

Vanuatu National Action Plan

to reduce releases of
Unintentional Persistent Organic Pollutants
2018-2022

28 June 2018

Acronyms

BAT	Best Available Techniques
BEP	Best Environmental Practices
DEPC	Department of Environmental Protection and Conservation
EU	European Union
KRAs	Key Result Areas
mg TEQ	Milligrams of Toxic Equivalents
NIP	National Implementation Plan
NWMPCS	National Waste Management and Pollution Control Strategy and Implementation Plan 2016-2020
PacWaste	Pacific Hazardous Waste Management Project
PICs.....	Pacific island countries
POPs	Persistent Organic Pollutants
PPE	Personal Protective Equipment
SPREP	Secretariat of the Pacific Regional Environment Programme
UN	United Nations
uPOPs	Unintentional Persistent Organic Pollutants

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1 Introduction

Persistent Organic Pollutants (POPs) are toxic chemicals that can travel long distances through air and water and accumulate in the fatty tissues of humans and other animals. These POPs do not degrade quickly over time, and consequently, potentially expose people to serious health issues including cancer, birth defects and immune system impairments. As a result of anthropogenic releases of POPs to the environment since the 1940s, POPs are now widely distributed over large regions, including the Pacific Islands.

To address the global environmental threat of POPs, the Stockholm Convention on POPs was adopted in May 2001 and entered into force on 17th May 2004. The Stockholm Convention commits Parties to reducing, and where feasible, eliminating the production and environmental releases of POPs. Vanuatu became a Party to the Convention on 15th December 2005. For more information on the Stockholm Convention, please visit <http://chm.pops.int/>.

When the Stockholm Convention first entered into force in 2004, it regulated 12 POPs; it now regulates 28 POPs. Of these, seven are classified as unintentionally produced POPs (uPOPs), which are unintentionally formed and released during thermal processes involving organic matter and chlorine because of incomplete combustion or chemical reactions.

As a Party to the Stockholm Convention, the Government of Vanuatu is required to develop, and endeavour to put into practice, a National Implementation Plan (NIP) setting out how the Government will implement the Stockholm Convention. The NIP must include a series of costed action plans that address the POPs relevant to Vanuatu. Vanuatu developed its first NIP addressing the management of 12 POPs in 2011, however, the NIP has never been formally submitted to the Stockholm Convention Secretariat.

This National Action Plan to Reduce the Formation and Release of Unintentional POPs (uPOPs Action Plan) is developed as an action plan under the NIP and must be read in conjunction with the NIP. As the waste management sector has been identified as a main source of uPOPs releases in Vanuatu, this uPOPs Action Plan includes activities related to improved waste management and it therefore complements the Vanuatu National Waste Management and Pollution Control Strategy and Implementation Plan 2016-2020.

The uPOPs Action Plan was developed under the Pacific POPs Release Reduction Project, funded through the Global Environment Facility–Pacific Alliance for Sustainability (GEF-PAS). The Pacific POPs Release Reduction Project aims to reduce Persistent Organic Pollutants (POPs) in the Pacific region through the improved management of solid and hazardous waste. The project is co-funded by *l'Agence Française de Développement* (AFD). It is executed by the Secretariat of the Pacific Regional Environment Programme (SPREP) and implemented by the United Nations Environment Programme (UNEP) and the Food and Agriculture Organization (FAO). For more information, please visit www.sprep.org/stopthepops.

Scope of the uPOPs Action Plan

This uPOPs Action Plan addresses the following seven uPOPs which are currently listed under Annex C of the Stockholm Convention:

- Hexachlorobenzene (HCB)
- Hexachlorobutadiene (HCBd)
- Pentachlorobenzene (PeCB)
- Polychlorinated biphenyls (PCBs)
- Polychlorinated dibenzo-p-dioxins (PCDDs or dioxins)
- Polychlorinated di-benzofurans (PCDFs or furans)
- Polychlorinated naphthalenes (PCNs)

It should be noted that dioxins and furans are indicative of the presence of other uPOPs and are considered to constitute a sufficient basis for identifying and prioritizing sources of all uPOPs, and for devising control measures

for all Annex C POPs (UNEP, 2013, p. 16). This means that efforts to address dioxins and furans under this uPOPs Action Plans will be deemed sufficient to address all Annex C POPs.

The uPOPs Action Plan includes measures to reduce or eliminate releases from unintentional production as required under Article 5 of the Convention. Specifically, the uPOPs Action Plan:

- assesses current and projected releases of uPOPs from several sources; and the national legislative and policy framework for managing releases from these sources
- identifies strategies to address unintentional releases of POPs, including promoting awareness, education and training around those strategies
- facilitates a five-yearly review of the effectiveness of the strategies (to be reported to the Stockholm Convention Secretariat)
- promotes available, feasible and practical measures to achieve realistic and meaningful reduction or source elimination
- promotes the development, and where appropriate the use of substitute or modified materials, products and processes to prevent the generation of uPOPs
- promotes the use of best available techniques and best environmental practices for uPOPs sources.

Description of the uPOPs¹

Hexachlorobenzene (HCB)

HCB has been used as a pesticide to protect the seeds of onions and grains against fungus, in wood preservation, and in the production of fireworks, ammunition, rubber, aluminium and dyes (Department of the Environment, 2014). In high doses, HCB is lethal to some animals and, at lower concentrations, can adversely affect their reproductive success. HCB has been found in food of all types.

Hexachlorobutadiene (HCBd)

HCBd was used for a variety of purposes including as a pesticide, fungicide, a solvent, heat transfer fluid, and hydraulic fluid. It is unintentionally formed as the by-product of several chemical processes, and during incineration of wastes containing high chlorine content. The United States Environmental Protection Agency has classified HCBd as a possible human carcinogen.

Pentachlorobenzene (PeCB)

PeCB was used in polychlorinated biphenyl (PCB) products, in dyestuff carriers, and as a fungicide and a flame retardant. It is also produced unintentionally during combustion, and in thermal and industrial processes. In the environment, PeCB is moderately toxic to humans and very toxic to aquatic organisms.

Polychlorinated biphenyls (PCBs)

PCBs are used in industry as heat exchange fluids, in electric transformers and capacitors, and as additives in paint, carbonless copy paper, and plastics. There are 209 different types of PCBs, of which 13 are of concern. PCBs are toxic to fish and are linked to reproductive failure and suppression of the immune system in various wild animals. PCBs also suppress the human immune system and are listed as probable human carcinogens.

Polychlorinated dibenzo-p-dioxins (PCDDs or dioxins)

Dioxins are produced unintentionally during incomplete combustion of healthcare waste, municipal waste, and hazardous waste, during paper manufacture using chlorine bleaching, and from automobile emissions, and peat, coal, and wood combustion, including forest fires. There are 75 different dioxins, of which seven are of concern. Dioxins are classified as possible human carcinogens and have been associated with several adverse effects in humans, including immune and enzyme disorders and chloracne. Laboratory animals given dioxins suffered a

¹ UNEP. (2008). All POPs listed in the Stockholm Convention. Retrieved 03 16, 2018, from The Stockholm Convention: <http://chm.pops.int/TheConvention/ThePOPs/ListingofPOPs/tabid/2509/Default.asp>.

variety of effects, including an increase in birth defects and stillbirths. Fish exposed to dioxins died shortly after the exposure ended. Food (particularly that sourced from animals) is the major source of exposure for humans.

Polychlorinated di-benzofurans (PCDFs or furans)

Furans are produced unintentionally from many of the same processes that produce dioxins. They have been detected in emissions from waste incinerators and automobiles. Furans are structurally similar to dioxins and share many of their toxic effects, although they are typically much less toxic than dioxins. There are 135 different types, and their toxicity varies. Furans persist in the environment for long periods and are classified as possible human carcinogens. Food, particularly animal products, is the major source of exposure for humans. Furans have also been detected in breast-fed infants.

Polychlorinated naphthalenes (PCNs)

PCNs include up to 75 different compounds and have been historically used as wood preservatives, paints and engine oils additives, heat exchange fluids, in capacitors and for cable insulation, and a range of other uses. While the use of PCN has ceased, they are also present in PCB formulations and more significantly, they are unintentionally produced during combustion processes. Many PCNs persist in the environment, and acute exposure causes chloracne. Chronic exposure increases the risk of liver disease and is suspected of increasing cancer risks.

2 Situational analysis

Sources of uPOPs in Vanuatu

According to UNEP (2013), uPOPs may be formed and released from 10 major source groups, not all of which are relevant to Vanuatu. Each source group has in turn, a number of potential source categories. The eight uPOPs source groups and their source categories relevant to Vanuatu are summarised in Table 1.

Table 1: uPOPs source groups and their source categories relevant to Vanuatu

Source Group	Source category	Comments
Waste incineration	Quarantine waste	International ship quarantine waste incinerators located at Port Vila and Luganville (see below)
	Healthcare waste (HCW)	Five healthcare waste incinerators are known to be operational
	Waste wood and biomass	Includes the wood fired quarantine waste incinerators
Heat and power generation	Household heating and cooking with biomass	A majority (80%) of Vanuatu's population is wholly or partially dependent on traditional fuels for cooking
Production of mineral products	Asphalt mixing	The construction of two asphalt plants are nearing completion in Santo and Efate, as part of the Vanuatu Aviation Investment Project.
Transport	4-Stroke engines	83,018 diesel and petrol 4-stroke engines reportedly registered between June 2013 and February 2017
	2-Stroke engines	All operate without catalytic converters
	Diesel engines	Only 2% of diesel engines are estimated to have a catalytic converter
	Heavy fuel oil fired engines	
Open burning processes	Waste burning	Dump fires occur as does backyard waste burning
	Accidental fires	
Miscellaneous	Drying of biomass	Burning wood to dry copra for export and for domestic coconut oil production
	Smoke houses	
	Tobacco smoking	19% of adults over 15 years of age use tobacco (WHO, 2018). The Tobacco (Control) Regulation is being enforced to create 'smoke-free' environments in schools, public transport, hospitals, public places, etc.
Disposal and landfill	Landfills and waste dumps	Each island has a waste disposal site
	Sewage and sewage treatment	There is no central sewage treatment system in Port Vila, but a sewage sludge treatment facility (for septic tank waste) is operational
	Open water dumping	Approximately 50% of wastewaters end up leaching into waterways and can be considered to be open water dumped
	Composting	Green waste composting is actively promoted, however, the waste is often contaminated with municipal waste (plastics, metals, etc)
	Waste oil disposal	Waste oil collected by Pacific Energy is used in the copra plant located in Espiritu Santo.
Contaminated sites and hotspots	Timber manufacture and treatment sites	Several pressure treatment plants have been in operation
	Waste incinerator sites	The locations of the quarantine waste and HCW incinerators are potentially contaminated sites
	Dredging of sediments	
	Accidental fire sites	
	Dumps of wastes/residues from other source categories	The Bouffa Landfill and waste disposal sites on the outer islands are potentially contaminated sites

The emissions from these source groups and categories have been estimated using the limited national data available, in accordance with the methodologies outlined in the *Toolkit for Identification and Quantification of Releases of Dioxins, Furans and other uPOPs* (uPOPs Toolkit)². Where national data was lacking, expert judgement, and data from comparable countries or regions were used.

Based on the available information and the analysis conducted, between 10g TEQ/year and 15g TEQ/year³ of dioxins and furans are estimated to be released in Vanuatu from various sources (Table 2). The most significant sources of emissions are waste incineration, heat and power generation, and open burning processes. A detailed description of the estimations and assumptions made for each source group is provided in Appendix A.

Table 2: Estimated releases of dioxins and furans in Vanuatu in 2017

Group	Source Group Description	Annual Releases (g TEQ/a)				
		Air	Water	Land	Product	Residue
1	Waste Incineration	1.8	0.0	0.0	0.0	0.1
2	Ferrous and Non-Ferrous Metal Production	No relevant activity in Vanuatu				
3	Heat and Power Generation	3.1	0.0	0.0	0.0	0.3–5.5
4	Production of Mineral Products	0.0	0.0	0.0	0.0	0.0
5	Transportation	0.0	0.0	0.0	0.0	0.0
6	Open Burning Processes	1.3	0.0	0.0	0.0	0.0
7	Production of Chemicals and Consumer Goods	No relevant activity in Vanuatu				
8	Miscellaneous	0.0	0.0	0.0	0.0	1.4
9	Disposal	0.0	0.0	0.0	0.0	1.5
10	Identification of Potential Hot-Spots	-	-	-	-	-
1-10	Total	6.3	0.0	0.0	0.0	3.4–8.6
	Grand Total	10–15				

Projected uPOPs emissions

Vanuatu's uPOPs emissions are likely to decrease in the future based on forthcoming regional waste management projects, including the Pacific Hazardous Waste Management Project Plus (PacWaste Plus) funded by the European Union and implemented by SPREP. PacWaste Plus will continue to address healthcare waste, asbestos and e-waste. However, other national activities may increase future uPOPs emissions as summarised in Table 3.

Table 3: Qualitative assessment of projected uPOPs emissions in Vanuatu

Source Group	Source Group Description	Likely future trends in uPOPs emissions
1	Waste Incineration	Decrease in uPOPs emissions likely due to improvement of healthcare waste treatment techniques under the SPREP/EU PacWaste Plus Project
2	Ferrous and Non-Ferrous Metal Production	Scavenging on landfills is currently discouraged, however, it is possible that open burning of cables and e-waste could occur resulting in an increase in uPOPs emissions.
3	Heat and Power Generation	Decrease in uPOPs emissions are likely if the Government achieves its goals of 65% renewable energy by 2020 and 20% improvement in diesel efficiency by 2020, under the National Energy Road Map 2016-2020 (Government of Vanuatu, 2016a)
4	Production of Mineral Products	Increase in uPOPs emissions likely during the operation of the asphalt plants under the Vanuatu Aviation Investment Project
5	Transportation	uPOPs emissions reduction likely under the National Energy Road Map 2016-2020 (Government of Vanuatu, 2016a)

² UNEP. (2013). Toolkit for identification and quantification of releases of dioxins, furans and other unintentional POPs under Article 5 of the Stockholm Convention, January 2013. Geneva, Switzerland: UNEP Chemicals.

³ The emissions are expressed as a single number with units of 'grams of Toxic Equivalents' (g TEQ). TEQ accounts for the different quantities and toxicity of the individual dioxins and furans compounds that may be in a particular mixture.

Source Group	Source Group Description	Likely future trends in uPOPs emissions
6	Open Burning Processes	
7	Production of Chemicals and Consumer Goods	Not currently relevant to Vanuatu and no future uPOPs emissions anticipated
8	Miscellaneous	
9	Disposal	
10	Identification of Potential Hot-Spots	No change anticipated in potential hot-spots, however, existing hot-spots expected to be identified for future remediation

Policy framework

The policy framework for uPOPs management includes the following regional and national policies:

- Cleaner Pacific 2025: Pacific Regional Waste and Pollution Management Strategy 2016–2025
- Regional uPOPs Action Plan
- Vanuatu 2030 – the People’s Plan
- The Vanuatu National Environment Policy and Implementation Plan 2016-2030
- The National Waste Management and Pollution Control Strategy and Implementation Plan 2016-2020

Cleaner Pacific 2025

Cleaner Pacific 2025: Pacific Regional Waste and Pollution Management Strategy 2016–2025 is the Pacific region’s long-term strategy for integrated sustainable waste and pollution management. It provides a strategic management framework to address the threats that waste, chemicals and pollutants pose to sustainable development in the region. Cleaner Pacific 2025 recognises uPOPs as a regional priority issue and includes several strategic actions to reduce uPOPs emissions, including:

- Inclusion of data on uPOPs releases in regional and national data collection activities (Strategic Action 1)
- Development and enforcement of national policies, strategies and legislation to address uPOPs emissions (Strategic Action 2)
- Implementation of best practice occupational health and safety measures including awareness of health impacts of uPOPs (Strategic Action 4)
- Implementation of organic waste recycling activities that reduce backyard burning and disposal of organic waste at dumps and landfills and reduces uPOPs emissions (Strategic Action 6)
- Improved access to national waste collection services to reduce the need for backyard burning and thus reduce uPOPs emissions (Strategic Action 8)
- Improved availability and sound operation of waste and chemicals management infrastructure to, inter alia, reduce uPOPs releases (Strategic Action 9).

Regional uPOPs Action Plan

The draft Pacific Regional Action Plan to Reduce Unintentional Persistent Organic Pollutants (Regional uPOPs Action Plan) provides a 5-year strategic basis for Pacific Island Countries to reduce emissions of uPOPs and comply with obligations under the Stockholm Convention. It identifies practical, implementable activities that can readily be adopted by countries. A copy of the Regional uPOPs Action Plan activities is provided at Appendix B.

Vanuatu 2030 – the People’s Plan

Vanuatu 2030 – the People’s Plan is the national sustainable development plan which envisions a *stable, sustainable and prosperous Vanuatu*. Several goals and policy objectives under three pillars (Society, Environment and Economy) are defined to translate the Plan’s vision into actionable priorities (Government of Vanuatu, 2016b). Under the Environment Pillar, the following policy objectives provide a mandate that supports the development of this uPOPs Action Plan:

- ENV 2.4: to reduce waste and pollution through effective waste management and pollution control
- ENV 2.5: to strengthen environmental institutions and governance to meet national and international obligations.

Vanuatu National Environment Policy and Implementation Plan 2016–2030 (NEPIP)

The NEPIP is the overarching policy for the sustainable conservation, development and management of Vanuatu’s environment. Among its guiding principles are the Polluter Pays Principle which provides an equitable basis for waste management cost recovery and encourages responsible waste management behaviour. The policy priorities include waste management and pollution control, with three related policy objectives that also support the development of this uPOPs Action Plan (Government of Vanuatu, 2016c). Moreover, the implementation plan for the waste policy objectives include several targets and actions which align with this uPOPs Action Plan. The waste policy objectives are:

- PO 3.1: Reduce waste and pollution through effective waste management and pollution control
- PO 3.2: Review and implement the National Waste Management Strategy and Action Plan
- PO 3.3: Establish incentive schemes that implement the polluter pays principle by encouraging cleaner production and waste recovery.

National Waste Management and Pollution Control Strategy and Implementation Plan 2016-2020 (NWMPCS)

The NWMPCS articulates a vision of a clean sustainable environment. It seeks to minimise waste generation and waste to landfill, maximise resource recovery, and improve residual waste management using environmentally sound techniques. The NWMPCS has nine objectives, each of which is associated with several targets and activities.

The development of this uPOPs Action Plan contributes to meeting a target for objective 1 of the NWMPCS, which is for “the National Implementation Plan for POPs [to be] updated and enforced”. Specific activities of the NWMPCS also complement the goals and objectives of this uPOPs Action Plan and vice versa.

Legislative framework

National uPOPs releases are sourced from several activities across different sectors including waste management, transport, and domestic cooking. This section (Table 5) summarises key legislation addressing uPOPs prevention and reduction from the waste management sector, which has been shown to be the main source of uPOPs emissions in Vanuatu. The pieces of legislation examined were:

- Waste Management Act 2014
- Pollution (Control) Act 2013
- Public Health Act 1994
- Tobacco Control Act No. 19 of 2008

Table 4: Legislative framework to support reduction of uPOPs emissions in Vanuatu

Section	Description
	Waste Management Act 2014: This act is administered by the Department of Environment Protection and Conservation (DEPC) and provides for protection of the environment through effective waste services and operations. It also defines the roles and responsibilities for waste management including healthcare and quarantine wastes
14	Enables the Minister to impose regulation pertaining to certain wastes, or things that may become waste, including regulating the importation, exportation, manufacture, use, storage or transportation.
15 - 17	Requires landfill sites, waste dumps and waste disposal facilities not operated by a Municipal Council, Provincial Government Council or the Department to be licensed, and to provide data relating to their operations as required by the Director
33	Requires designated waste management operators (Municipal Council, Provincial Government Council or the Department) to prepare and submit reports of their operations at the request of DEPC, the Ministry of Health, and the Biosecurity Department
35	Requires designated waste management operators to promote reduction, reuse and recycling of waste. Those engaged in recycling of waste must ensure compliance with Vanuatu’s international obligations associated with the movement and management of wastes, and must observe international best practices
39	Makes it an offence to light an unauthorised fire at any dumpsite

Pollution Control Act 2013: This act is administered by the DEPC and provides for control of the discharge and emission of pollution in Vanuatu	
8, 9	Requires the owner or occupier of any premises to obtain a permit, and comply with prescribed standards for discharging, inter alia, pollution and wastewater
13	The Director of DEPC may impose conditions on a permit that requires installation of pollution control equipment, adoption of pollution control measures, or implementation of a monitoring program
17	Empowers the Director to decide to manage a pollutant from premises under certain circumstances, and to recover expenses incurred in doing so from the owner or occupier of the premises
18	Prohibits a person from operating a vehicle, vessel or aircraft that does not comply with prescribed standards, or that emits pollution above the prescribed limit
19	Prohibits a person from discharging pollutants into any land, body of water, foreshore or air such that it adversely affects another person or the environment.
Public Health Act: This act is administered by the Ministry of Health and provides for public health in Vanuatu	
64	Prohibits the discharge of raw sewage into any body of water
65	Prohibits the disposal of wastes and noxious matter into any body of water; however, a local authority may grant a person permission to discharge wastewater or sewage effluent, if the authority is satisfied it is safe to do so
66	Prohibits littering on beaches and the foreshore
72	Prohibits littering in public places
104	Prohibits smoking in government buildings, enclosed public places, and on domestic airline flights
105	Bans cigarette advertisements
114	Enables the Minister to issue advisory or mandatory codes of practices relevant to implementation of the Act
Tobacco Control Act: This act is administered by the Ministry of Health and governs the import, distribution, sale, marketing, promotion and use of tobacco products in Vanuatu.	
11	Prohibits sale of tobacco to minors
16	Prohibits sales of tobacco in places where healthcare services are provided or in educational facilities servicing people under 18 years of age
19	Requires Tobacco companies to submit analysis reports of constituents and other information on Tobacco products
22	Requires compulsory health message and other information to be affixed to packaging of tobacco products
27	Prohibits smoking in public places and workplaces

3 The Action Plan

Goal

The goal statement describes the outcome expected to be achieved at the end of the Action Plan period. The goal of this uPOPs Action Plan is to **reduce, and where possible prevent the formation, release and adverse impacts of uPOPs emissions in Vanuatu.**

Key Result Areas

Key Result Areas (KRAs) describe the thematic areas that must be addressed to achieve the goal. Seven KRAs have been identified for the uPOPs Action Plan:

- KRA1: Strengthen the national policy & legislative framework
- KRA2: Reduce human exposure to uPOPs
- KRA3: Increase adoption of best practices in the waste management sector
- KRA4: Improve domestic cooking practices
- KRA5: Reduce uPOPs emissions from the transport sector
- KRA6: Improve coordination among stakeholders
- KRA7: Ensure timely implementation, monitoring and reporting under the uPOPs Action Plan

Activities

KRA1: Strengthen the national policy and legislative framework

There is a basic legislative framework in place that supports uPOPs prevention in the waste management sector. However, there is room for improvement, for example in banning the open burning of waste, prohibiting landfill disposal of certain wastes. The activities to strengthen the national policy and legislative framework are:

- 1.1 Implement and enforce a nation-wide ban on open burning, including burning in the agricultural sector, on landfills, and in urban backyards.**
- 1.2 Prescribe rules for open burning in remote communities** if complete elimination is not possible for cultural reasons, or to cater for cases of disaster or other emergencies. Rules should be written in accordance with section VI.A of the UNEP BAT/BEP guidance.
- 1.3 Prohibit local land-based disposal of POPs (e.g. stockpiles of POPs pesticides) and articles known to contain POPs (e.g. electrical transformers containing PCB oils).** These wastes should be diverted into temporary storage facilities until they can be safely managed according to best practices. This may mean export for recycling or disposal.

KRA2: Reduce human exposure to uPOPs

- 2.1 Prepare, disseminate, and conduct awareness on a handbook for PPE usage in the waste sector (e.g. for incinerator operators, landfill workers, etc).** The guideline should, at a minimum, cover landfill workers and those involved in incineration and burning of healthcare waste and quarantine waste. It should include general guidance on selecting PPE and specific recommendations of suitable PPE for different working environments and risks.
- 2.2 Require employers to provide mandatory PPE and training to relevant workers as a condition of their environmental and/or business licences.** For the private sector, this requirement can be a

condition of the waste management licence. All employers have a duty of care to ensure the welfare of their workers.

- 2.3 Promote well-balanced, low-fat diets with adequate amounts of fruits and vegetables.** Given that uPOPs accumulate in the fatty tissues of animals (e.g. pigs), promoting a low-fat diet is one way of avoiding exposure to uPOPs in food.
- 2.4 Implement an on-going national anti-smoking campaign.** Tobacco leaves naturally contain both organic carbon and chloride ions, and consequently, smoking of cigarettes and cigars produces dioxins. As a consequence, smokers are likely to have a measurably elevated dioxin intake compared to non-smokers, and also place themselves at significant health risk from the many other toxic and carcinogenic components present in cigarette smoke.
- 2.5 Progressively introduce higher national tobacco taxes.**
- 2.6 Establish smoke-free environments (e.g. universities, government facilities, restaurants, public areas).**

KRA3: Increase adoption of best practices in the waste management sector

Based on the results of the uPOPs inventory, the waste management sector is Vanuatu's main source of uPOPs emissions. While waste management practices are gradually improving with the implementation of recent donor-funded projects, there is still room for further improvement. For example, open burning of backyard waste still occurs, and there is limited understanding of the application of BAT/BEP to the waste sector. Future donor-funded projects will help to address some of these issues. Reductions in uPOPs emissions can be achieved through greater implementation of BAT and BEP measures. The specific activities to encourage adoption of best practices are as follows:

- 3.1 Implement a 5-year national composting campaign.** This activity will contribute to achieving the NWMPCS goal of composting 60% of segregated organic wastes by 2020. This activity recognises that a sustained long-term effort is required to cause meaningful behaviour change. The composting campaign should seek to: raise awareness of composting as an alternative to open burning and its link to reducing uPOPs production; promote practical forms of composting (e.g. backyard, community, and worm farm composting); and involve all stakeholders (e.g. through local competitions to design posters and compost bins, and public recognition for individuals and communities consistently engaging in good practices, demonstration of good techniques).
- 3.2 Implement at least one composting project in each province annually.** This activity is realistic and achievable. Projects that could be implemented include market waste composting, community-based composting, introducing composting to selected schools, and establishment of worm farm composting.
- 3.3 Establish partnerships with key stakeholders (e.g. Ministry of Agriculture, large farms, beautification committees, etc) to promote the use of compost and help create domestic demand for compost.** This may require partners to take steps to mandate the use of domestically-produced compost in national beautification and agricultural projects. Creating domestic demand for compost will encourage greater production of compost, which will result in greater diversion of organic waste and material from landfill into compost production processes. This may also contribute to creating local economic opportunities (e.g. jobs with compost producers).
- 3.4 Develop and disseminate appropriate public guidance on the safe management of hazardous wastes and chemicals.** The guidelines developed in this activity should, among other things, cover the entire chemical lifecycle and should include information on the intended use, toxicity, management and disposal of chemicals imported into Vanuatu.
- 3.5 Complete implementation of the EU/SPREP PacWaste Project recommendations on healthcare waste management.** The recommendations (see details in Appendix C) are outlined in the 2014 report, *Baseline Study for the Pacific Hazardous Waste Management Project: Healthcare Waste – Vanuatu*. The recommendations are still relevant and include the following:

- (1) Develop a waste management framework consisting of a Healthcare Waste Management Plan specific to each hospital, appointment of an officer responsible for development and implementation of the Plan, and establishment of a waste management committee.
 - (2) Procure and make available consumables for segregation and storage, including colour-coded waste bins and plastic liners in sufficient quantities, colour-coded wheelie bins to act as in-ward storage and internal transport trolleys, and signage and posters to explain and promote the colour-coded segregation system.
 - (3) Provide a sustainable training program consisting of a structured waste management education/awareness program developed and delivered to all stakeholders.
 - (4) Provide appropriate storage facilities within each healthcare facility.
 - (5) Improve the treatment infrastructure. Since the PacWaste recommendations were made in 2014, five new high-temperature incinerators were installed under the EU/SPREP PacWaste Project. Treatment infrastructure at other healthcare facilities should be progressively improved.
 - (6) Procure and make available PPE consumables, including overalls, protective clothing, gloves and eye protection for all waste handlers, as well as face masks and noise protection for incinerator staff.
- 3.6 Increase operational budget allocation for quarantine waste incinerators.** Sufficient funding must be allocated to ensure the high-temperature destruction of quarantine wastes.
- 3.7 Establish sites for safe temporary storage of hazardous wastes and chemicals and ban these substances from landfill disposal.** Temporary storage is necessary until sufficient hazardous wastes and chemicals can be accumulated for export.
- 3.8 Facilitate the collection of hazardous wastes and chemicals on a semi-annual basis once storage sites are operational.** Provision of a regular, well-advertised collection service for hazardous wastes and chemicals will encourage people to safely dispose of these wastes.
- 3.9 Develop national landfill management guidelines incorporating relevant aspects of BAT/BEP.**
- 3.10 Implement national guidelines for landfill management.**

KRA4: Improve domestic cooking practices

Approximately 80% of Vanuatu's population is wholly or partially dependent on traditional fuels for cooking. Most traditional cooking methods are inefficient, and some cooking may be done in poorly ventilated areas. Women, who traditionally prepare the daily meals, and children are most at risk. Activities under this uPOPs Action Plan to improve domestic cooking practices and reduce uPOPs emissions are as follows:

- 4.1 Conduct community meetings and demonstrations on the negative effects of smoke inhalation, and on improved cooking appliances and techniques.** Improved stoves that burn fuel (biomass) more efficiently, and alternative appliances (such as solar cooking) will reduce releases of uPOPs, improve indoor air quality, and potentially save fuel compared to older stoves. Improved practices include increasing ventilation in the cooking area. Further guidance on BAT/BEP for domestic cooking practices is provided in Section VI.C of the Stockholm Convention BAT/BEP Guidelines.⁴ Community sessions could include preparation and dissemination of fact sheets on improved cooking methods (e.g. how to ensure good ventilation and maintain cooking equipment).
- 4.2 Provide awareness training to extension workers in health, agriculture and forestry, so that they can help with long-term promotion of good domestic cooking practices in rural communities.** This requires collaboration between DEPC and departments responsible for health, agriculture and forestry.
- 4.3 Collaborate with the private sector to offer incentives that encourage people to trade-in their inefficient stoves for improved ones.** Incentives could include, for example, discounted price on new stoves.

⁴ Available at: <http://chm.pops.int/Implementation/BATandBEP/BATBEPGuidelinesArticle5/tabid/187/Default.aspx>

KRA5: Reduce uPOPs emissions from the transport sector

The uPOPs emissions calculated for the transportation sector in Vanuatu are insignificant compared to other sectors. Nonetheless, there are simple measures that can be implemented to help reduce emissions and raise awareness of uPOPs:

- 5.1 Restrict the age of imported vehicles.** Vehicles must meet increasingly stringent vehicle emission standards in their countries of manufacture. Restricting the age of vehicles that can be imported into Vanuatu will help to ensure that older, more polluting vehicles are not imported.
- 5.2 Require imported vehicles to be fitted with mandatory emission control systems.** These systems minimise pollution by limiting the emissions (including uPOPs, hydrocarbons, carbon monoxide, nitrogen oxides and sulfur oxides) produced by motor vehicles.
- 5.3 Strengthen vehicle inspection standards to include emissions testing.** This activity will expand the existing basic vehicle inspection points to require emissions testing.
- 5.4 Prepare and disseminate guidelines on good vehicle maintenance and operation practices that reduce uPOPs emissions.** Poorly maintained vehicles burn fuel less efficiently and completely and thus contribute to more uPOPs emissions. Good vehicle maintenance can not only save the vehicle owner money but can also minimise the formation and release of uPOPs.

KRA6: Improve coordination among stakeholders

As uPOPs are formed and released from activities across several sectors, coordination and collaboration amongst all stakeholders is essential to reducing uPOPs releases. The activities to improve coordination among stakeholders are described below:

- 6.1 Establish an interagency National Waste and Chemicals Coordinating Committee** to provide strategic direction and oversight over all national waste and chemical issues including projects, programmes, and implementation of the Stockholm Convention and other international conventions applicable to Vanuatu.
- 6.2 Convene a regular (e.g. annual) National Environment Forum** as a platform for showcasing progress in environmental priorities, including implementation of the Stockholm Convention. The Forum would also be a mechanism to consistently engage with the public and maintain public awareness of priority environmental matters.

KRA7: Ensure timely implementation, monitoring and reporting under the uPOPs Action Plan

Implementation, monitoring and reporting of activities under the Stockholm Convention continue to be challenges for Vanuatu. The majority of the activities of the previous NIP have not been implemented as planned for various reasons, including limited allocation of human and financial resources, and high staff turnover rate. Programme monitoring and reporting frameworks are also lacking, which makes collection of baseline data from different stakeholders difficult and time consuming and evaluation of progress almost impossible. Moreover, Vanuatu is failing in its reporting obligations as a Party to the Stockholm Convention. The following activities to ensure timely implementation, monitoring and reporting under the uPOPs Action Plan will also contribute to overall implementation of the Vanuatu NIP.

- 7.1 Develop and implement a data collection and analysis plan in consultation with stakeholders**, which identifies the data to be collected, frequency of collection, data sources, approaches to data collection, and roles and responsibilities for data collection. A stakeholder workshop should be convened to identify the data needed, frequency of collection, data sources, roles and responsibilities for data collection, and approaches to data collection (e.g. require mandatory reporting by importers as part of business or waste licence conditions).
- 7.2 Establish a central database for all waste and chemicals data.** The database should be hosted by DEPC, with appropriate access given to all stakeholder agencies

- 7.3 Require licensed facilities to report relevant activity data as a condition of their business or environmental licences.** Also require relevant government departments and agencies to collect and report relevant information
- 7.4 Collaborate with the National Statistics Office to collect relevant data** through surveys such as the Household Income and Expenditure Survey (this may also be part of the data collection and analysis plan above)
- 7.5 Integrate activities from this uPOPs Action Plan into relevant departmental work plans and budgets.** This will help to ensure that the uPOPs Action Plan is mainstreamed into the work of relevant departments and not be seen as 'extra work'.
- 7.6 Prepare an annual progress report on implementation of the uPOPs Action Plan.** The progress report will assist with overall reporting to the Stockholm Convention. Preparing an annual report can also be a catalyst for action, for example, if little to no progress is being reported year on year.

Implementation plan

Activity	Lead agencies	Timeframe					Government of Vanuatu commitment (USD)	External assistance needed (USD)	Cost description or comments
		2018	2019	2020	2021	2022			
KRA1: Strengthen the national policy and legislative framework									
1.1 Implement and enforce a nation-wide ban on open burning, including burning in the agricultural sector, on landfills, and in urban backyards	DEPC							-	Using existing internal resources. Model legislation will be provided under the POPs Release Reduction Project
1.2 Prescribe rules for open burning in remote communities if complete elimination is not possible within the timeframe, or to cater for cases of disaster or other emergencies. Rules should be written in accordance with section VI.A of the UNEP BAT/BEP guidance	DEPC							-	Using existing internal resources
1.3 Prohibit local land-based disposal of POPs (e.g. stockpiles of POPs pesticides) and articles known to contain POPs (e.g. electrical transformers containing PCB oils)	DEPC							-	Using existing internal resources
KRA2: Reduce human exposure to uPOPs									
2.1 Prepare, disseminate, and conduct awareness on a handbook for PPE usage in the waste sector (e.g. for incinerator operators, landfill workers, etc)	DEPC							5,000	Handbook preparation and printing
2.2 Require employers to provide mandatory PPE and training to relevant workers as a condition of their environmental and/or business licences	Labour							-	Using existing internal resources
2.3 Promote well-balanced, low-fat diets with adequate amounts of fruits and vegetables	Health							20,000	Awareness and promotional materials
2.4 Implement a national ongoing anti-smoking campaign, including anti-smoking awareness programs in schools	Health							30,000	Awareness materials
2.5 Progressively introduce higher national tobacco taxes	Finance, Health							-	
2.6 Establish smoke-free environments (e.g. universities, government facilities, restaurants, public areas)	Health							5,000	Signage

Activity	Lead agencies	Timeframe					Government of Vanuatu commitment (USD)	External assistance needed (USD)	Cost description or comments
		2018	2019	2020	2021	2022			
KRA3: Increase adoption of best practices in the waste sector									
3.1 Implement a 5-year national composting campaign	DEPC, Municipalities							100,000	Awareness materials, workshops, composting equipment, travel
3.2 Implement at least one composting project in each province annually	Municipalities, DEPC							75,000	
3.3 Establish partnerships with key stakeholders (e.g. Ministry of Agriculture, large farms, beautification committees, etc) to promote the use of compost and help create domestic demand for compost	DEPC						2,500		Minimal costs for meetings
3.4 Develop and disseminate appropriate public guidance on the safe management of hazardous wastes and chemicals	DEPC, Municipalities							5,000	Consultant's fees
3.5 Complete implementation of the PacWaste Project recommendations on healthcare waste management (Appendix C)	Ministry of Health							PacWaste Plus	Funding anticipated under PacWaste Plus Project
3.6 Increase operational budget allocation for quarantine waste incinerators	Biosecurity Vanuatu							20,000	
3.7 Establish sites for safe temporary storage of hazardous wastes and chemicals and ban these substances from landfill disposal	Municipalities, DEPC							50,000	Construction of safe storage facilities
3.8 Facilitate the collection of hazardous wastes and chemicals on a semi-annual basis once storage sites are operational	Municipalities, DEPC							30,000	Collection costs for 3 years
3.9 Develop national landfill management guidelines incorporating relevant aspects of BAT/BEP	DEPC							5,000	Consultant's fees
3.10 Implement national guidelines for landfill management	Municipalities							-	
KRA4: Improve domestic cooking practices									
4.1 Conduct community meetings and demonstrations on the negative effects of smoke inhalation, and on improved cooking appliances and techniques	Ministry of Health, DEPC							50,000	Community meetings, awareness materials, demonstrations, etc
4.2 Provide awareness training to extension workers in health, agriculture and forestry, so that they can help with long-term promotion of good domestic cooking practices in rural communities	DEPC							10,000	Training costs
4.3 Collaborate with the private sector to offer incentives to encourage trade-in of inefficient stoves for improved stoves	Ministry of Health, DEPC							10,000	Subsidies

Activity	Lead agencies	Timeframe					Government of Vanuatu commitment (USD)	External assistance needed (USD)	Cost description or comments
		2018	2019	2020	2021	2022			
KRA5: Reduce uPOPs emissions from the transport sector									
5.1 Restrict the age of imported vehicles	Transport							-	Using existing legal resources
5.2 Require imported vehicles to be fitted with mandatory emission control systems	Transport							-	Using existing legal resources
5.3 Strengthen vehicle inspection standards to include emissions testing	Transport							25,000	External legal and technical assistance, emissions testing equipment
5.4 Prepare and disseminate guidelines on good vehicle maintenance and operation practices that reduce uPOPs emissions	Transport, DEPC							10,000	Guideline preparation and dissemination
KRA6: Improve coordination among stakeholders									
6.1 Establish an interagency National Waste and Chemicals Coordinating Committee to provide strategic direction and oversight over all national waste and chemical issues including projects, programmes, and implementation of the Stockholm Convention and other international conventions applicable to Vanuatu	DEPC, all government departments							20,000	- Establish by 2018. Costs (meeting, communications, etc) to run the National Committee over 5 years
6.2 Convene a regular (e.g. annual) National Environment Forum as a platform for showcasing progress in environmental priorities, including implementation of the Stockholm Convention	DEPC							15,000	Preparatory meetings, venue hire, promotional materials, catering, etc
KRA7: Ensure timely implementation, monitoring and reporting of the uPOPs Action Plan									
7.1 Develop and implement a data collection and analysis plan in consultation with stakeholders, which identifies the data to be collected, frequency of collection, data sources, approaches to data collection, and roles and responsibilities for data collection	DEPC							-	Using existing resources
7.2 Establish a central database for all waste and chemicals data. The database should be hosted by DEPC, with appropriate access given to all stakeholder agencies	DEPC							15,000	IT expert input, hardware (e.g. storage drive), etc
7.3 Require licensed facilities to report relevant activity data as a condition of their business or environmental licences. Also require relevant government departments and agencies to collect and report relevant information	DEPC							-	Enforcement of existing provisions
7.4 Collaborate with the National Statistics Office to collect relevant data through surveys such as the Household Income and Expenditure Survey (this may also be part of the data collection and analysis plan above)	DEPC, Statistics							-	Minimal costs to be covered under existing budgets

Activity	Lead agencies	Timeframe					Government of Vanuatu commitment (USD)	External assistance needed (USD)	Cost description or comments
		2018	2019	2020	2021	2022			
7.5 Integrate activities from this uPOPs Action Plan into relevant departmental work plans and budgets	All lead agencies						-	-	
7.6 Prepare an annual progress report on implementation of the uPOPs Action Plan	DEPC						5,000	-	Editing, printing & e-publishing
		Total					27,500	460,000	
		Grand Total					487,500		

Key Performance Indicators

The key performance indicators in Table 4 have been identified for the uPOPs Action Plan. Performance against these indicators should be measured and reported annually in the annual progress report for the uPOPs Action Plans.

Table 4: Key performance indicators for the uPOPs Action Plan

Indicator	2017 Baseline	2022 Target	Sources of verification
Goals/Outcomes			
1. uPOPs emissions (g-TEQ)		10% Reduction	Estimation of uPOPs emissions
Key Result Areas			
2. Legislative ban on open burning and landfill disposal of POPs	No	Yes	Amended legislation
3. Number of local handbook on PPE usage available	0	1	Published handbook
4. Number of employers providing training and PPE to employees	To be established	To be established after baseline set	Interviews with employers & employees; numbers of PPE imported
5. Percentage reduction in tobacco importation		2% reduction per annum	Customs records
6. Number of households engaged in composting programs	To be established	To be established after baseline set	Interviews, inspections
7. National guideline on safe chemical and hazardous waste management available	No	Yes	Published guideline
8. uPOPs emissions from healthcare waste management	1.568 g TEQ	25% less emissions	uPOPs inventory
9. Proportion of quarantine waste treated in incinerator (i.e. not burnt at landfill/dump)	To be established	100%	Incinerator records, landfill/dumpsite records
10. Appropriate safe storage facility established and receiving hazardous wastes and chemicals annually	No	Yes	Inspection of facilities, facility records
11. Landfill management guidelines available	No	Yes	Published guidelines
12. Number of households that have adopted improved cooking appliances/practices	0		Household interviews
13. Emissions inspection program in place	No	Yes	
14. Number of mechanics and vehicle owners adopting good vehicle maintenance practices	0		Interviews
15. National Waste and Chemicals Coordinating Committee established and functional	No	Yes	Terms of Reference, Committee meeting minutes
16. National Environment Forum convened annually	No	Yes, starting in 2021	Media reports, Records of forum proceedings
17. Database on waste and chemicals established and kept updated	No	Yes	Interrogation of the database
18. Number of annual progress reports on the uPOPs Action Plan published	0	5	Published reports
19. Number of annual reports submitted to the Stockholm Convention Secretariat	0	5	Stockholm Convention website

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Appendix A: Estimation of uPOPs releases

Source Group 1: Waste incineration

Healthcare waste incineration

High temperature healthcare waste incinerators (currently operational) were installed in five healthcare facilities⁵ in Vanuatu as part of the European Union funded Pacific Hazardous Waste Management Project (PacWaste) implemented by SPREP.

Each facility is estimated to incinerate 1.0 kg of HCW per occupied bed day (equivalent to about 71 tonnes/year, Table A1). In the absence of other information, it is assumed that the other healthcare facilities in Vanuatu burn HCW in simple wood-fired incinerators. The five healthcare facilities surveyed, serviced approximately 185,000 people (or 64% of the total population of 289,700⁶). If it is assumed that the waste generated by these facilities (71 tonnes) is also equivalent to 64% of the total HCW, then the total HCW generated in Vanuatu can be estimated as 110 tonnes/year. Of this amount, 71 tonnes are incinerated in high temperature, double chamber incinerators without air pollution control systems, and 39 tonnes are assumed to be burnt in simple wood fired incinerators.

uPOPs are also formed and released from the burning of the solid fuels (wood, coconut shells/husks, etc) in the wood fired incinerators. If each kilogram of waste requires 3.5 kilogram of solid fuel⁷, incinerating 39 tonnes of quarantine waste annually would require 136.5 tonnes of solid fuel. The resulting uPOPs emissions from incineration of healthcare waste are summarised in Table A2.

Table A1: Healthcare waste management statistics

Healthcare facility	Population served	No. of beds	Healthcare waste including sharps (kg/year)
Port Vila Central Hospital	65,000	146	39,000
Northern Districts Hospital	40,000	43	13,000
Lenakel Hospital	32,000	43	13,000
Norsup Hospital	36,000	54	5,200
Panunagis Health Centre	12,000	4	520
Total	185,000	290	70,720

Source: ENVIRON Pty Ltd. (2014). *Baseline study for the Pacific hazardous waste management project: Healthcare waste, Vanuatu*. Melbourne: ENVIRON Pty Ltd.

Quarantine waste

Whist incinerators exist for the destruction of quarantine waste on Port Vila and Luganville, they may not always be operated due to the high cost of the fuel required. In these cases, quarantine waste will often be burnt at the dumpsite.⁸ For this reason, uPOPs emissions from treatment of quarantine wastes are considered under Source Group 6: Open burning.

⁵ Port Vila Central Hospital, Northern Districts Hospital, Lenakel Hospital, Norsup Hospital, and Panunagis Health Centre

⁶ Secretariat of the Pacific Community, 2016, *Pacific Islands population poster*, retrieved from <https://sdd.spc.int/en/news/latest-news/137-2016-pacific-islands-population-poster>.

⁷ Batterman, S. (2004). *Assessment of small-scale incinerators for health care waste. Report prepared for the Protection of the Human Environment*. World Health Organization. Retrieved from http://www.who.int/water_sanitation_health/medicalwaste/en/smincinerators.pdf, (page 15).

⁸ DEPC. (2016). *National waste management and pollution control strategy and implementation plan 2016-2020*. Port Vila: DEPC, (page 22).

Table A2: uPOPs emissions for Source Group 1: Waste incineration

Source Category	Activity rate (tonnes/year)	Annual release (g TEQ/year, unless stated otherwise)					
		Air	Water	Land	Product	Fly ash	Bottom Ash
Healthcare waste – uncontrolled batch combustion without air pollution control system (APCS)	39	1.560				0.000	0.008
Healthcare waste – controlled, batch combustion with no APCS	71	0.213				0.000	0.001
Waste wood/biomass	137	0.014				0.137	0.000
Total for Source Group 1	-	1.787	0	0	0	0.137	0.009

Source Group 2: Ferrous and non-ferrous metal production

There are no activities from this source group currently occurring in Vanuatu.

Source Group 3: Heat and power generation

Fossil fuel power plants

The heat and power generation source group defined by the uPOPs Toolkit includes power plants that generate electricity using steam generators. However, electricity in Vanuatu is produced by diesel generators. Emissions from electricity generation in Vanuatu are therefore considered in Source Group 5: Transport under diesel engines.

Household heating and cooking with biomass

The Global Green Growth Institute (GGGI) estimated that 79% of Vanuatu's population in 2012 was wholly or partially dependent on traditional fuels which included fuelwood, coconut husks and other agricultural wastes.⁹ At the time of writing, there was no commercial use of biogas or biomass resources for energy apart from coconut oil.¹⁰ Data on biomass consumption is limited; however, the international Renewable Energy Agency (IRENA) estimated that as at 2012, around 43,600 tonnes of oil equivalent (toe) of fuel wood (approximately 1825 terajoules) was burned each year for cooking and crop drying.¹¹ Assuming a 3% annual growth in fuel wood consumption¹² since 2012, fuel wood consumption as at 2017 could be approximately 50,000toe (2,093 terajoules). The composition of the fuel wood (contaminated wood, virgin wood, charcoal, etc) is not known, therefore a conservative approach is adopted in assuming that all the fuel wood is contaminated wood/biomass, which has the highest emission factors under the uPOPs Toolkit.

The ash generated from cooking with biomass depends on several factors including the minerals present in the wood and any soil and other contamination. It is known that the main species used as fuelwood in urban areas of Vanuatu are broad-leaved trees: *Leucaena leucosephala*, *Macaranga spp*, and *Accasia spirobis*.¹³ The Food and

⁹ Department of Energy & GGGI. (2016). *Vanuatu energy demand projections: Business as usual scenario*. Seoul: GGGI (page 20).

¹⁰ DoE & UNDP. (2015). NAMA on rural electrification in Vanuatu. Retrieved from <http://www.undp.org/content/undp/en/home/librarypage/environment-energy/mdg-carbon/NAMAs/nama-on-rural-electrification-in-vanuatu.html>.

¹¹ IRENA. (2015). *Vanuatu renewables readiness assessment*. Abu Dhabi: IRENA, (page 11)

¹² Department of Energy & GGGI. (2016). *Vanuatu energy demand projections: Business as usual scenario*. Seoul: GGGI (page 21).

¹³ Department of Energy & GGGI. (2016). *Vanuatu energy demand projections: Business as usual scenario* (page 20). Seoul: GGGI

Agriculture Organization suggest that the ash content for broad-leaved biomass can range from 0.3% to 5% on a dry weight basis, and the calorific value can range from 19–20MJ/kg (or 0.019–0.02 TJ/tonne) of biomass. As a first approximation, the ash generation from domestic cooking is therefore estimated to range from approximately 315 tonnes¹⁴ to 5,500 tonnes¹⁵.

Table A3: uPOPs emissions for Source Group 3: Heat and power generation

Source Category	Activity rate (Terajoules/ year)	Annual release (mg TEQ/year, unless stated otherwise)					
		Air	Water	Land	Product	Residue	Ash (tonnes)
Household heating and cooking – contaminated biomass fired stoves	2,093	3.140				0.315 – 5.500	315 – 5,500

Source Group 4: Production of mineral products

There are no long-term activities from this source group currently occurring in Vanuatu. Asphalt mixing plants are expected to be operational in the future for several months as part of the Vanuatu Aviation Investment Project.

Source Group 5: Transport

POPs emissions from transport sector result from the incomplete combustion of fossil fuels in 4-stroke and 2-stroke engines, and in engines fuelled by diesel and heavy fuel oil. In the case of Vanuatu, this source group also includes diesel-powered combustion engines used for power generation.

Unfortunately, the proportion of the fuels used in 4-stroke versus 2-stroke engines is not known. In the absence of suitable data, it is assumed that 80% of all imported petrol (gasoline) is burnt in 4-stroke engines (e.g. cars, trucks, and a few motorbikes and outboard motors), whilst the remaining 20% of imported petrol is burnt in 2-stroke engines (e.g. motorbikes, and outboard motors), as summarised in Table A4.

Approximately 10.6MI (7,863 tonnes) of petrol and 44.9MI (38,164 tonnes) of diesel were imported into Vanuatu in 2016.¹⁶

Table A4: Vanuatu fuel imports and consumption

Fuel	Fuel imported in 2016 (litres) [see note 1]	Estimated fuel imports in 2017 [see note 2]	Fuel estimated to be consumed in...			
			2-stroke engines	4-stroke engines	Diesel engines	Heavy fuel oil engines
Gasoline	10.63 MI	10.63 MI (7,866 tonnes)	2.13 MI (1,573 tonnes) (20%)	8.50MI (6,293 tonnes) (80%)	-	
Diesel	44.87 MI	44.87 MI (38,140 tonnes)	-	-	44.87 MI (38,140 tonnes) (100%)	
Heavy fuel oil	No data	No data				

Notes: [1] Source: <https://vnso.gov.vu/index.php/document-library?view=download&fileId=4562>

[2] Assumes negligible growth in fuel imports between 2016 and 2017.

¹⁴ (2093 TJ of biomass) ÷ 0.02 TJ/tonne x 0.3% = 313,950 kg = approx. 315 tonnes

¹⁵ (2093 TJ of biomass) ÷ 0.019 TJ/tonne x 5.0% = 5,507,895 kg = approx. 5,500 tonnes

¹⁶ Vanuatu National Statistics Office. (2018). *Quarterly statistical indicators*. Retrieved from <https://vnso.gov.vu/index.php/document-library?view=download&fileId=4562>.

Table A4: uPOPs emissions for Source Group 5: Transport

Source Category	Activity rate (tonnes/year)	Annual release (g TEQ/year, unless stated otherwise)				
		Air	Water	Land	Product	Residue
4-Stroke engines -unleaded gasoline without catalyst	6,293	0.001				
2-Stroke engines – unleaded fuel	1,573	0.004				
Diesel engines	38,140	0.004				
Total for Source Group 5	-	0.008	0	0	0	0

Source Group 6: Open burning processes

Open burning of waste

Domestic waste

There is very little data on the rates of waste generation and open burning of domestic waste in Vanuatu. Exercises conducted in Port Vila in 2011, and Luganville in 2014, suggest daily domestic waste generation rates of 0.4 and 1.2 kg/person respectively (SPREP, 2015). In the absence of any other data, the average national waste generation rate is calculated as 0.6 kg/person, using the following formula:

$$\text{Average national daily waste generation rate (kg/person)} = \frac{(\text{Port Vila rate} \times \text{2011 Port Vila population}^{17}) + (\text{Luganville rate} \times \text{2014 Luganville population}^{18})}{(\text{Port Vila population} + \text{Luganville population})}$$

The total national annual waste generation is therefore estimated to be about 63,000 tonnes based on the daily waste generation rate of 0.6 kg/person and a population of 289,700.¹⁹ According to the 2009 census, 52% of all households burn their waste,²⁰ and this is assumed to remain unchanged in 2017. This means that approximately 32,800 tonnes of waste are burned annually.

Quarantine waste

Whilst incinerators exist for the destruction of quarantine waste on Port Vila and Luganville, they may not always be operated due to high cost of the fuel required. In these cases, quarantine waste will often be burnt at the dumpsite.

In the absence of national data on the quantities of quarantine wastes burned in Vanuatu, quarantine waste generation (609 tonnes) has been estimated based on data from the Caribbean region (Table A5). Quarantine waste is considered the same as 'domestic waste' for the purpose of estimating uPOPs emissions using the uPOPs Toolkit.

The total quantity of municipal waste (domestic and quarantine wastes) burnt is therefore approximately 33,409 tonnes, which produces the uPOPs emissions summarised in Table A6.

¹⁷ Estimated to be 47,033 people, based on assumptions that Port Vila comprises 18.8% of total population and grew at 3.4% per year between 2009 census and 2011.

¹⁸ Estimated to be 16,286 people, based on assumptions that Luganville comprises 5.6% of total population and grew at 3.4% per year between 2008 and 2014.

¹⁹ Secretariat of the Pacific Community, 2016, *Pacific Islands population poster*. Retrieved from <https://sdd.spc.int/en/news/latest-news/137-2016-pacific-islands-population-poster>.

²⁰ Vanuatu National Statistics Office. (2011). *2009 National population housing census: Analytical report volume 2*. Port Vila: VNSO, (page 142).

Table A5: Estimated quarantine waste generation

Activity in 2013 (assumed same in 2017)	Port Vila [note 1]	Luganville [note 1]	Total	Assumptions	Estimated waste generation
No. of domestic ships calling at port	202	780	982	<ul style="list-style-type: none"> 28 crew members per ship each generating 2 kg/day of waste for 2 days [see note 2] 	110 tonnes
No. of international ships calling at port	200	95	295	<ul style="list-style-type: none"> 120 cruise ship vessels 175 non-cruise ship vessels with 28 crew members per ship each generating 2 kg/day of waste for 2 days [see note 2] 	20 tonnes
No. of passengers disembarking domestic ships	10,535	5,200	15,735	<ul style="list-style-type: none"> Each passenger generates 3kg of waste daily for 1 day [see note 2] 	47 tonnes
No. of passengers disembarking international ships	144,000	No data	144,000	<ul style="list-style-type: none"> Each passenger generates 3kg of waste daily for 1 day [see note 2] 	432 tonnes
				TOTAL	609 tonnes

Notes: [1] Source: *Inter-island and International shipping background (23-25th July 2013)*, Retrieved from <http://www.unescap.org/sites/default/files/0.Vanuatu.pdf>.

[2] Estimates based on the report: *Ship generated waste disposal in the wider Caribbean region (page 101)*, retrieved from https://web.wpi.edu/Pubs/E-project/Available/E-project-121610-185147/unrestricted/Team5_USCG1_IQP_FINAL.pdf

Fires at waste dumps

Fires on open dumpsites are assumed to be a common occurrence, particularly in rural areas. However, there is insufficient information available to enable a reasonable assessment of uPOPs emissions.

Table A6: uPOPs emissions for Source Group 6: Open burning processes

Source Category	Activity rate (tonnes/year)	Annual release (g TEQ/year, unless stated otherwise)				
		Air	Water	Land	Product	Residue
Open burning of domestic waste	32,800	1.312	0	0.033	0	0
Open burning of quarantine waste	609	0.024	0	0.001	0	0
Fires at waste dumps	No data	-	-	-	-	-
Total for Source Group 6	-	1.336	0	0.033	0	0

Source Group 7: Production and Use of Chemicals and Consumer Goods

There are no activities from this source group currently occurring in Vanuatu.

Source group 8: Miscellaneous processes

Drying of biomass

The major use of biomass for drying is in copra drying. Copra—the dried coconut kernel from which coconut oil is extracted—is Vanuatu's main agricultural export commodity with 69% of households are engaged in coconut

production.²¹ Although in decline, the coconut sector is the second largest contributor to foreign exchange earnings and contributes 45% to GDP.²²

The total domestic production of copra is not fully known; however, some data is available on the quantities of copra, coconut oil and copra meal exported between 2013 and 2016 (Table A7). The data presented in Table A7 includes an estimation of the copra used to produce coconut oil for export, but excludes any products consumed locally. Based on this analysis, an average of 31,000 tonnes of copra are estimated to be exported annually.

Copra may be dried by the sun or in a (biomass-fuelled) hot air drier or a smoke drier,²³ with the latter two methods contributing to uPOPs emissions. Used lubricant oil may also be used to fuel the driers. The degree to which each drying method has been used in recent times is not known; however, in 1983, crop-drying requirements for 37,900 tonnes of copra were estimated at 87,530 tonnes of biomass (coconut residues and wood).²⁴ Equivalently, 2.3 kg of biomass were required to dry 1 kg of copra in 1983. Applying this rate to recent copra production results in biomass requirements of 71,000 tonnes (Table A7). The resulting uPOPs emissions (resulting largely from the presence of sea salt on incinerated biomass) are summarised in Table A9.

Table A7: Exportation of coconut products from Vanuatu between 2013 and 2016

item	Quantity (tonnes)				
	2013	2014	2015	2016	4-yr average
(a) Copra exported	12,508	25,194	12,584	27,932	19,555
(b) Coconut oil exported	5,535	9,208	6,570	6,056	6,842
(c) Coconut meal exported	7,692	4,786	5,011	2,741	5,058
(d) Copra that produced the coconut oil (= coconut oil exported ÷ 60%) ¹	9,225	15,347	10,950	10,093	11,404
Total copra [sum of (a) and(d)]	21,733	40,541	23,534	38,025	30,958
Biomass required to dry copra²	49,986	93,244	54,128	87,458	71,204

1. Copra contains about 60–65% coconut oil by weight (Krishna et al, 2010). The lower value of 60% is used to estimate the amount of copra that would have been required to produce the coconut oil exported.
2. Based on 1983 estimate of 2.3 kg of biomass per 1 kg of copra (UNDP & World Bank, 1985).

Tobacco smoking

Between 2013 and 2017, about 111 million units of cigarettes were estimated to be imported into Vanuatu according to national trade statistics from Vanuatu Customs (Table A8). Much smaller quantities of cigars and other cigarettes were also imported. The Vanuatu activity rate for this source category does not produce significant uPOPs emissions (compared to other sources), based on the uPOPs Toolkit.

Table A8: Importation of cigars and cigarettes into Vanuatu between 2013 and 2017

Description	2013	2014	2015	2016	2017	4-year average
Cigars (kg)	567	445	1,163	428	291	579
Cigarettes (units)	113,602,937	110,206,184	120,338,292	146,317,201	62,579,196	110,608,762
Other cigarettes (units)	330	6,960	5,800	4,594	29,066	9,350

Source: Vanuatu Customs

²¹ Government of Vanuatu. (2015). *Vanuatu agriculture sector policy*. Retrieved from https://malffb.gov.vu/doc/Vanuatu_Agriculture_Sector_Policy.pdf, (page 11).

²² Government of Vanuatu. (2016). *Vanuatu national coconut strategy 2016-2025*. Retrieved from <https://pafpnet.spc.int/attachments/article/651/Vanuatu%20National%20Coconut%20Strategy%202016-2025.pdf> (page 10).

²³ Ministry of Education. (1997). *Agriculture in Vanuatu: Coconuts*. Port Vila: Ministry of Education.

²⁴ UNDP & World Bank. (1985). *Vanuatu: Issues and options in the energy sector, report no. 5577-VA*. World Bank.

Table A9: uPOPs emissions for Source Group 8: Miscellaneous processes

Source Category	Activity rate (tonnes/year)	Annual release (g TEQ/year, unless stated otherwise)				
		Air	Water	Land	Product	Residue
Drying of biomass – moderately contaminated fuel	71,000	0.007			0.007	1.420
Tobacco smoking (per million items)	111	0.000				0.000
Total for Source Group 8	-	0.007	0	0	0.007	1.420

Source group 9: Disposal

This source group addresses non-thermal waste disposal processes which are the routes by which PCDD/PCDF already present in waste may be released. These processes are not sources of PCDD/PCDF formation and release per se. Processes in this group include waste disposal to land (landfills and dumpsites), sewage treatment, open water dumping, composting, and used oil management.

Waste dumps

According to the 2009 population census, 52% of the population dispose of waste by burning. Although other disposal methods are practiced including disposal in dumps, lagoons, streams and the ocean, it is assumed that 48% of the domestic waste generated (30,200 tonnes/year) is disposed to dumps.

Sewage treatment

Vanuatu does not have reticulated sewerage and sewage treatment facilities.

Open water dumping

Open water dumping is the practice of discharging untreated wastewater or other wastes directly into ground water, the lagoon or the ocean. This wastewater comes from both urban communities and remote environments with no industries. Most of Port Vila and Luganville wastewater is generally disposed of via illegal stormwater connections, direct discharge, or into poorly designed and maintained septic systems, which leach contaminants into adjacent coastal and fresh water systems.²⁵

In the absence of national data, wastewater generation in Vanuatu has been estimated as 8.5 million m³ based on the assumptions that:

- the average per capita consumption of water is 100 litres daily²⁶ for a population of 289,700
- 80% of the daily water consumption becomes wastewater.²⁷

It is further assumed that 50% (4.2 million m³) of the wastewater generated can be categorised as open water dumping, producing the uPOPs emissions summarised in Table A10.

Composting

The Port Vila Municipal Council (PVMC) and Luganville Municipal Council (LMC) have introduced projects to separate and compost green wastes from the markets and to separate aluminum cans in the generation areas. PVMC transports the separated market green wastes to Vanuatu Direct, a private company which composts the

²⁵ Government of Vanuatu. (2008). Vanuatu national water strategy 2008-2018. Port Vila: Government of Vanuatu. Retrieved from http://www.nab.vu/sites/default/files/nab/documents/03/04/2014%20-%2012%3A37/national_water_strategy_-_finalsmall.pdf (page 9).

²⁶ von Sperling, M., and Chernicharo, C.A.L. (2005). *Biological wastewater treatment in warm climate regions*. Retrieved from <https://www.iwapublishing.com/sites/default/files/ebooks/9781780402734.pdf>, (page 24).

²⁷ Ibid (page 21).

green waste and uses it in agricultural activities. LMC has set up a composting facility at the Luganville market and is composting the green waste by itself and selling to users.

The presence of dioxins and furans in compost may be due to contaminated feedstock, such as residues from backyard burning, or other wastes.

Used oil management

For the uPOPs Action Plan, used oils are defined as any petroleum-based, synthetic, or plant- or animal-based oil that has been used. Used oils streams include industrial oil (e.g. hydraulic oil, engine lubricant, cutting oil); garage or workshop oil; and transformer oil. Used oils have been found to be contaminated with dioxins and furans and PCBs, and their improper disposal may result in contamination of land or water; however, the uPOPs Toolkit does not provide any emission factors to estimate uPOPs releases. Nonetheless, this uPOPs Action Plan recognises the importance of safe management of used oil in accordance with best practices.

Table A10: uPOPs emissions for Source Group 9: Disposal

Source Category	Activity rate	Annual release (mg TEQ/year, unless stated otherwise)				
		Air	Water	Land	Product	Residue
Waste dumps – mixed wastes	30,200 tonnes	0	0.015	0	0	1.510
Open water dumping	4,200,000 m ³	0	0.021	0	0	0
Composting	No data	-	-	-	-	-
Total for Source Group 9	-	0.000	0.036	0	0.000	1.51

Appendix B: Regional uPOPs Action Plan activities

Table B1: Activities in the Regional uPOPs Action Plan

Objectives	Expected Outcomes	Activities	Lead Agency	Priority	
1. To establish nationally-agreed policy, strategic, and reporting frameworks for long-term prevention and management of uPOPs.	Enforceable legislation adopted in each PIC.	Implement and enforce a nation-wide ban on open burning (including burning in the agricultural sector and on landfills), in consultation with relevant sectors (e.g., agriculture).	PICs (environmental protection department/ agency)	Short-term	
		Prescribe rules for open burning in low-density and remote communities (where a total ban on burning may not be realistic) in accordance with BAT/BEP guidance issued by the Stockholm Convention	PICs (waste management department/ agency)	Short-term	
		Prepare and implement ongoing campaigns to raise public awareness of community obligations under relevant regulations and rules.	PICs (environmental protection department/ agency, waste management department/ agency)	Short-term	
		Update regulations (e.g., customs, pesticides, or waste regulations) in consultation with relevant stakeholders, to ban the importation of POPs regulated under the Stockholm Convention.	PICs (department/agency responsible for environmental protection, customs, agriculture, and/or waste management)	Medium-term	
		Conduct national training for enforcement officers on the enforcement of applicable legislation and rules.	PICs (Attorney General's Office, environmental protection department/ agency)	Medium-term	
	Coordination, monitoring and reporting framework for uPOPs management established.		Convene a national multi-stakeholder group (using existing forums such as National Environmental Committees, or Heads of Departments Meetings) to promote uPOPs-related initiatives in relevant sectors (e.g., agriculture and transportation).	PICs (environmental protection department/ agency)	Ongoing
			Update, endorse and implement national waste management strategies, ensuring that a waste minimisation model (e.g., 3R+Return or another appropriate model) is included.	PICs (waste management department/agency)	Short-term
			Prepare a regional data reporting template for waste incineration, in line with BEP guidance (e.g., waste quantities, combustion time and temperature, appearance of ash, and ash disposal location).	SPREP	Short-term
			Require the operators of all healthcare and quarantine waste incinerators to maintain and submit records of key incineration parameters utilising the regional (or other appropriate) template.	PICs (environmental protection department/ agency)	Ongoing
			Prepare a regional survey template to be integrated into national census questionnaires to gather information on activities that contribute to uPOPs (e.g., number of households that: rely on wood fires for cooking; practice open burning; and practice composting).	SPREP	Medium-term
			Integrate the regional survey template into national census questionnaires, and ensure the collected data is analysed and reported.	PICs (census bureau, waste management department/agency)	Medium-term
			Prepare an annual report on the implementation of this <i>Action Plan</i> .	SPREP	Ongoing

Objectives	Expected Outcomes	Activities	Lead Agency	Priority	
2. To reduce human exposure to uPOPs.	Reduction in occupational exposure to uPOPs.	Prepare a regional code of practice or guidance on appropriate personal protective equipment (PPE) for workers in the waste sector.	SPREP	Short-term	
		Enforce the use of appropriate PPE for the waste management sector (healthcare waste incineration, quarantine waste incineration, and landfill operations), in accordance with national laws, or the regional code of practice.	PICs (labour department/agency)	Ongoing	
		Document safe work procedures for waste incinerator and landfill workers and ensure provision of training on the procedures for new workers, and regular (e.g., annual) refresher training.	PICs (healthcare facilities)	Ongoing	
		Develop and implement an occupational health surveillance programme for waste management workers and waste pickers.	PICs (health ministry/ departments, waste management facilities)	Medium-term	
		Implement a registration and management system for waste pickers—where a ban is impractical or would cause economic hardship—and restrict reclamation activities to the designated area. The system should include provision of a suitable level of training in acceptable reclamation techniques, and supply of suitable PPE.	PICs (landfill operator, waste management department/agency)	Short-term	
3. To reduce uPOPs emissions from waste incineration.	Better source segregation of healthcare waste	Implement and enforce a colour-coded healthcare waste segregation system in all hospitals and healthcare centres, which should include the provision of structured training on healthcare waste segregation and incineration BEP to all members of staff.	PICs (health department/agency)	Short-term	
		Provide signage to all hospitals and healthcare facilities to promote and explain the segregation system.	PICs (healthcare facilities, health ministry/department)	Short-term	
		Conduct regular inspections to verify compliance with segregation and incineration procedures.	PICs (health department/agency, environmental protection department/agency)	Short-term	
	Improvement in healthcare and quarantine waste incineration techniques		Develop and disseminate a regional code of practice for waste incinerators (including a simple BAT/BEP checklist) based on related Stockholm Convention guidance and other appropriate guidance.	SPREP	Medium-term
			Develop, adopt, and enforce a national code of practice for waste incinerators based on the regional code and/or other appropriate guidance and national requirements.	PICs (environmental protection department/ agency)	Medium-term
			Develop or update, endorse, and implement healthcare waste management plans for each healthcare facility ensuring the inclusion of waste segregation and treatment in accordance with BAT/BEP.	PICs (healthcare facility)	Short-term
			Assess the waste management practices of healthcare and quarantine facilities (using the regional BAT/BEP checklist or other appropriate tools) to identify incinerators or practices not compliant with BAT/BEP, and to support decision-making on priorities for replacement/upgrading.	PICs (environmental protection department/agency, health/quarantine department/agency)	Ongoing
			Upgrade, improve or replace healthcare and quarantine waste incinerators ensuring adherence to BAT guidance, and rationalising operations between healthcare waste and quarantine waste where practical.	PICs (healthcare facilities, health department/agency, quarantine department/ agency)	Ongoing

Objectives	Expected Outcomes	Activities	Lead Agency	Priority
4. To reduce uPOPs emissions from disposal/landfilling	Reduction in the disposal of hazardous substances to landfill.	Develop safe storage facilities for temporary storage of hazardous wastes and chemicals (e.g., e-waste) that would otherwise be disposed of to landfill. This should include posting appropriate signage/directions at waste disposal sites.	PICs (waste management department/agency)	Short-term
		Identify and action environmentally-sound disposal of stored hazardous wastes.	PICs (waste management department/agency)	Ongoing
		Issue regular public guidance on the safe storage and disposal of hazardous wastes and chemicals.	PICs (waste management department/agency)	Ongoing
		Provide a regular collection service (e.g., twice annually) for hazardous wastes and chemicals once storage facilities are operational.	PICs (waste management department/agency)	Ongoing
	Reduction in the disposal of organic wastes to landfill.	Designate an area on each landfill/dump (away from the main tipping face) for active or passive composting of green (vegetative) waste and market waste and divert incoming waste to this area.	PICs (landfill operator, waste management department/agency)	Short-term
		Require waste haulers to segregate organic waste (e.g., vegetative waste, market waste) and offer incentives for compliance (e.g. waiver of any tipping fees).	PICs (landfill operator, waste management department/agency)	Short-term
		Scale-up and expand existing backyard and community composting programmes at the rate of 2 communities each year.	PICs (waste management department/agency)	Ongoing
		Conduct a regional awareness campaign focused on increasing national participation in composting and other forms of organic waste management.	SPREP	Medium-term
		Conduct a National Compost Awareness Week to coincide with the International Compost Awareness Week currently observed annually by Australia, Canada, United Kingdom, and USA during the first full week of May. This could include poster competitions, schools and community competitions, demonstrations, workshops, and a range of other activities to encourage the different forms of composting and to highlight the dangers of open burning.	PICs (waste management department/agency)	Medium-term
		Develop a partnership and work programme with the Agriculture Working Group of the Pacific Islands Private Sector Organisation (PIPSO) or other relevant stakeholder, to promote organic waste recycling (composting, mulching, etc.) and increase the domestic market demand for the resulting products (compost, mulch, etc.).	PICs (waste management department/agency, agriculture department/agency)	Medium-term
	Improved waste disposal sites	Prepare and implement a landfill operating manual for each waste disposal site using currently available SPREP guidelines. Each manual should include procedures for data collection, waste inspection, and fire management, and training should be provided to landfill staff to implement the manual.	PICs (environmental protection department/agency)	Short-term
		Require the preparation and implementation of an Environmental Management Plan for every dump rehabilitation project, ensuring implementation of BAT and BEP to minimise release of potentially-contaminated leachate, dust and waste to the wider environment during construction works.	PICs (environmental protection department/agency)	Short-term
		Close temporary unregulated dumps, and close or improve existing authorised open dumps.	PICs (waste management department/agency)	Ongoing

Objectives	Expected Outcomes	Activities	Lead Agency	Priority
5. To reduce uPOPs emissions from open burning (including burning on landfills)	Reduction in number of instances of open burning in communities	Identify and maintain a record of areas susceptible to repeated open burning and ramp-up compliance monitoring of these 'hotspots'.	PICs (environmental protection department/ agency)	Ongoing
		Design and implement a social marketing programme in collaboration with NGOs and environmental groups to discourage open burning and encourage the public to report illegal open burning activities (e.g. using texts, pictures or video clips).	PICs (environmental protection department/ agency)	Medium-term
		Develop and implement an annual Best Kept Community programme to recognise community efforts in waste management, beautification and overall environmental protection. Reward good efforts with community improvement programmes rather than cash.	PICs (waste management department/ agency)	Medium-term
	Reduction in number of landfill fires	Designate an area in each landfill/dump (away from the main tipping face) for reclamation of recyclable materials and divert incoming waste to this area for an agreed period, before removing the residues to the main tipping face.	PICs (landfill operator, waste management department/agency)	Short-term
		Restrict public access to the tipping face where possible and adhere to landfill management best practices (such as no-smoking, frequent soil cover, waste inspection, litter pickup, and grounds maintenance).	PICs (landfill operator, waste management department/agency)	Short-term
	Increase in waste recycling rates.	Develop and implement "Clean Schools" and "Clean Campus" programmes to encourage adoption of waste reduction and recycling best practices in schools and educational institutions.	PICs (waste management department/ agency, educational institutions)	Short-term
		Design and implement a national container deposit programme to incentivise the recycling of targeted waste materials, including food and beverage containers.	PICs (waste management department/ agency)	Medium-term
		Design and implement extended producer responsibility programmes for used oil and E-waste.	PICs (waste management department/ agency)	Medium-term

Source: Draft Pacific Regional Action Plan to Reduce Unintentional Persistent Organic Pollutants

Acronyms: **BAT**–Best Available Techniques; **BEP**–Best Environmental Practices; **PICs**–Pacific Island Countries; **SPREP**–Secretariat of the Pacific Regional Environment Programme;

Appendix C: Healthcare waste management recommendations

The following recommendations for healthcare waste management in Vanuatu have been extracted from the baseline study of five healthcare facilities in Vanuatu (Port Vila Central Hospital, Northern Districts Hospital, Lenakel Hospital, Norsup Hospital, and Panunagis Health Centre).²⁸

8.1.1 Recommendation 1: Develop a Waste Management Framework

1. Develop a **Healthcare Waste Management Plan (WMP)** specific to each hospital, including technical guidelines and procedures relating to waste management and if not already present, infection control.
2. Appoint an **officer responsible** for the development and implementation of the Healthcare Waste Management Plan
3. Establish a **waste management committee**, appropriate to the scale of the facility.

A Healthcare Waste Management Plan, specific to each healthcare facility outlining waste definitions and characterisation, segregation techniques, containment specifications and storage practices, collection and transport, treatment and disposal and emergency procedures should be developed as an overarching document to guide healthcare waste management processes and procedures at each healthcare facility.

No known policies, guidelines and management plan were identified at federal, provincial or hospital level relating to the management of healthcare waste. It is therefore proposed that a Waste Management plan be developed for each hospital. However given it is rare that anyone at any of the hospitals visited had any training in developing such a Plan external assistance will be required.

It is proposed that the first aim of the WMP is for the two largest public hospitals (Port Vila Central Hospital and Northern District Hospital) to develop a waste management plan specific to their hospital but in consultation with each other for consistency. This part of the project will need to be overseen and assisted by an external waste consultant and/or SPREP representative.

Once the plan has been developed and rolled out it can then be applied to other hospitals and health care centres in Vanuatu who can tailor WMP to be specific to their facility.

The WMP needs compatible with any regional or local waste strategy to ensure consistency of approaches such as with external transport, disposal of treated direction etc. For example there is the *Sanma Province and Luganville Municipality Waste Management Plan for 2013-2016* which would apply for any waste management plan relating to the Northern Districts Hospital.

8.1.1.1 Short Term (0-6 months)

Locations: Luganville and Port Vila

- Engage waste management consultant to oversee the project.
- First aim of the plan is for the two largest public hospitals (Port Vila Central Hospital and Northern District Hospital) to develop a waste management plan specific to their hospital but in consultation with each other for consistency.
- Waste management consultant in consultation with key hospital staff to formulate a plan to develop the WMP.

²⁸ ENVIRON Pty Ltd. (2014). *Baseline study for the Pacific hazardous waste management project: Healthcare waste, Vanuatu*. Melbourne : ENVIRON Pty Ltd, 2014.

8.1.2 Recommendation 2: Procurement of Consumables (Segregation & Storage)

Waste should be collected in accordance with the schedules specified in the Waste Management Plan (Recommendation One). The correct segregation of healthcare waste is the responsibility of the person who produces each waste item, whatever their position in the organisation. The healthcare facility is responsible for making sure there is a suitable segregation, transport and storage system, and that all staff adhere to the correct procedures. Labeling of waste containers is used to identify the source, record their type and quantities of waste produced in each area, and allow problems with waste segregation to be traced back to a medical area.

The correct segregation of health-care waste is the responsibility of the person who produces each waste item, whatever their position in the organisation. The health-care facility is responsible for making sure there is a suitable segregation, transport and storage system, and that all staff adheres to the correct procedures. Labeling of waste containers is used to identify the source, record their type and quantities of waste produced in each area, and allow problems with waste segregation to be traced back to a medical area.

From the inspections undertaken by ENVIRON it was evident proper coloured coded healthcare waste bins and liner were not readily available and consequently healthcare waste was not properly segregation. Supply of signage that clearly illustrates and explains the colour-coded segregation system will be of great benefit educating staff and the general public.

8.1.2.1 Short Term (0-6 months)

Locations: Nation wide

- Procurement of in-hospital healthcare waste management consumables including:
 - Colour coded bins and bin liners (approximately 30 each of yellow healthcare; black general waste and green organic waste for each hospital)
 - Wheelie bins (approximately 10 for each hospital)
 - Classification and segregation signage as well as instructional posters to promote good healthcare waste management practices (all hospitals)
- Procurement plan developed to ensure the sustainable supply of healthcare waste management resources.

8.1.2.2 Medium Term (6 months-1 year)

As per short term above.

8.1.2.3 Long Term (1year-3 years)

Consumables to be supplied from in-country health agency budgets.

8.1.3 Recommendation 3: Provide a Sustainable Training Program

Development and delivery of a structured healthcare waste training program to all hospital personnel as well as personnel from other stakeholders (e.g., government health and environment agencies).

This could be facilitated/ delivered by SPREP staff, or outside trainers, or a combination of both, as no competent healthcare waste management training capability exists in Vanuatu.

Training should be coordinated with other countries'

All staff and contractors should attend a waste management training session. This is to be conducted during all induction programs in the first instance. For those staff and contractors currently employed on-site, they will be required to attend a dedicated training session so that they are fully aware of their roles and responsibilities in respect to waste management. Records shall be maintained of all staff and contractors attendance at a training session to ensure that all personnel attend.

8.1.3.1 Short Term (0-6 months)

- Identify potential trainers and build training skills
- Develop a budget for long term training delivery
- Identification and prioritization of employees that need to be trained
- Defining the specific learning objectives for each target audience
- Develop a detailed curriculum specifying the training plan for each session.

8.1.3.2 Medium Term (6 months-1 year)

- Explore incentives for training (e.g. training in collaboration with a health professional society or university that can award certificates or professional credentials)

8.1.3.3 Long Term (1year-3 years)

- Continually improve the mandatory standards of health-care waste management
- A continuing audit program be implemented to identify incorrect waste management practices and results of such audits communicated to staff in all wards/departments. Results from these audits and corrective actions to be reported to the facility waste management committee

8.1.4 Recommendation 4: Appropriate Storage Facilities

Storage areas for healthcare waste should be designated within the healthcare facility. Storage facilities should be labeled in accordance with the hazard level of the stored waste and should be designed to prevent the risk of infection risk and environmental harm. Spill Kits for healthcare waste should also be located in the storage areas.

It was evident from the hospitals visited in Vanuatu that public access is generally unrestricted and feral animals and vermin such as dogs and rats are common therefore it is important that waste storage is kept in a manner that restricts access to such beings.

The storage areas are fenced, lockable, paved and suitably designed and isolated from patients, public and animals (as described in **Appendix E**).

8.1.4.1 Short Term (0 – 6 months)

- Procure contractors to design and develop a healthcare waste storage facility at the Port Vila Central Hospital and Lenakel Hospital.
- Procure contractors to design and develop an upgrade to the waste storage facility at Northern Districts Hospital.
- Upgrade central storage areas to meet minimum standards outlined in **Appendix C** to eliminate the risk of ongoing public risk and environmental harm.

8.1.4.2 Medium Term (6 months – 1 year)

- Procure spill kits for each central storage area.

8.1.4.3 Long Term (1 year – 3 years)

- Implement an ongoing healthcare waste facilities audit program to monitor the condition of central storage areas
- Port Vila Hospital and Northern Districts - Procurement of a new incinerator and/or new incinerator location (high priority).
- Northern Districts Hospital - Procurement of a new incinerator or existing incinerator to replace missing transformer (high priority).
- Lenakel Hospital - Procurement contractor for incinerator and upgrade/maintenance at Lenakel Hospital which includes increasing the stack height and building an enclosure (medium priority).
- Norsup hospitals - Procurement contractor for incinerator and upgrade/maintenance at Norsup Hospital which includes increasing the stack height and building an enclosure (low priority).

8.1.5 Recommendation 5: Improved Treatment Infrastructure ^{U2H}

Wastes should be treated and disposed of accordingly to ensure the infectious hazard is destroyed. All five healthcare facilities in Vanuatu require some investment in either replacement or maintenance of infrastructure:

Port Vila Hospital - Procurement of a new incinerator.

Northern Districts Hospital - Procurement of a new incinerator.

Procurement contractor for incinerator and upgrade/maintenance at **Lenakel Hospital** and **Norsup Hospital** which includes increasing the stack height and building an enclosure.

8.1.5.1 Short Term (0 – 6 months)

- Feasibility study into the following two options for healthcare waste treatment at the Port Vila Central Hospital:
 - Procure a new incinerator and construct an enclosure at the Bouffa landfill. Discussions with the Port Vila local landfill (Bouffa landfill) about possible siting of an incineration with enclosure to be built on the landfill site as well as fencing. This incinerator has the potential to service other health clinics on Efate Island
 - Procure the option of a new fumeless incinerator for the Port Vila Central Hospital. Additionally refer to Autoclave with shredder option below.
- Procurement of incinerator at the Northern Districts Hospital.
- Procurement contractor for incinerator and upgrade/maintenance at Lenakel Hospital and Norsup hospitals which includes increasing the stack height and building an enclosure.

8.1.5.2 Medium Term (6 months – 1 year)

- Installation of incinerators for Port Vila Hospital / Bouffa landfill and Northern Districts Hospital including enclosure.
- Ongoing assessment of incinerator function, implemented through a long-term incineration systems assessment program.

8.1.5.3 Long Term (1 year – 3 years)

- Upgrade/maintenance work performed at the Lenakel Hospital and Norsup hospitals.
- Ongoing incineration system maintenance support, promotion of non-incineration/smokeless incinerator upgrades to prevent exposure to dioxins and furans.
- Procure woodfired incinerator for Panunagis Health Centre.

8.1.6 Recommendation 5: Procurement of Consumables (PPE)

All waste handlers are provided with and use appropriate PPE including overalls/protective clothing, gloves and eye protection. Incinerator staff are provided with additional PPE such as face masks and noise protection.

8.1.6.1 Short Term (0-6 months)

- Procurement of in-hospital healthcare waste management PPE including overalls/protective clothing, gloves and eye protection
- Incinerator staff are provided with additional PPE such as face masks and noise protection
- Procurement plan developed to ensure the sustainable supply of healthcare waste management resources.

8.1.6.2 Medium Term (6 months-1 year)

- A system is set up to monitor correct use of PPE.

8.1.6.3 Long Term (1-3 years)

Nil.