Customs Act, under paragraph 8, prohibits the importation into Tonga of "all toxic or hazardous wastes".

#### 3.11 Petroleum Act 2020 and Petroleum Regulations 2020

This Act and associated regulations regulate the import, export, transport, storage and overall management of petroleum in Tonga.

<sup>&</sup>lt;sup>6</sup> SPREP PacWaste Plus (2020). Stocktake of Existing and Pipeline Waste Legislation: TONGA p8

#### 3.12 Pesticides Act (2016)

This Act specifically relates to pesticides, but could be involved in controlling irregular use of used oils where they are used as pesticides. Unless used oil was registered as pesticide under the Act, it cannot be used as such in Tonga.

One use for used oil is to paint timber to discourage termites, and another is on playing fields to kill grass so as to make out boundary lines.

#### 3.13 Ozone Layer Protection Act

This is a standard piece of legislation which fulfils Tonga's obligations under the Montreal Protocol of the Vienna Convention on substances that damage the Ozone layer.

This Act is not likely to have any direct relevance to control of used oils, but the systems the Act uses to control imports of Ozone Depleting Substances (ODS) could possibly provide a template if it was decided that certain oils were to be banned for import, or that importers of oil should be controlled in some way, or have to provide regular reports on their imports.

#### 3.14 Water Resources Bill (2012)

This is a Bill to provide for the management and conservation of the water resources in the Kingdom of Tonga<sup>7</sup>. This Bill will, if enacted, ensure that environmental standards are applied to the taking of water and any activity that might affect the water management operations and supply.

The Bill will also establish a national water resources committee to ensure the effective monitoring of the water resources by the responsible agencies and will require that records of such monitoring are maintained and made accessible.

<sup>&</sup>lt;sup>7</sup>Government of Tonga (2012). Water Resources Bill (2012). 19pp

## 4.0 Relevant Policy and Strategy

#### 4.1 National Infrastructure Investment Plan (NIIP)<sup>8</sup>

The National Infrastructure Investment Plan (NIIP) outlines the Government of Tonga's priorities and plans for major infrastructure initiatives over the next five to 10 years. This is the second NIIP (NIIP2). It updates and builds on the successes of the first NIIP that was prepared in 2010. Of the 12 priority investment projects proposed in the first NIIP, most are now underway and many of the supporting reforms and capacity building initiatives are also moving forward. The Plan covers major infrastructure initiatives with national, regional, or local significance over the 2013-2023 time period. The Plan focuses on economic infrastructure facilities that support everyday life and business activity, such as energy supply systems, telecommunications, water and waste management, and transportation. In particular, the NIIP includes priorities and plans for major initiatives in the following sectors:

- Telecommunications (telephone, internet, broadcasting)
- Water and waste related services (water supply Energy (electricity, fuel), wastewater, drainage, solid waste)
- Transport (airports, roads, seaports)

Other categories of built infrastructure supporting social services and governance, such as education, healthcare, and correctional services, are not included in this Plan and generally have their own sector plans.

The two key areas of interest with regard to used oils are whether it is expected that there would be future investment in extra diesel-powered electricity generation, and in more roads. The plan clearly shows that investment in increased electricity generation is expected to be in solar power projects, so the current production of used oil from diesel generation plant can be expected to hold into the medium-term future, but not increase. For vehicles, the plan focuses on improvements and upgrades to outer island roads, which might be expected to encourage wider vehicle use in the outer islands, rather than new road networks.

However, the plan does note a strong urban drift, with Tongatapu island having 75% of the population and growing at a rate of 2.5% whilst the outer islands population is falling. This may tend to show increased use of lubricating oil in Tongatapu compared to the rest of the nation, and so encouraging the focus on Tongatapu as the island with by far the most used oil generation.

<sup>&</sup>lt;sup>8</sup>Government of Tonga (2013). Tonga National Infrastructure Investment Plan 2013 -2023. PRIF, 65pp

#### 4.2 Tonga National Strategic Development Framework 2015 - 2025

This is the second such document. It is broad and far-reaching and is framed in a positive way as indicated by the quote below at the start of the Foreward:

"We approach the second Tonga Strategic Development Framework (TSDF II), 2015-2025 with great optimism and with a renewed sense of purpose and confidence in our ability to improve the quality of life for all the people of Tonga. These improvements will be achieved through improving equality, justice, and good governance in addition to expanding our economic and social opportunities. These processes must be carried out with integrity and accountability. TSDF II must focus upon implementation and the delivery of results."

This document takes a broad perspective on how Tonga should develop and sets organizational outcomes for a range of sectors, and targets, mostly specific, are also set.

The Strategic development framework does look at waste and recycling, and has a specific desired outcome in the table of National Outcomes, being:

Organisational Outcome 5.3: Cleaner environments and less pollution from household and business activities building on improved waste management, minimization and recycling, making conditions safer, healthier and more pleasant for residents and visitors.<sup>9</sup> This is also expressed at a 'cleaner environment with improved waste recycling' in the outcomes table at 5.4.<sup>10</sup>

Some other key development aims are:

- Dynamic & knowledge-based economy.
- Strengthened business-enabling environment.
- Improved public enterprise performance.
- Better access to overseas trade, employment and foreign investment.
- Balanced urban & rural development across island groups.
- Improved health care and delivery systems (universal health coverage).
- Improved resilience to natural disasters and impact of climate change.
- More reliable, safe and affordable energy services.
- More reliable, safe, affordable transport services.

## 4.3 National Implementation Plan for the Stockholm Convention (2009 and 2019)

 $<sup>^9</sup>$  Tonga Strategic Development Framework , pillar 5 natural Resources and Environmental Inputs p. 21  $^{10}$  ibid, p. 60

The National Implementation Plan (NIP) for Tonga under their Stockholm Convention Obligations, was prepared in 2009, and updated in 2019 for the additional Persistent Organic Pollutants (POPs). The Stockholm Convention covers 28 POPs, and the NIP is required periodically under the Convention reporting requirements to plan out what actions are to be taken to reduce and if possible eliminate POPs from Tonga.

Whilst waste oil *per se* is not named on the list of POPs covered by the convention, there are oils, such as electrical insulating oils, which may contain the POP Polychlorinated Biphenyl (PCB). Waste and used oil management is often covered by national NIPs. The NIP reports note that a common source of POPs, transformer oil, is not present in Tonga as the transformers were all tested before the first NIP<sup>11</sup>. If the transformers in 2009 did not have PCBs then there are unlikely to be any present today as PCB oil in transformers is a legacy issue from old electrical equipment from many years ago.

The 2009 NIP does have a plan of action that mentions waste oils, requiring the establishment of a waste oil disposal regulatory regime<sup>12</sup>, with the key contributing agency being Ministry of Transport, as marine pollution was part of this action.

#### 4.4 Tonga Agriculture Sector Plan (2016-2020)

The Tonga Agriculture Sector Plan was identified as part of Tonga's national planning process. The plan identifies Tonga's vision and priorities for maximizing contributions from the agriculture sector to Tonga's economic growth and sustained food security in the face of a changing world economy, looming climate change, and on-going natural disasters in the Pacific. The plan also:

- articulates specific programmes and activities which are required to achieve sector priorities;
- clarifies the roles and responsibilities of the different sector stakeholders;
- estimates investment needs; and
- provides a framework for measuring progress over the short- and medium-terms.

Increased agriculture in Tonga will increase used oil production with a wider use of tractors and agricultural machinery.

#### 4.5 Tonga Energy Roadmap Strategy 2010 - 2020

The Tonga Energy Roadmap Strategy (TERM) was prepared to set out a ten year road map to reduce Tonga's vulnerability to oil price shocks and to achieve an increase in quality access to modern energy services in an environmentally sustainable manner.

<sup>&</sup>lt;sup>11</sup> Tonga National Implementation Plan for the Stockholm Convention 2009. UNEP, p 6

<sup>&</sup>lt;sup>12</sup> Ibid, Table 3.3e, 6) p 52

The report examined several strategies to achieve this aim including petroleum price hedging and efficiency gains in the whole system.

The report concluded that to diversify away from nearly total dependence on diesel for power generation will require the development of domestic, renewable energy resources, which will require substantial investment and private sector participation.

An increased use of renewable energy will reduce the use of diesel generators and thus reduce the production of used oil from the power sector.

#### 4.6 Waste Authority Ltd Business Plan 2020/2021

The Waste Authority Ltd Business Plan sets out a clear pathway for the Authority, with a focus on customer satisfaction, clean environment and business sustainability.

WAL is in a good position making a real difference to waste management in Tonga. The Business Plan identified the following objectives, Strategies and Key Performance Indicators for the WAL, as shown in Table 2 below:

Objective	Strategies	Key Performance Indicators
	<ul> <li>Reduce costs – undertake a cost review and look for improved efficiencies</li> </ul>	• Expenses to maintain within approved budget.
	<ul> <li>Increase revenue – ongoing tariff review to evolve the tariffs towards the preferred rate of return</li> </ul>	• Tariff review is complete with recommendations to the Board by September 2020
Enhanced financial sustainability	• Improve debt collection – conduct an analysis of the causes of bad debt and seek to work with customers to reduce the incidence of bad debt	• Plastic bottles from imported beverages to include in plastic levy
	<ul> <li>Additional loans are taken out to fund the development of WAL</li> </ul>	<ul> <li>Seek approval from Ministry of Customs to include WAL's plastic levy in processing of customs documentations</li> </ul>
		<ul> <li>Bad debt reduced by 10%</li> </ul>
		<ul> <li>Loan approved</li> </ul>
Improved Infrastructure and Plant Management	• Develop a comprehensive asset management plan (AMP) and set of procedures	<ul> <li>An AMP is available and assets and plant are being managed in accordance with approved procedures</li> </ul>

Table 2: WAL Objectives, Strategies and Key Performance Indicators as at 2020

Objective	Strategies	Key Performance Indicators
	<ul> <li>Prepare new landfill site for Tongatapu</li> </ul>	<ul> <li>New landfill capacity is developed ahead of the need – 6 months before use is required</li> </ul>
	• Construct new purpose-built rubbish collection and landfill vehicles for Tongatapu and Vava'u	• A reliable and safe fleet of vehicles is in operation – number of breakdowns is reduced by 10% and there are no accidents caused by plant failure.
Improved	<ul> <li>Investigate shortening route distances for residential collection by looking at optimal truck routes and intermediate stockpiling</li> </ul>	• Time to collect rubbish is reduced by 10%
efficiency of Waste Processing	• Investigate alternative methods to landfill such as composting and waste-to-energy plants	<ul> <li>Volumes of waste going into landfill are reduced by 10%</li> </ul>
		<ul> <li>Report of the cost/benefit of outsourcing completed within 12 months</li> </ul>

## 5.0 Previous Used Oil Audits

#### 5.1 Golder Used Oil Audit 2014

The main points arising from the 2014 Audit are:

- Total imports of lubricating and hydraulic oil equal approximately 450,000 L per year.
- 2 major companies (TOTAL, Pacific Energy) supply lubricating and hydraulic oil.
- The main consumer is the public power authority: Tonga Power Limited (TPL) and their Power Station located in Popua (Tongatapu).
- The main volume of waste oil is generated by the TPL power station. All the waste oil (50 to 60,000 L estimation) is currently sold to local customers.
- Local customers are using the waste oil as a poor quality lube oil for tractors, chainsaw, timber painting, sport field.
- Pacific Energy offers a take-back service.
- Considering the consistency of the national import figures, the total volume of waste oil to be potentially collected should be 225,000 L per year.
- Tonga has ratified Basel and Waigani Conventions.
- Waste Oil Management strategy could be a mix of the following options :
  - Obligation of take-back services for major oil companies
  - o Building a waste Oil Storage Site to store the waste oil collected in the Islands
  - Shipping to Fiji or India and the costs have to be paid by final client.
- With the volume of potential waste oil in Tonga, it would strongly be recommended to study the feasibility of a treatment equipment in Tongatapu.
- Recycling private companies exist in Tonga and should be in prior involved in the process.
- The common approach to fund a waste oil management programme is the introduction of a universal levy for all oil imports, which is the first principle of polluter-pays.

The report presented the following Import data as supplied by the National Statistics Bureau, and Customs Import Data, see Table 3 below.

Year	Description	Quantity (Litres)
2010	Lubricating Oils	418,196
2011	Lubricating Oils	528,995
2012	Lubricating Oils	418,995
2013	Lubricating Oils	416,652

Table 3: Tonga Imports of Lubricating Oil – 2010 to 2013

The conclusion regarding the quantity of used oil collected was presented as follows:

It is generally recognised that only about 50% of the oil sold will end up as waste. Considering the consistency of the national import figures, the total volume of waste oil to be collected should be 225,000 L per year.

The report also concluded that a Waste Oil Management Strategy could be a mix of the following options:

- Obligation of take-back services for major oil companies;
- Building a used Oil Storage Site to store the waste oil collected in the Islands;
- Shipping to Fiji or India, with the costs have to be paid by the final client;
- With the volume of potential waste oil in Tonga, it was recommended to study the feasibility of a treatment plant in Tongatapu;
- Recycling private companies exist in Tonga and should be involved in the process;
- The common approach to fund a used oil management programme is the introduction of a universal levy for all oil imports, which is the first principle of polluter-pays.

The only bulk storage facilities for used oil noted in the report was 1,000 litre Intermediate Bulk Containers (IBCs) which can be handled by a forklift. There are no details regarding whether Pacific Energy or Total oil companies have any bulk storage tanks on their tank farms.

The report does not detail any proposals regarding how the waste oil would be collected, although the options presented for managing used oil do refer to a levy on lube oil. There are no details about how that levy might be implemented, or any evaluation about what level of levy might be acceptable to the public.

#### 5.2 Cost-Benefit Analysis of Used Oil Management Options for Tonga (2015)

Subsequent to the 2014 report, a Cost-Benefit Analysis (CBA) was conducted for Tonga in 2015. This report assumed that used oil represented 38% of the imported lubricating oil, and so taking a figure of 450,000 litres as imports, from the 2014 Audit, it predicted that 171,000 litres would be produced annually for disposal. It is not stated on what basis the 38% figure is derived.

The CBA report stated that Pacific Energy, one of two lubrication oil importers, ships used oil to Fiji on its own ship, but does not state how much goes on that route, or what it is used for<sup>13</sup>.

<sup>&</sup>lt;sup>13</sup> Cost-Benefit Analysis of Used Oil Management Options for Tonga (2015), Executive Summary, p 3.

The report has a list of 'Practical Options' for used oil management, namely:

- recycling in Tonga for use as an industrial fuel,
- batch incineration in a specifically designed incinerator,
- blending with diesel fuel so as to use in large diesel engines ('black diesel'),
- off-shore shipment.

The first three in -country options were then investigated as to cost-benefit, and offshore shipping (the only option currently in place at that time) was treated separately<sup>14</sup>.

All four options were evaluated as to the costs involved<sup>15</sup>. The summary then put recycling in-country and use as black diesel in the same category for evaluation, as it appeared that the two options were in fact one. The summary then found that incineration would cost 4¢/litre, recycling/use as black diesel would be 12¢/l, and shipping off-shore as 26¢/l. The analysis did not include details of shipping costs.

The incinerator identified was quoted as having a capacity of 20 litres per hour. If total used oil in Tonga is 171,000 litres per year, this would require 8,550 hours to burn a year's worth of oil with this unit. 8,550 hours is 1,068 days at eight hours per day<sup>16</sup>. Typical working days per year are around 240. At least four units would be required to work 8 hours per day during all normal working days to dispose of the amount of oil generated. This might be expected to require something like eight people, plus 256 kWh of electricity use per day<sup>17</sup> (for four units) as a very basic running cost.

The analysis at the end of the report did not include these running costs broken down, simply costing the entire operation as \$40/day, which is far too low. The black diesel option appears to be predicated on the assumption that the recycled used oil could be mixed with diesel in an 80/20 mix of used oil to diesel, which would be surprising. The option was based on 171,000 litres of used oil being available to displace some similar amount of diesel imports. In fact the black diesel option is unacceptable, due to damage to generators and invalidating generator guarantees.

The incineration option was recommended as the most cost-effective operation, after a suitable incinerator was costed out at a purchase price of around US\$10,000, which is a very low estimate. No costs were described in any option for collection, storage or handling of the used oil prior to processing or shipment.

This report thus provided few useful conclusions.

<sup>&</sup>lt;sup>14</sup> Ibid, sections 3 & 4.

<sup>&</sup>lt;sup>15</sup> Ibid, section 6 Cost Analysis, p 12

<sup>&</sup>lt;sup>16</sup> Ibid, section 3 Disposal and Treatment Options, p 6

 $<sup>^{\</sup>rm 17}$  Ibid, section 6 Cost-Benefit Analysis table, p 12

## 6.0 Used Oil Import Information

#### 6.1 Government Import Information

#### 6.1.1`Dept of Statistics

A meeting was held with Ana Kama, Senior Statistics Officer and Ana Moa, Statistics Officer, from the Customs Trade Div. They supplied the "International Merchandise Trade Statistics" Quarterly Report April-June 2022.

The following data has been extracted:

Quarter 2, 2022 –

HS Code 27101219 (the HS Code used by the Department of Statistics for Mineral Oil)

Australia:2,880 litresFiji:16,940 litresNew Zealand:277 litresSingapore:94,068 litres

Total: 114,165 litres/quarter = **456,660 litres/yr** (assuming all quarters are equal which they may not be)

#### 6.1.2 Dept of Customs

A meeting was held with Palatasa Havea, Customs Officer who showed us the data on imported oil they collected and said that, subject to an official request, they could supply us with the necessary data. An official request was made, and a detailed spreadsheet was supplied for 2021 with 665 entries. The following information was extracted for oil imports for 2021 – see Table 4 below:

Importer	Hydraulic Oil	Lubricating Oil	2 Stroke Oil
Total Energies	20,172	168,556	0
Pacific Energy	10,080	125,018	3,840
Spare Parts Zone	19,348	105,005	703
Vaitohi Auto Parts	7,934	41,229	4,040
Others	12,075	76,421	6,864
Total	69,609	516,229	15,447

Table 4: Quantities of Used Oil Imported (Litres)

The following should be noted:

• The data collection was very through and comprehensive and even quantities of one litre were picked up.

- Some entries were difficult to interpret, and commercial names were used widely. Internet searches could, however, usually identify the type of oil from the commercial name provided.
- The "Hydraulic Oil" category included a wide range of different oils, including gear oil, automatic transmission fluid and brake oil.
- Some cutting oil imports were identified but these have been left out. Cutting oil does not generally appear in used oil collections, and should be kept separate due to potential metal contamination.
- Both lubricating oil and hydraulic oil produce used oil, probably at different percentages of the original oils. Smaller amounts of automotive hydraulic oils are consumed during vehicle operation than lubricating oils.
- Two stroke oils are fully consumed during operation of the two stroke engines as they are mixed with the fuel.
- Some imports may have been missed. The thoroughness of the data collection indicates that most of the commercial entries have been recorded. A few private entries have also been recorded but it is probable that not all private entries have been recorded. Imports that were missed may be about 5-10% of the imports that have been recorded.

#### 6.2 Pacific Energy

A meeting was held with Ifalemi Ma'u, Operations Manager, who advised that Pacific Energy (PE) import about 16,000 litres of lube oil every three months. This would amount to about 64,000 litres per year. The 2021 figure for Pacific Energy is 125,018 litres of lubricating oil but that includes 60,000 litres for Tonga Power who now purchase their lubricating oil from Total Energies.

PE has a policy of taking back used oil from their customers and have been sending it to Fiji for disposal. They haven't shipped anything for three years, but recently applied for a permit to ship to Fiji again. They have about 10,000 litres stockpiled at present and were hoping to send that to Fiji as soon as it could be arranged, assuming Bluescope Steel in Fiji were still able to receive used oil.

Mr Mau said that used oil disposal had been a big problem for years and a solution was urgently needed. He also said that they were regularly audited by external environmental auditors Aurora Consulting from Australia, for a wide range of matters, including used oil management and were keen to meet all their obligations.

#### 6.3 Total Energies

A phone conversation was held with Jese Tikomailepononi, Country Manager who advised that the amount of oil that Total Energies (Total) import is confidential although he did understand that the information was available from the Department of Customs. The 2021 import figure shown in Table 5 above is 168,556 litres of lubricating oil. They now supply Tonga Power so about 60,000 litres/year could be added to this figure, making the import figure for Total Energies about 230,000 litres/year.

Mr Tikomailepononi advised that they have taken back used oil in the past but do not do it now as they have no way of disposing of it. They would like to find a solution to the used oil problem in Tonga and are keen to take part in the solution.

#### 6.4 Spare Parts Zone

Spare Parts Zone is a major auto parts and accessories supplier. A meeting was held with Mohammad Razak, Director, who advised that they import about 5-6 shipping containers of lube oil per year from Singapore - about 528 x 200 litre drums per year or 105,600 litres, plus other oils. They sometimes also purchase lube oil on the local market from Total Energies or Pacific Energy. The 2021 figure for Spare Parts Zone from Table 5 above is 105,005 litres, which accords with Mr Razak's advice.

Spare Parts Zone is also a major vehicle servicing centre and Mazda dealer. They have about 30 x 200 l drums (6000 litres) of used oil stored at the moment – about one years' worth. It is stored under cover in a warehouse. Some is given away to people for marking sports grounds and for timber treatment (painting posts). Mostly, though they have a used oil problem that needs a solution.

They know that many other parties also import lube oil, including private individuals who may not be known to Customs. This confirmed the need to adjust the total Customs figure upwards to account for importers not recorded by Customs.

Mr Razak was keen for us to find a local solution to the used oil disposal problem and a solution is badly needed. He also pointed out:

- He sells two stroke oil but that is all used up in the engine combustion process.
- Many vehicle owners hardly ever bother to change their oil but just keep topping it up.
- Hydraulic oil is a slow seller and not much waste is produced.
- People keep buying low viscosity oil, despite it not being the correct oil for their engines. Low viscosity oil burns more readily.

#### 6.5 Vaitohi Auto Parts

Vaitohi is an auto parts and hardware retailer and a vehicle servicing centre. They are also Japanese second-hand car importers.

A meeting was held with Daniel Vaitohi, Admin Manager, and Alipate Afui, Workshop Supervisor. They advised that they import about one container of oil every two months, consisting of a wide variety of oils, mostly for retailing. The approximately equates to the import figures in Table 5 above.

From their workshop they produce about 100 litres/month of used oil, which they just store on site (about three drums are at present safely stored), although some is given away for various uses. They would very much like assistance to get rid of their used oil.

They said there were about 6-8 other companies servicing vehicles on Tongatapu, and numerous other small businesses operating from private homes. Used oil from these businesses is often not managed satisfactorily.

They liked the idea of a central collection and storage system, perhaps administered by the Waste Authority. They stressed, however, that the central storage system should not be at the Port area because of the tsunami risk.

## 7.0 Used Oil Generation

#### 7.1 Tonga Power Ltd

Tonga Power Ltd (TPL) is the main source of electricity in Tonga. A meeting was held with Lolohea Halaufia, Operations Supervisor. Their main lubricating oil supplier is Total. They have a policy of taking all the used oil back and sending it to Fiji, but this hasn't happened for several years. Total have supplied a Tanktainer to TPL to store the used oil in, until their take-back service is restored.

Table 5 below presents the details of power generation by TPL and also shows the quantities of used oil that are produced.

Location	Number	Units	Total Power Output (MW)	Used Oil Generated (litres/year)
Tongatapu	6	1.5 MW Caterpillar Generators	9	
	2	2.8 MW MAK Generators	5.6	25,000-50,000
	2	0.8 MW Portable Generators	1.6	
	Numerous			
	Units	Solar Power	11	Nil
Ha'apai	3	Generators	0.4	5000-7000
Vava'u	5	Generators	1	5000-7000
Eua	3	Generators	0.4	10,000-12,000

#### Table 5: TPL Power Generation

TPL purchase from Total about 20-30 drums/month, i.e. about 4,000 – 6,000 litres/month, or about 48,000 – 72,000 litres per year. Based on Table 6, they could produce up to 76,000 litres of used oil per year, which seems too high compared to the quantity purchased. It should be noted, however, that used oil from the separators contains about 50% water as an emulsion. Used oil from maintenance contains no water.

TPL have the following quantities of used oil stored:

- IBCs x 28 = 28,000 litres
- Drums x 290 = 58,000 litres
- 2 x 10000 litre tanks = 20,000 litres
- 1 x 30,000 litre tank

The total quantity stored used oil is therefore 136,000 litres at the time of inspection.

There are concerns about the quality of storage.



Photo 1: Tanktainer Supplied by Total



Photo 2: Oil Stains on Grass



Photos 3-6: Drums Stored Un-bunded with evidence of corrosion



Photos 7-8: IBCs stacked un-bunded and showing signs of collapsing



Photo 9: Large Un-bunded Storage Tanks and Drums





Photos 10-12: Drums and IBCs stored un-bunded next to lagoon

#### 7.2 Workshops

#### 7.2.1 Asco Motors

Asco Motors is the local Toyota agent and Avis Rentals agent. A meeting was held with Tonga Fauu'ese Po'oi, CEO, who advised that they now employ less technicians than they used to do, and service less cars, so they produce less used oil. They purchase all their used oil from Pacific Energy, about 3,000 litres per month, and generate about the same amount of used oil per month.

PE always collect all their used oil and they are required to provide proof that they are disposing of it satisfactorily. The Toyota company audit Asco Motors regularly for a range of environmental issues including used oil management. For example, if there are any spills, the clean-up must be photographed, and the photos are sent to Brisbane for confirmation.

Asco Motors stock limited amounts of new oil, and they wait until two drums of used oil have accumulated until the call PE for a pick-up.

#### 7.2.2 E. M. Jones

A meeting was held with Fatafehi Pusiaki, Sales Manager, who explained that they are the agents for Yamaha and they import one container per year from Japan of a 50/50 mix of 2 stroke oil and engine lubricating oil.

E. M. Jones service Yamaha Outboard engines and they keep their used oil in drums. They produce about 1-2 drums / month of used oil. They let farmers take their used oil for lack of a better option, and they would prefer a more satisfactory environmental solution. They have about 1.5 drums of used oil stored at present.

#### 7.2.3 Ministry of Infrastructure (MOI) Workshop

The Ministry of Infrastructure (MOI) carries out major earthworks and developments and uses a large range of heavy machinery.

A meeting was held with Matangi Ma'asi, Workshop Supervisor. MOI use about 4 drums of lubricating oil / month, which they buy from Total and Spare Parts Zone. They produce about 50 litres / day of used oil which they store out the back of the site, although the used oil is mostly taken by people to use for various uses such as spraying the underside of rusty cars, sportsground marking and painting posts. They have about 500 litres stored at present.

Photo 13 below shows their storage area, which is untidy, with evidence of large amounts of spilled oil.



Photo 13: MOI Used Oil Storage

#### 7.2.4 Ports Authority (Domestic)

A meeting was held with Viliamu Pua, Workshop Supervisor. The Domestic Ports equipment is maintained in this workshop. They produce about 200 litres/month of used oil, which is placed in drums. They have about 3 drums at present and often the used oil is taken by the public. Mr Pua commented that some time ago the main hospital in Nuku'alofa was burning used oil as part of the fuel mix to run their boiler, but they stopped because of problems with the burner system.

#### 7.2.5 Agriculture Experimental Farm

A meeting was held with Paula Vaioleti, Machinery Supervisor. They are a large experimental farm with a wide range of farm equipment and the workshop services all the work vehicles, tractors and machinery. They purchase about 150 litres/month of lube oil and they produce about 6 drums/year of used oil.

Mr Vaioleti advised that all the used oil they produce is taken by local farmers for a variety of uses including coating their pigs to treat a common skin disease.

#### 7.2.6 Fletcher Royco

Fletcher Royco is the Tongan branch of Fletcher Construction Company Ltd, New Zealand. They service all their own equipment.

A meeting was held with Lini (Raelynn) Latu. Fletcher Royco service their own equipment and have stored on site at present 2 x 200 litre drums of used oil. The Tongan economy is picking up after the pandemic and soon they expect to be producing more used oil.

#### 7.2.7 Lulutai Airlines

Lulutai Airlines is the local airline for domestic flights. It used to be called Real Tonga. A meeting was held with Uluaki Taumalolo, Engineering Manager. They service all their aircraft and produce about 200 litres/yr of used oil which they store in drums. They have about one drum full at the moment.

They have about 10,000 litres stockpiled at present and were hoping to send that to Fiji or some suitable destination as soon as export could be arranged.

#### 7.2.8 Bin Go / Transam Tonga

A meeting was held with Alani Schaumkel, Admin Manager. Bin Go is a subsidiary of Transam Tonga and operate a small fleet of tipper trucks and skip trucks. They service their own trucks and produce about 1 drum of used oil per year which they give away to the public.

#### 7.3 Ferries and Fishing

#### 7.3.1 Tofa Ramsey Shipping Company

Tofa Ramsey operate ferries to 'Eua, Ha'apai, Va'vau, and other destinations under charter. A meeting was held with Tunamailangi Likiliki CEO and her husband. They have two vessels operating, transporting passengers and freight. They transport fuel for PE and Total in Isotanks.

They produce about 4-6 drums a month of used oil and they currently have 5,000 litres stored in drums and tanks, as shown in Photos 14-16 below.

Any used oil Tofa Ramsey generate in the Outer Islands is brought back to Nuku'alofa. Every two years they send ships to Fiji for dry-docking. If Fiji was accepting used oil, they could take used oil to Fiji in isotanks at that time.



Photos 14-16: Tofa Ramsey Used Oil Storage

When Tofa Ramsey were showing the above used oil storage, a white isotank in the distance was pointed out – see Photo 17. It was explained that this tank contained used oil from a business that had failed.



Photo 17: White Used Oil Storage Tank Formerly Owned by a Failed Business

#### 7.3.2 Friendly Islands Shipping Agency (FISA)

The Friendly Islands Shipping Agency (FISA) have three ferries, although the largest one is currently in dry dock in Auckland.

A meeting was held with Captain Viliami Maka Toputopu and Sione Pongia, Second Engineer. FISA purchases 400 litres/month lube oil for the two smaller ships and 800 litres/month for the largest ship, i.e. 1600 litres/month or 19,200 litres/year. They produce in total about 6,000 litres/year of used oil.

They buy their lube oil from PE who used to take it back but no longer do so. They therefore have no alternative but to store it, and they are very keen for a national used oil solution to be found. Most of their used oil contains about 50% water. Their used oil is always accumulated and never thrown away. Part of their used oil storage is shown in Photo 18 below. They estimate they are storing about 20,000 litres in total.



Photo 18: FISA Used Oil Storage

#### 7.3.3 'Eua Ferry Services

'Eua Ferry Services are community-owned by the 'Eua community. They own three ferries that go to 'Eua, Vav'au and Ha'apai. They can also charter their vessels, including to Niue.

A meeting was held with Lilio Masi, CEO. They purchase for the three ferries, about 30,000 litres of lube oil per year from PE. They produce about 3,000 litres of used oil per year which is stored, although some is used by the 'Eua community for marking fields. They currently have about 3,000 litres stockpiled.

#### 7.3.4 Pacific Sunrise Fishing

Pacific Sunrise Fishing (PSF) is a major fishing company. A meeting was held with Tim Cumming, Fleet Operations Manager, who was keen to help and wished to be kept informed of progress with used oil management.

PSF buy about 400 litres of lubricating oil per month from Vaitohi or PE, for servicing their fishing fleet. Currently they have a stockpile of about 8 drums (see Photo 19 below) plus two shipping containers full of used oil - probably about 30,000 litres in total. They badly need a solution and have explored a number of options, including filtering and centrifuging the used oil and blending it back into their new lube oil at about 5%. They stopped doing this, however, because of engine damage concerns.

They have also considered setting up a fishmeal plant where the boilers for the cookers would be powered by used oil. They produce about 5,000 litres/year of used oil and are very keen to find a solution.



Photo 19: PSF Used Oil Storage

#### 7.3.5 Chinese Fisheries

Advice was provided that Chinese Fishery Companies were also collecting used oil, and they had several vessels tied up in Port. Several efforts were made to meet with them but the gate was always locked and no contact details were available.

#### 7.4 Other Sources

#### 7.4.1 Tonga Waste Authority

The Tonga Waste Authority (TWA) manages waste collection and disposal in Tonga, including sewage sludge. A meeting was held with Lola Liava'a Tonga, Manager Admin and Special Projects and Charleen Lautuha, Landfill Supervisor.

TWA service their own equipment and trucks and purchase 800 litres/yr of lube oil for Tongatapu and 400 litres/yr for Vav'au. They produce 400 litres of used oil per year and have two drums stockpiled at present. Sometimes staff take it for marking fields.

As a prelude to finding a storage solution for used oil, they were asked if they would be prepared to have a properly designed and managed used oil storage facility at their main facility, the Tapuhia Landfill. The TWA representatives confirmed that they were very interested in having such a facility at the Tapuhia Landfill. They would also be interested in managing used oil collections, provided they were supplied with the right equipment. A visit was later made to the Tapuhia Landfill and a likely site was identified for storing used oil.

#### 7.4.2 Aotearoa Tonga Forestry Company

The Aotearoa Tonga Forestry Company own and manage the 'Eua Forest Reserve, Vaitaki Sawmilling Site and Mataliku Forest Processing Plant. A meeting was held with Patiola Tuipulotu, who advised that they do not maintain their vehicles and thus do not produce used oil.

They do, however, have a serious waste management problem. They have a 20ft containers packed with drums containing Copper, Chromium, Arsenic (CCA) timber treatment waste. They do not know what to do with this waste and they need assistance. One of the aims of this project was, in the course of used oil investigations, to identify other hazardous waste management issues. Technology is available to deal effectively with CCA waste and this could be done locally. If funding was available, this problem could be solved. CCA waste is potentially very environmentally damaging.

#### 7.4.3 Marine Imports Authority

A phone conversation was had with Hemaloto Tupou, Marine Environment Officer for the Marine Imports Authority (MIA). The MIA had about 20,000 litres of used oil from various shipping sources stored at the Port in IBCs and drums. About 90% of this stockpile was washed into the sea by the recent tsunami. The remaining 10% was taken by the public for various uses and the MIA have no intention of stockpiling any more used oil.

#### 7.4.4 PTH Hardware

This is the major hardware store on Tongatapu. A visit revealed, however, that they do not import or sell any lubricating oil.

#### 7.5 Estimate of Used Oil Storage

Based on the visits described in Sections 6.0 and 7.0 above, the following amounts of used oil are known to be stored in Tongatapu, as per Table 6 below:

Location	Quantity of Used Oil Stored (Litres)	
Pacific Energy	10,000	
Spare Parts Zone	6000	
Vaitohi Auto Parts	600	

#### Table 6: Used Oil Stored in Tongatapu

	Quantity of Used Oil
Location	Stored (Litres)
Tonga Power Ltd	136,000
Asco Motors	400
E. M. Jones	300
Ministry of Infrastructure	500
Ports Authority (Domestic)	600
Fletcher Royco	400
Lulutai Airlines	10,000
Tofa Ramsey Shipping Company	5000
Friendly Islands Shipping Agency	20,000
Eua Ferry Services	3000
Pacific Sunrise Fishing	30,000
Tonga Waste Authority	400
Total	223,200

#### 7.6 Estimate of Used Oil Generation

The three categories of imported oil identified from the Department of Customs Import Spreadsheet (see Section 6.1.2 above) are lubricating oil, hydraulic oil and two stroke oil. The following used oil generation estimations can be made of these categories:

- Lubricating Oil about 50% is consumed in vehicle operation, based on other Analysis Report calculations. This figure comes up in several previous SPREP Used Oil Reports and some justification is provided in these reports, including the Vanuatu Analysis Report<sup>18</sup>.
- Hydraulic Oil this has a number of uses, including for operation of excavators and heavy machinery, but mostly in automobiles for automatic transmission and brake systems. Most hydraulic oil is not consumed in operation and becomes used oil as a result of servicing. A reasonable estimate of consumption would be 10%, leaving 90% as used oil.
- Two Stroke Oil this is all consumed in operation as the oil is mixed with the fuel.

This information is presented in Table 7 below, using data from Section 6.1.2) in order to arrive at a figure for the total base annual amount of used oil generated.

<sup>&</sup>lt;sup>18</sup> "Vanuatu Used Oil Analysis Report" Prepared for SPREP by Araspring Ltd July 2022

		Percentage	Amount of Used	
	Quantity Imported	Consumed in	Oil Generated	
Type of Oil	in 2021 (Litres/Year)	Operation	(litres/year)	
Lubricating Oil	516,229	50	258,115	
Hydraulic Oil	69,609	10	62,648	
Two Stroke Oil	15,447	100	0	
Total	601,285		320,763	

Table 7: Base Annual Amount of Used Oil Generated

Two additional factors should be considered as follows:

- As stated in Section 6.1.2, about 5-10% of imports may have been missed. Based on the calculations in Table 8 above, this could result in an increase in the base used oil figure of about 3-6%.
- The Department of Customs figures presented in Section 6.1.2 were for 2021, which was during the pandemic. Economic activity may pick up in succeeding years by 5-10%.

There are no doubt also errors in the percentages consumed in operation, for lubricating oil and hydraulic oil, say of +/-5%. Given all these factors, the used oil quantity of 320,763 could be adjusted upwards by 3-21%, resulting in a used oil generation range of 330,385-388,123 litres/year, or rounded figures of **330,000 – 388,000 litres/year**.

### 8.0 Used Oil Management

#### 8.1 Used Oil Storage Facilities

The survey of used oil generators discovered that used oil is being stored at twelve premises, often in an unsatisfactory fashion, as evidenced by the numerous photos in Section 7 above.

A site on the port was used to store some used oil and this was administered by the Marine Imports Authority (MIA). The resent tsunami, however, washed most of the 20,000 litres stored at this site into the sea, and comments were made during the data gathering interviews that it will be unwise to site used oil storage at the Port or near the sea.

The TWA are willing to site the used oil storage facility at the Tapuhia Landfill. This landfill is tidy and well operated, to a careful plan, and is environmentally satisfactory. There is not much free land at the landfill, but a suitable site could be found to the left of the entrance – see Photo 20 below. TWA are also willing to undertake the collection of the used oil. A properly constructed and bunded tank farm would be needed, together with small mobile storage tanks that could be left at generator locations and a suitable vehicle to transport the mobile tanks.



Photo 20: Suitable Site for Used Oil Storage at Tapuhia Landfill.

#### 8.2 Local Disposal Options

#### 8.2.1 Local Uses

No suitable local uses were found for used oil during the data gathering although one reference was made to the main hospital in Nuku'alofa was burning used oil as part of the fuel mix to run their boiler. This was apparently stopped because of problems with the burner system. The hospital was not contacted during the data gathering and this option should be followed up, although it is not surprising that the burner system in the boiler was unable to tolerate unprocessed used oil.

One option that was considered by Pacific Sunrise Fishing was to set up a fishmeal plant where the boilers for the cookers would be powered by used oil. This still remains a possibility and if some funding assistance was provided, then this project may prove to be very useful.

The Nufuels process described in Section 8.2.2 below could provide processed used oil that could be used by the hospital boiler and also a fishmeal plant.

#### 8.2.2 NuFuels Option for Remote Communities.

In 2018 the NZ Government (MFAT) funded a pilot project in the Solomon Islands 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. Nufuels has indicated their wish to establish similar initiatives in other Pacific Island Countries, and this could include Tonga.

The Solomon Islands project report is included in Appendix 1. The focus of the Solomon Islands work has been on plastic waste, which is also a problem in Tonga. The system can, however, be readily adopted to process used oil.

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

#### 8.3 Unsatisfactory Use / Disposal Practices

#### 8.3.1 Use as a Timber Preservative

Use of used oil on fence posts will to some degree assist in preventing timber decay, although it is not very effective. Such practices will, however, result in soil contamination from the hydrocarbons and other contaminants in the used oil

#### 8.3.2 Use on Dirt Roads to Prevent Dust

Tonga has a number of unsealed roads and in dry periods these roads become very dusty. It is tempting to make use of used oil to control this dust.

This is, however, not a common practice and normally the residents do not have access to the sufficient quantities of used oil to have a significant environmental impact. It is a practice that should be discouraged as applying the used oil to the unpaved roadway may have adverse impact on vegetation, soil, and water supplies and systems.

#### 8.3.3 Use as a Replacement for Chainsaw Bar Oil

Many Tonga households rely on wood for everyday cooking and villages collect and sell large volumes of wood for Custom cooking purposes. A lot of construction of basic houses and outdoor kitchens is from wood gathered from bush land close to villages.

Due to the requirement for cut wood, the ownership and use of chainsaws may be higher than many developed countries that are not reliant on wood for cooking or building these types of structures.

Used Oil is sometimes given away to people to use for chainsaw bar oil. Whilst used oil can be used as a replacement for chainsaw bar oil, used motor oil is thinner in viscosity than formulated chainsaw bar oil and it does not stick to the bar and chain. Also the oil 'burning" on the bar due to friction can cause damage to a person's lungs through inhaling fumes that contain harmful properties. Such a practice can also invalidate warranties. These problems are discussed further on "thehometoolspro.com" website.<sup>19</sup>

#### 8.3.4 Painting on Vehicles to Protect from Corrosion.

Used oil is used in Tonga to protect the underside of vehicles from corrosion. This is an understandable practice and but only a temporary fix and most of the oil will end up on roads, soil and waterways as a harmful soil and water pollutant.

#### 8.3.5 Marking Sports Fields

The marking of sports fields with used oil is common in Tonga and also understandable. There are a wide range of sports field marking paints on the market, however, together with marking equipment. A white or bright colour stands out better and does not risk

<sup>&</sup>lt;sup>19</sup> Can You Use Used Motor Oil For Chainsaw Bar Oil? (thehometoolspro.com)

contaminating the ground or exposing sports teams to the hazards presented by contact with used oil.

#### 8.3.6 Treating Skin Disease on Pigs

The Agriculture Experimental Farm revealed an unusual use for used oil, namely local farmers coating their pigs with used oil to treat a common skin disease. This will expose farmers, pigs, soil and water to the hazards of used oil, and it is likely that a satisfactory veterinary solution is available to treat the skin disease that the pigs suffer from.

#### 8.4 Used Oil Export

Some exports of used oil have already taken place in Tonga. GIO Recycling has exported used oil to India in the past decade. Pacific Energy has also sent used oil to Fiji on several occasions. Such exports must be done in accordance with Basel Convention requirements, and it has also been noted that these requirements may not always have been followed.

Possible destinations to be recommended for export of used oil from Tonga are Bluescope Pacific Steel in Fiji and Salters Cartage Ltd in New Zealand, although others will be recommended, and this matter will be examined further in the Feasiblity Study Report.

The following information is from a 2018 report<sup>20</sup>

#### Bluescope Pacific Steel, Fiji

- a) Bluescope Pacific Steel (BPS) collect and burn used oil in their steel processing plant in Suva.
- b) They are very proactive in the local market in collecting used oil for this purpose and they operate a professional collection and storage system.
- c) They have quite a large storage capacity but not sufficient to take very large amounts of used oil. They have a limited capacity to manage sludge and they do not have a tank cleaning capacity.
- d) The local market keeps them well supplied to meet their used oil needs and their core business is steel making and not used oil.
- e) They are therefore not interested in importing used oil directly into Fiji from overseas countries.
- f) They do receive used oil from other countries indirectly if they have the capacity for example from Pacific Energy shipments from other countries.

<sup>&</sup>lt;sup>20</sup> Used Oil Report – Fiji, Niue, Kiribati, Vanuatu, SCL, Araspring Ltd, April 2018

- g) The BPS operation is sound and meets audit criteria for health, safety and environmental impact, with the possible exception of the air emissions, which BPS is working to address now.
- h) BPS may be willing to take part in plans to import used oil from other countries in the future but only as an indirect partner, and only if they have the capacity and resources to manage the used oil.

#### Salters Cartage Ltd (SCL)

- a) SCL is a company based in Auckland New Zealand that receives and processes used oil. Their main outlet for the used oil is the two main Oji plants in New Zealand.
- b) SCL has been receiving used oil from various Pacific countries for many years and are keen to continue and expand this source of used oil.
- c) They receive not only used oil, but also used oil filters, oily rags, oily sludge, and hydrocarbon-contaminated soils.
- d) They take used oil in a variety of containers, drums, IBCs, pallets and TTs.
- e) They are well set up to receive used oil from Pacific countries and they offer a good option as a recipient for any Pacific used oil exporting scheme.
- f) They fully accord with all the consent conditions imposed on them by Auckland Council.

It should also be noted that, in a new initiative brokered by JICA, the Indian company Sun Petrochem Corporation (SPC) have indicated a willingness to export all bulk used oil currently held in storage in Samoa for processing in India at no cost. Samoa will pay for the packing and transportation of used oil from the storage facility to the port. Samoa will also be responsible for the local costs involved (i.e. packing, loading, transportation to the wharf, custom documentation and Basel documentation, etc.). All used oil will need to be dewatered and transferred into new IBCs prior to shipment overseas. This work is now underway, and the first shipment is expected shortly.

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

The following points should be noted<sup>21</sup>:

- SPC will pick up used oil from a country if the volume exceeds 100,000 litres per shipment. They have no upper limit.
- SPC provide this service free of charge, and will continue to do so, provided the price of virgin oil remains high.
- They need the water removed and the oil filtered, at least to take out the grosser contaminants.

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<sup>&</sup>lt;sup>21</sup> Pers Com Mr Ramani, CEO Sun Petrochem Corporation

- The do not take sludge.
- They can pick up used oil in drums and IBC's, which need to be placed in shipping containers. They will also receive oil in isotanks, which is their preferred container.
- They also use flexitanks or plastic bladders, which are inserted into containers.
- SPC require suppliers of used oil to undertake at the supplier's cost, all the "incountry" work of packaging, transport to the wharf and documentation, so the used oil is ready for shipment.
- Once the shipment is loaded on the vessel at the port of export, SPC take ownership and responsibility for the used oil.
- SPC also take out the necessary insurance cover. They pointed out that for flexitanks, Infinity provides their own insurance cover for \$US7M.

## 9.0 Known Government and Stakeholder Priorities

#### 9.1 Priorities Identified from Policy and Strategy Documents.

The National Infrastructure Investment Plan (NIIP) identified two key areas of interest with regard to used oils, namely whether it is expected that there would be future investment in extra diesel-powered electricity generation, and also future investment in more roads. No statement was made, however, with respect to how to manage used oil.

The Tonga National Strategic Development Framework 2015 – 2025 has a specific desired outcome in the table of National Outcomes, relating to waste management and environmental pollution:

Organisational Outcome 5.3: Cleaner environments and less pollution from household and business activities building on improved waste management, minimization and recycling, making conditions safer, healthier and more pleasant for residents and visitors.<sup>22</sup> This is also expressed at a 'cleaner environment with improved waste recycling' in the outcomes table at 5.4.<sup>23</sup>

The National Implementation Plan for the Stockholm Convention (2009 and 2019) includes a plan of action that mentions waste oils, requiring the establishment of a waste oil disposal regulatory regime<sup>24</sup>, with the key contributing agency being Ministry of Transport, as marine pollution was part of this action.

The Waste Management Authority, in its Business Plan 2020/2021 cited "Improved Infrastructure and Plant Management" and "Improved efficiency of Waste Processing" as two of its main objectives. At a meeting during the data gathering exercise (see 7.4.1 above) they indicated a willingness to collect and store used oil.

Furthermore the willingness of MEIDECC to participate in this used oil project, and the considerable assistance they provided, indicates a real commitment to finding a used oil management solution for Tonga.

#### 9.2 Initial Stakeholder Meeting

The Inception Phase of this used oil project required initial consultation with key stakeholders in Tonga. A list of key stakeholders was compiled in cooperation with MEIDECC that involved both private sector and government. The main stakeholder meeting was very fruitful with a lively discussion of the issue, after a presentation by the consultant on the key points of the project.

<sup>&</sup>lt;sup>22</sup> Tonga Strategic Development Framework , pillar 5 natural Resources and Environmental Inputs p. 21

<sup>&</sup>lt;sup>23</sup> ibid, p. 60

<sup>24</sup> Ibid, Table 3.3e, 6) p 52

At the end of the meeting, the question was posed as to where, after the presentation and discussion of the current situation in Tonga, both government and private sector partners saw that the solution to the used oil problem might lie. Whilst the meeting showed that there were clearly some re-use options (most are unsatisfactory) for used oil in Tonga, there was a unanimous agreement that export of waste oil for processing overseas was the solution for the vast majority of used oil generated today in Tonga.

It was noted that a local enterprise had tried to re-refine oil in Tonga, but it had failed. The idea of Product Stewardship and Advance Recycling Fees was offered during the presentation, and this was accepted in principle as a sound way forward. It was recognised by the meeting that a financially sustainable system was important.

## 10.0 The Feasibility Study

As per the contract, the next stage of the project, namely 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 implement and operate 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.

Important inputs into this stage will be:

- This Analysis Report.
- The report prepared by MRA Consulting Group for SPREP/ADF on Technology Options for Used Oil.<sup>25</sup>
- 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. In Tonga this pilot study is awaiting the outcome of the Feasibility Study.
- Analysis of the options for exporting used oil from Pacific countries to other countries where it can be properly reused. This needs to include consideration of costs and carbon footprint. This analysis will be conducted by Consultant Team member Boyne Drummond.
- Assessment of the potential for imposing an Advanced Disposal Fee on imported lubricating oil.

<sup>&</sup>lt;sup>25</sup> "Used Oil Management Technology Options Report" April 2022. MRA Consulting Group

## 11.0 Conclusions

- a. Based on the information supplied by the Department of Customs in 2021, there was 601,285 litres of oil imported into Tonga, 86% of which was lubricating oil and 11% was hydraulic oil. The remainder was two stroke oil.
- b. An estimate has been made of used oil generated at present, taking into account the increase in economic activity since the pandemic and the fact that the Department of Customs may have missed some importers. This estimate is 330,000 – 380,000 litres/year.
- c. A total of 223,200 litres of used oil is being stored on Tongatapu at numerous locations, including 136,000 litres at the Tonga Power Ltd plant at Popua. Much of this storage is unsatisfactory and is posing a serious risk of contamination of soil and water.
- d. Some used oil is being used for a variety of unsatisfactory uses, including timber preservative, chainsaw bar oil, painting vehicles to prevent corrosion, and marking sports fields. These and other uses described have the potential to cause significant environmental and health risks.
- e. The remainder of the used oil is probably just being disposed of to land or to waterways, although no direct evidence of this happening was discovered, except for evidence of spills and leakage in some of the current storage areas.
- f. There are no potential local reuse /disposal options available that may be satisfactory, although some industrial uses have been tried.
- g. There are government priorities for the management of used oil that require effective management to protect human health and the environment.
- h. During the data gathering work for this report, it was evident that numerous used oil generators are keen to find a solution to the current problem of used oil mismanagement in Tonga.
- i. The first stage in finding a solution is to set up an effective collection and storage system. Waste Management Authority is prepared to take this on if funding assistance is provided. They have a suitable location to set up a used oil storage facility.
- j. Disposal will be examined in detail at the next stage of the project, and it is likely that export will be a favoured option, although the NuFuels process is worth investigating further to manage some of the used oil locally.
- k. This data gathering phase of the project was delayed by the pandemic, but it is considered that sufficient information has now been gathered to move on with some confidence to the next stage of the project, i.e. the Feasibility Study.
- 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: NuFuels - Solomon Islands Plastic Waste to Energy Programme

#### A1.1 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

#### A1.2 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 <u>not</u> incineration. Depending on the system design, the gases can be flared off directly for heat with a small amount going through a condenser and becoming liquid fuel. If

more liquid fuel is wanted rather than mainly gas, then more liquid fuels can be produced.

#### A1.3 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.

#### A1.4 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.

#### A1.5 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.

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#### A1.6 Environmental and Health Impacts and Benefits

#### A1.6.1 Waste Diversion

The current adopted design delivers the following waste diversion results<sup>26</sup>:

- 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.<sup>27</sup>
- 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.<sup>28</sup>
- One system will remove the following waste quantities annually from the environment under low, medium and high use scenarios<sup>29</sup>:

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	Number of households with full Number of low-income		
scenarios	plastic waste diversion (Average	nouseholds with full plastic waste	
	Household size <sup>30</sup> )	diversion <sup>31</sup>	
Low	11	9	
Medium	23	18	
High	35	26	

<sup>&</sup>lt;sup>26</sup> 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.

<sup>&</sup>lt;sup>27</sup> Measurement by volume can be undertaken but is less useful as compression will vary.

<sup>&</sup>lt;sup>28</sup> Honiara City Council Waste Characterisation Study 2011 and National Waste and Pollution Control Strategy 2017-2026

<sup>&</sup>lt;sup>29</sup> Low scenario: 1 cook 5 days a week. Medium scenario: 2 cooks 6 days a week. High scenario 3 cooks 7 days a week.

<sup>&</sup>lt;sup>30</sup> Based on Solomon Islands average household size – urban areas. Solomon Islands Statistics 2007

<sup>&</sup>lt;sup>31</sup> Honiara City Council Waste Characterisation Study 2011 – average household size for low income household sample.

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

#### A1.6.2 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.

#### A1.6.3 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.

#### A1.6.4 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

#### A1.7 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	Diesel	Kerosene	Wood
	No. of 9kg gas bottles	Litres	Litres	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.

#### A1.8 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.