Tuvalu

National Implementation Plan for Persistent Organic Pollutants

December 2019

Foreword

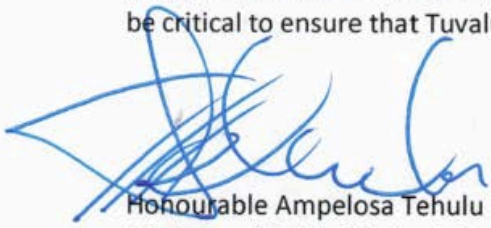
Tuvalu's accession to the Stockholm Convention on Persistent Organic Pollutants (the Stockholm Convention) on 19th January 2004 reflects the nation's global commitment towards the protection of human health and the environment from the adverse effects of persistent organic pollutants (POPs). As a Party, Tuvalu is required to take appropriate measures to reduce and eliminate releases of POPs chemicals to the environment.

The National Implementation Plan (NIP) on management of POPs fulfils, in part, Tuvalu's commitment to the Stockholm Convention and provides a framework for the future management of POPs (and other) chemicals in Tuvalu. This NIP updates the first NIP developed in 2008, taking into consideration new POPs chemicals listed under the Stockholm Convention up to 2017 and has been developed based on guidance documents provided by the Stockholm Convention Secretariat.

The success in revision of the NIP document could not have been realised without the cooperation and support of all stakeholders including government agencies and utilities. We express our gratitude to the Secretariat of the Pacific Regional Environment Programme (SPREP), the United Nations Environment Programme (UNEP) and the Global Environment Facility (GEF) for the support and assistance provided towards the review and development of this document. A special word of appreciation is due to Mr Faoliu Teakau (Tuvalu Environment Department) and International Consultants Dr David Haynes and Mr Glenn Cant for undertaking and drafting the revised National Implementation Plan on behalf of the Government of Tuvalu.

We consider the National Implementation Plan as a living document that will be updated on a regular basis to accommodate changes to relevant national policies and strategies, taking into consideration any new POPs chemicals added to the Stockholm Convention in the future. The experience and lessons learnt in this process will be critical in future reviews of the National Implementation Plan.

In conclusion, I wish to record my appreciation of the lead role played by Tuvalu's Department of Environment, Department of Waste Management and other key stakeholders in revising the NIP. The Government of Tuvalu is committed to ensuring a safe and healthy environment for its citizens, and the endorsement of the NIP by my Ministry clearly paves a way forward for improved chemical and waste management in the country. The identification of the need for the Government to seek further funding and technical support to implement the NIP will be critical to ensure that Tuvalu meets its obligations as a Party to the Stockholm Convention.



Honourable Ampelosa Tehulu
Minister of Public Works, Infrastructure, Environment, Labour, Meteorology & Disaster
20/10/2020

Executive Summary

The Tuvalu National Implementation Plan (NIP) facilitates fulfilment of Article 7 of the Stockholm Convention on Persistent Organic Pollutants (Stockholm Convention), which the country acceded[1] to on 19th January 2004. It contains available data and information about Persistent Organic Pollutants (POPs), including other organochlorine substances of interest that are (or may be) present in Tuvalu. It draws on available data and field surveys, workshops and information that was gathered during the review and revision of the first NIP under the direction of the Tuvalu Department of Environment (DoE).

The NIP has been developed in accordance with the guidelines of the United Nations Environment Programme (UNEP),[2] with an emphasis on provision of background information regarding POPs in Tuvalu to set the context for management of these pollutants into the future.

The NIP highlights that none of the eight originally listed POPs pesticides (aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, hexachlorobenzene (HCB), mirex, and toxaphene) are present in Tuvalu. The presence of the seven POPs pesticides listed after 2004 (alpha-hexachlorocyclohexane (alpha-HCH), beta-hexachlorocyclohexane (beta-HCH, chlordecone, lindane, pentachlorobenzene (PeCB), pentachlorophenol, and endosulfan) is unknown, but the pollutants are unlikely to be present. However, low concentrations of several POPs residues (including chlordane, endrin, dieldrin, HCB, and HCH) have been detected in national air and/or breast milk samples collected under the Global Monitoring Plan (GMP). Continued participation in the GMP will assist in the future monitoring of the presence of, and assessment of the potential impact of, these chemicals in Tuvalu. A number of non-POPs insecticides are imported for use in quarantine operations and for use in two market gardens.

Tuvalu does not have a chemical production industry and as such, does not produce any of the POPs listed in Annex A, Part 1. Tuvalu has no intention to deliberately import any of these POPs chemicals into the country for use, and there is enough generic legislation in place (Pesticide Act; Customs Revenue and Border Protection Act 2014) that would control or prohibit the deliberate importation of these chemicals into the country into the future.

The pesticide DDT has previously been used for malaria control in Tuvalu, but is not currently used, or known to be present. It has been detected in GMP air and breast milk samples collected in Tuvalu in 2010-2011, and its presence should continue to be routinely monitored for under the GMP.

Transformer oils suspected to be contaminated with polychlorinated biphenyls (PCBs) were tested in 2003, and contaminated oils were disposed of offshore. A contemporary inventory of PCB-containing oil and equipment is required to assess remaining potentially PCB-

[1] 'Accession' is an act by which a State signifies its agreement to be legally bound by the terms of a treaty. It has the same legal effect as ratification, but is not preceded by an act of signature

[2] UNEP (2017). *Guidance for Developing a National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants*. UNITAR. 71 pp

contaminated oil in decommissioned transformers, along with a work-based education and awareness programme for power sector employees. The tests to detect PCBs in transformers would also detect Hexachlorobutadiene (HCBD), and therefore measures to address PCBs in Tuvalu will also be effective for HCBD management. The GMP has detected low concentrations of PCBs in air and breast milk samples collected in Tuvalu. Continued participation in the GMP will assist in the future monitoring of the presence and assessment of the potential impact of these chemicals in Tuvalu.

No direct information is available on the presence or use of polybrominated diphenyl ethers (POP-PBDEs) and hexabromocyclododecane (HBCD) in Tuvalu. However, it is highly likely that POP-PBDEs and HBCD have entered the country in manufactured articles. These POP-PBDEs may be present in plastic components of common household and office goods, such as computers and electrical appliances, and in furniture fabrics and textiles, and in foamed plastics and rubbers used in furniture, mattresses, carpet underlays, car seats, and HBCD in foamed building insulation. Improved solid waste and e-waste management will minimise the risk to Tuvalu from these chemicals into the future.

Due to the similarity in use between hexabromo-biphenyl (HBB) and POP-PBDEs, any minor amount of HBB that may be present in Tuvalu will be addressed through national POP-PBDE management measures.

The presence of short-chain chlorinated paraffins (SCCPs) in Tuvalu is currently unknown. However, improved national management of e-waste and national participation in the GMP will also assist in the management of these chemicals into the future.

In most worldwide applications, polycholorinated naphthalenes (PCNs) have not been produced or used for over 30 years and it can be assumed that most PCN-containing products with short lifetimes (e.g. textiles, papers, lubricants, cutting oils and grease) have already been disposed of and will not be present in Tuvalu. PCNs are also unintentionally formed and released together with dioxins and furans in thermal processes. Unintentionally produced PCNs are not separately addressed in this NIP as PCN emissions will be reduced by the same measures applied to reduce dioxins and furans.

Perfluorooctane sulfonic acid (PFOS) and PFOS precursors are not present in aviation fire-fighting foams used at the Tuvalu international airport, although areas at the airport that have been used in fire suppression training exercises are potentially contaminated with fluorinated surfactants, and these will need to be managed as contaminated sites as a national priority.

Management of HCB, HCBD, PeCB, PCDDs, PCDFs, PCBs and PCNs will be managed through a national management programme for unintentionally produced POPs (uPOPs) including a national community education and awareness programme. UPOPs emissions from Tuvalu are very low by world standards. The most significant national uPOPs management priorities include minimisation of landfill fires and reductions in national tobacco smoking rates.

Tuvalu has enough generic legislation that would control or prohibit the deliberate importation of chemicals listed in the Stockholm Convention. The updated NIP presents an opportunity for Tuvalu to address its entire chemical management framework to cater for current and future challenges, including implementation of capacity building to improve management of POPs chemicals.

The NIP also presents a range of pragmatic actions that Tuvalu should pursue in the course of implementing the NIP. These include improved regulatory measures, infrastructure development, and improved waste management practices, as well as technical and scientific improvements including ongoing monitoring of POPs and pesticides to enhance the country's capacity to manage POPs challenges into the future. The integration of a national chemical management framework as a sustainable development goal for the country would help improve the national management of organochlorine and other pesticides and chemicals to prevent impacts to its peoples and local environments. Key national actions and priorities for future management of chemicals listed under the Stockholm Convention are summarised in Table 1.

Table 1: Tuvalu NIPs POPs management priority summary (green = initial POPs, orange = new POPs)

Chemical	Use	Annex	National Presence	Action required	Action Plan number
Aldrin	Pesticide	A	Unlikely to be present	Monitor (GMP)	AP11
Chlordane	Pesticide	A	Past use in Tuvalu	Monitor (GMP)*	AP11
Dieldrin	Pesticide	A	Past use in Tuvalu	Monitor (GMP)*	AP11
Endrin	Pesticide	A	Unlikely to be present	Monitor (GMP)*	AP11
Heptachlor	Pesticide	A	Unlikely to be present	Monitor (GMP)	AP11
Hexachlorobenzene (HCB)	Pesticide	A & C	Past use in Tuvalu	uPOPs management Monitor (GMP)*	AP4 AP8 AP11
Mirex	Pesticide	A	Unlikely to be present	Monitor (GMP)	AP11
Toxaphene	Pesticide	A	Unlikely to be present	Monitor (GMP)	AP11
Chlordecone	Pesticide	A	Not Present	Not required	
Alpha Hexachloro-cyclohexane (alpha -HCH)	Pesticide	A	Unlikely to be present	Monitor (GMP)	AP11
Beta Hexachloro-cyclohexane (beta-HCH)	Pesticide	A	Unlikely to be present	Monitor (GMP)*	AP11
Lindane (gamma-HCH)	Pesticide	A	Unlikely to be present	Monitor (GMP)*	AP11
Pentachlorophenol (PCP) and its salts and esters	Pesticide	A	Unlikely to be present	Not required	
Technical Endosulfan and its related isomers	Pesticide	A	Unlikely to be present	Monitor (GMP)	AP11
DDT	Pesticide	B	Past use in Tuvalu	Monitor (GMP)*	AP7 A11
Perfluorooctane sulfonic acid (PFOS), its salts and Perfluorooctane sulfonyl fluoride (PFOS-F)	Industrial chemical	B	Unlikely to be present	Improved waste management	AP6 AP9
Polychlorinated biphenyls (PCBs)	Industrial chemical	A & C	Potentially present	PCB management uPOPs management Monitor (GMP)*	AP4 AP9 AP11
Decabromodiphenyl ether (commercial mixture, c-decaBDE)	Industrial chemical	A	Unknown	Improved waste and e-waste management	AP5 AP11

Chemical	Use	Annex	National Presence	Action required	Action Plan number
Hexabromobiphenyl (HBB)	Industrial chemical	A	Unlikely to be present	Not required	
Hexabromocyclododecane (HBCD)	Industrial chemical	A	Unknown	Improved waste and e-waste management Monitor (GMP)*	AP5 AP11
Hexabromodiphenyl ether (hexaBDE) and Heptabromo-diphenyl ether (heptaBDE)	Industrial chemical	A	Unknown	Improved waste and e-waste management	AP5 AP11
Short Chain Chlorinated Paraffins (SCCPs)	Industrial chemical	A	Unlikely to be present	Not required	
Tetrabromodiphenyl ether (tetraBDE) and Pentabromo-diphenyl ether (pentaBDE) (commercial pentabromo-diphenyl ether)	Industrial chemical	A	Unknown	Improved waste and e-waste management	AP5
Hexachlorobutadiene	Industrial chemical	A & C	Unintentionally produced	uPOPs management	AP8 AP11
Polychlorinated naphthalenes (PCN)	Industrial chemical	A & C	Unintentionally produced	uPOPs management and Improved waste management	AP8 AP11
Pentachlorobenzene (PeCB)	Pesticide and Industrial chemical	A & C	Unintentionally produced	uPOPs management	AP8 AP11
Polychlorinated dibenzo-p-dioxins (PCDDs)	By products	C	Unintentionally produced	uPOPs management Monitor (GMP)*	AP8 AP11
Polychlorinated dibenzofurans (PCDFs)	By products	C	Unintentionally produced	uPOPs management Monitor (GMP)*	AP8 AP11

*Detectable in air and/or human breast milk samples collected in Tuvalu under the GMP (2010-2011)

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Abbreviations

ADB	Asian Development Bank
ADF	Advanced Disposal Fee
AFFF	Aqueous Film-Forming Foam
AP	Action Plan
ASL	Above Sea Level
BAT	Best Available Techniques
BEP	Best Environmental Practices
BFR	Brominated Flame Retardants
BHC	Benzenehexachloride
BWPT	British Western Pacific Territories
CA	Conservation Area
c-OctaBDE	Commercial octabromodiphenyl ether
c-PentaBDE	Commercial pentabromodiphenyl ether
COP	Conference of Parties
DDT	Dichlorodiphenyltrichloroethane
DoA	Department of Agriculture
DoE	Department of Environment
EDF	European Development Fund
EEE	Electrical and Electronic Equipment
EEZ	Exclusive Economic Zone
EIA	Environment Impact Assessment
ENSO	El Niño–Southern Oscillation
EOL	End of Life (Motor Vehicles)
EPS	Expandable Polystyrene
EU	European Union
e-waste	Electronic and Electrical Waste
FADs	Fish Aggregating Devices
FAO	Food and Agriculture Organisation
FMCA	Funafuti Marine Conservation Area
GDP	Gross Domestic Product
GEF	Global Environment Facility
GEF-PAS	Global Environment Facility Pacific Alliance for Sustainability
GMP	Global Monitoring Plan
HBB	Hexabromobiphenyl
HBCD	Hexabromocyclododecane
HCB	Hexachlorobenzene
HCBD	Hexachlorobutadiene
HCHs	Hexachlorocyclohexane
Hexa BDE	Hexabromodiphenyl ether
Hepta BDE	Heptabromodiphenyl ether
HIPS	High Impact Polystyrene
IBC	Intermediate Bulk Carrier
ICAA	International Civil Aviation Authority
IMO	International Maritime Organization
LABs	Lead Acid Battery
LDC	Least Developed Country
MARPOL	Convention for the Prevention of Pollution from Ships
MEPC	Marine Environment Protection Committee
MW	Megawatt
MSL	Mean Sea Level
NGO	Non Government Organisation
NIP	National Implementation Plan
NSDP	National Sustainability Development Plan
ODS	Ozone Depleting Substance

PBDEs	Polybrominated diphenyl ethers
PCBs	Polychlorinated biphenyls
PCDDs	Polychlorinated dibenzo-p-dioxins
PCDFs	Polychlorinated dibenzofurans
PCN	Polychlorinated naphthalenes
PCP	Pentachlorophenol
PeCB	Pentachlorobenzene
pentaBDE	Pentabromo-diphenyl ether
PESW	Pacific Energy South West Ltd
PET	Polyethylene terephthalate
PFOS	Perflurooctane sulfonic acid
PFOSF	Perfluorooctane sulfonyl fluoride
PIC	Pacific Island Country
POPs	Persistent Organic Pollutants
POP-PBDEs	POPs- Polybrominated diphenyl ethers
PESW	Pacific Energy South West Pacific Ltd
SCCP	Short Chain Chlorinated Paraffins
SPC	Secretariat of the Pacific Community
SPREP	Secretariat of the Pacific Regional Environment Programme
SWAT	Solid Waste Agency of Tuvalu
SWMS	Solid Waste Management Strategy
TBDEs	Tetrabromodiphenyl ether
TEC	Tuvalu Electricity Corporation
tetra BDE	Tetrabromo-diphenyl ether
uLABs	Used Lead Acid Battery
UNEP	United Nations Environment Programme
uPOPs	Unintentionally Produced Persistent Organic Pollutants
WEEE	Waste Electronic and Electrical Equipment
WHO	World Health Organisation
XPS	Extruded Polystyrene

1. Introduction

The Stockholm Convention on Persistent Organic Pollutants (the Stockholm Convention) is an international treaty that requires Parties to phase-out and eliminate the production and use of the most persistent and toxic chemicals that have adverse impacts on human health and the environment. The Stockholm Convention was adopted on 22nd May 2001 and entered into force on 17th May 2004. On entry into force, the Stockholm Convention identified a list of 12 priority Persistent Organic Pollutants (POPs), which was subsequently expanded to include 28 chemicals through amendments adopted by the Conference of Parties (COP) in 2009, 2011, 2013, 2015 and 2017.

Tuvalu acceded[3] to the Stockholm Convention on 19th January 2004 and its obligations as a Party commenced when the Convention entered into force on 17th May 2004. As such, under Article 7 of the Stockholm Convention, Tuvalu is required to develop, endeavour to implement, and update as appropriate a National Implementation Plan (NIP), outlining how its obligations under the Convention will be met. Tuvalu developed its first NIP in 2008[4] to address management of the 12 initial POPs. This current NIP represents the first review and update to the initial NIP and it covers the 28 POPs chemicals listed under the Stockholm Convention to 2017. The NIP has been developed and structured in accordance with guidelines provided by the United National Environment Programme (UNEP)[5].

1.1 The 28 listed POPs

POPs chemicals are toxic, persist in the environment, bio-accumulate in the food chain, and have trans-boundary transportation capabilities, often ending up in locations and being bio-accumulated in human (and animal) populations that are removed from the source of generation. The 28 POPs chemicals managed under the Convention (Table 2) include pesticides, industrial chemicals and unintentionally produced POPs (uPOPs), which are listed under three Annexes as follows:

Annex A: these chemicals are mostly, but not exclusively, pesticides scheduled for elimination; Parties may register specific exemptions to continue the use of Annex A chemicals to allow for the time that may be needed to adapt and take necessary management measures required by the Convention.

Annex B: Parties must take measures to restrict the production and use of these chemicals; Parties may register specific exemptions or restrict use of Annex B chemicals to an 'acceptable purpose' listed under the Convention.

[3] 'Accession' is an act by which a State signifies its agreement to be legally bound by the terms of a particular treaty. It has the same legal effect as ratification, but is not preceded by an act of signature

[4] Government of Tuvalu (2008). *National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants*. 103pp

[5] UNEP (2017). *Guidance for Developing a National Implementation Plan for the Stockholm Convention on Persistent Organic Pollutants*. UNITAR. 71 pp.

Annex C: these chemicals are produced unintentionally due to incomplete combustion, and during the manufacture of pesticides and other chlorinated substances. They are emitted mostly as a by-product of the incineration of hospital waste, municipal waste, and hazardous waste, and from automobile emissions, and the combustion of biomass including coal and wood. Parties must take measures to reduce the unintentional release of chemicals listed in this Annex, with the goal of continuous minimisation and, where feasible, ultimate elimination.

Table 2: POPs chemicals listed in the Stockholm Convention up to COP 8 - 2017

Stockholm Convention Chemical (listed alphabetically)	Annex	Date listed	Pesticide	Industrial chemical	By product
Aldrin	A	May 2004	●		
Chlordane	A	May 2004	●		
Chlordecone	A	May 2009	●		
Decabromodiphenyl ether (commercial mixture, c-decaBDE	A	May 2017		●	
DDT	B	May 2004	●		
Dieldrin	A	May 2004	●		
Endrin	A	May 2004	●		
Heptachlor	A	May 2004	●		
Hexabromobiphenyl (HBB)	A	May 2009		●	
Hexabromocyclododecane (HBCD)	A	May 2013		●	
Hexabromodiphenyl ether and heptabromodiphenyl ether	A	May 2009		●	
Hexachlorobenzene (HCB)	A & C	May 2004	●	●	●
Hexachlorobutadiene (HCBD)	A	May 2015		●	
Alpha-hexachlorocyclohexane (α-HCH)	A	May 2009	●		
Beta-hexachlorocyclohexane (β-HCH)	A	May 2009	●		
Lindane (γ-HCH)	A	May 2009	●		
Mirex	A	May 2004	●		
Pentachlorobenzene (PeCB)	A & C	May 2009	●	●	●
Pentachlorophenol and its salts and esters (PCP)	A	May 2015	●		
Perfluorooctane sulfonic acids and salts and Perfluorooctane sulfonyl fluoride (PFOS)	B	May 2009	●	●	
Polychlorinated biphenyls (PCBs)	A & C	May 2004		●	●
Polychlorinated dibenzo-p-dioxins	C	May 2004			●
Polychlorinated di-benzofurans	C	May 2004			●
Polychlorinated naphthalenes	A & C	May 2015		●	●
Short-chain chlorinated paraffins	A	May 2017		●	
Technical endosulfan and its related isomers	A	May 2011	●		
Tetrabromodiphenyl ether and pentabroodiphenyl ether	A	May 2009		●	
Toxaphene	A	May 2004	●		

1.2 Stockholm Convention Obligations

In addition to the obligation to develop and implement a NIP, Tuvalu has several other obligations under the Stockholm Convention (Table 3). This NIP outlines the actions that Tuvalu will undertake to deliver on these obligations.

Table 3: Summary of Tuvalu's obligations as a Party to the Stockholm Convention

Stockholm Convention	Tuvalu's obligations
Article 3	Eliminate the importation, production, use, and export of chemicals listed in Annex A except where authorised under the Convention, and restrict the production and use of chemicals listed in Annex B
Article 5	Reduce or eliminate unintentional production and release of Annex C chemicals
Article 6	Reduce or eliminate releases from stockpiles and wastes containing chemicals listed in Annexes A, B and C, and identify products or articles in use and sites contaminated with these chemicals
Article 7	Develop, endeavour to implement, and update as appropriate, a National Implementation Plan (NIP) outlining how its obligations under the Convention will be met
Article 9	Establish mechanisms to exchange information on POPs between Parties and the Secretariat
Article 10	Promote awareness of POPs among policy and decision makers and educate the public on the dangers of POPs to their health and the environment
Article 11	Encourage and/or undertake appropriate research, development, monitoring and cooperation pertaining to persistent organic pollutants and, where relevant, to their alternatives and to candidate persistent organic pollutants
Article 15	Report periodically to the Conference of Parties Secretariat on the status and measures on POPs reduction undertaken nationally
Article 16	Participate in the Global Monitoring Plan on POPs for the national presence of chemicals listed in Annexes A, B and C, as well as their global and environmental transport

1.3 NIP development process

The Government of Tuvalu sought assistance to update the NIP from the Secretariat of the Pacific Regional Environment Programme (SPREP), who contracted an international consultant team to complete the NIP revision in late 2019. This NIP update was carried out in seven connected phases:

I. A desktop review of available information and data relevant to contemporary chemical management in Tuvalu;
II. A review of progress achieved by the Government of Tuvalu in completing actions identified in the original NIP for improved national management of chemicals listed under the Stockholm Convention;
III. In-country training of national stakeholders on the national requirements of the Stockholm Convention, on improved national management of chemicals and the minimisation of the release of uPOPs;
IV. In-country investigation of the status of management of Stockholm Convention (and other) chemicals;
V. In-country inventory of Stockholm Convention listed chemicals;
VI. Identification and costing of appropriate actions at the national level to implement the requirements of the Stockholm Convention at the national level; and
VII. Drafting of the updated NIP document.

1.4 Structure of the NIP

This NIP contains five chapters including this introductory chapter.

Chapter 2 of the NIP sets the country context by providing an overview of the social, economic, and environmental conditions of Tuvalu. Where relevant, the potential contribution of national activities to POPs releases and the potential impacts of POPs on national activities have been highlighted. Chapter 2 also summarises the national policy, regulatory and institutional environment within which POPs are managed. Chapter 2 of the NIP presents the findings of the national inventory on POPs, which was conducted as part of the NIP update process. Where necessary, inventory findings have been supplemented with additional desktop research and analysis to fill national data gaps.

Chapter 3 describes the gender dimensions relevant to successful NIP Implementation.

Chapter 4 presents a socio-economic assessment of management of Stockholm listed chemicals and describes the relative cost (and benefit) of implementing management of the chemicals under the NIP.

Chapter 5 contains the Strategy and Action Plan elements of the NIP. Each Action Plan is costed and identifies a lead implementing agency, who will be responsible for driving the national implementation of the corresponding activities.

2. Country Baseline

2.1 Country Profile

2.1.1 Geography[6,7]

Tuvalu is a volcanic archipelago, comprising nine islands scattered over a 676km long arc of the Pacific Ocean, approximately 1,100km north of Fiji and 250km south of Kiribati. The islands are widely spread over 1.2 million km^2 of the central Pacific Ocean between latitudes 5 and 11 degrees south and from 176 to 180 degrees east.

The islands that make up Tuvalu are Nanumea, Niutao and Nanumaga in the northern area; Nui, Vaitupu and Nukufetau in the central area; and Funafuti, Nukulaelae and Niulakita to the south (Figure 1). Although Tuvalu means eight, there are in fact 9 islands. The ninth, Niulakita, is a "colony" of Niutao and is administered from that island. Funafuti, the capital, is the most developed of the islands in terms of both infrastructure and population. It is the first port of entry and has the only airfield.

The combined land area of the Tuvalu island group is just 25.6km^2. This area is relatively evenly distributed across the nine atoll islands. Most of the atolls range in size from 2.4 to 4.9km^2. The smaller islands of Niulakita and Niutao. Fogafale (Funafuti), where over half of the country's population is concentrated, is on average less than 100 metres wide.[8]

All nine islands of Tuvalu are low coral formations seldom rising more than five metres above sea level. Six of the islands are low lying atolls made up of *motu* (islets) fringing the edges of lagoons, and made up of young, poorly developed, infertile, sandy or gravel coralline soils. Nanumaga, Niutao and Niulakita are raised limestone reef islands. The substrates and soils of Tuvalu are among the poorest in the world.[9] They include exposed limestone rock, beach or reef rock, sand and gravel, loamy sands, acid peat soils, swamp or hydromorphic organic soils or muds created in excavated taro-pits, and artificial soils. The natural soils are normally shallow, porous, alkaline, coarse-textured, and have carbonate mineralogy and high pH values of up to 8.2 to 8.9. Soils are usually deficient in most of the important nutrients needed for plant growth. In late 2015, the reclamation and infilling of extensive areas of borrow pits with dredged lagoon sediments was completed on both north and south Fogafale Islet, adding a significant area of mainly biogenic sand of foraminiferous origin along with varying proportions of calcareous algae, coral and shell remains to the atoll.

2.1.2 Climate[10]

Tuvalu experiences a hot, humid tropical maritime climate, with near constant temperatures throughout the year. The climate is characterized by a consistently uniform temperature which ranges from 25 to 32 degrees Celsius, with high humidity and heavy rainfall between November to March. Easterly trade winds prevail except during the wet season when winds

[6]Tonkin & Taylor. (2005). *Tuvalu Integrated Solid Waste Plan.* Government of Tuvalu.
[7]SPREP (2016). *Tuvalu Integrated Waste Policy and Action Plan 2017-2026*. 75pp.
[8]UNDP (2010). *Tuvalu National Biodiversity Strategy and Action Plan 2012-2016. 75pp.*
[9]Government of Tuvalu (2016). *Tuvalu National Biodiversity Strategy and Action Plan 5th Report.* 101pp.
[10]UNDP (2010). *Tuvalu National Biodiversity Strategy and Action Plan 2012-2016*. 75pp.

blow from the west or north. There are frequent thunderstorms during the wet season. There is a significant seasonal variability in precipitation with a May to October dry season and a November to April wet season. The average annual rainfall is 3,000 mm and can exceed 4,000 mm per annum at times, though Tuvalu often experiences droughts because of its location near the Pacific equatorial dry zone. Dry periods are more severe in the northern than the southern islands, notably in the months of August-October. Dry years in Tuvalu are associated with a positive Southern Oscillation Index (the cold phase of ENSO).

The tropical cyclone season is from November to April. Tuvalu is particularly vulnerable to cyclone-generated winds, storm surges and swells, as well as spring tides. The resulting flooding causes agricultural losses, particularly of taro crops and damage to buildings and roads. Tropical cyclones mainly develop in the Tuvalu area and move to higher latitudes with a few hitting the islands in the warm, rather than the cold phase of ENSO.[11] The south-most islands lie in the cyclone belt and the whole group often has strong wind warnings.

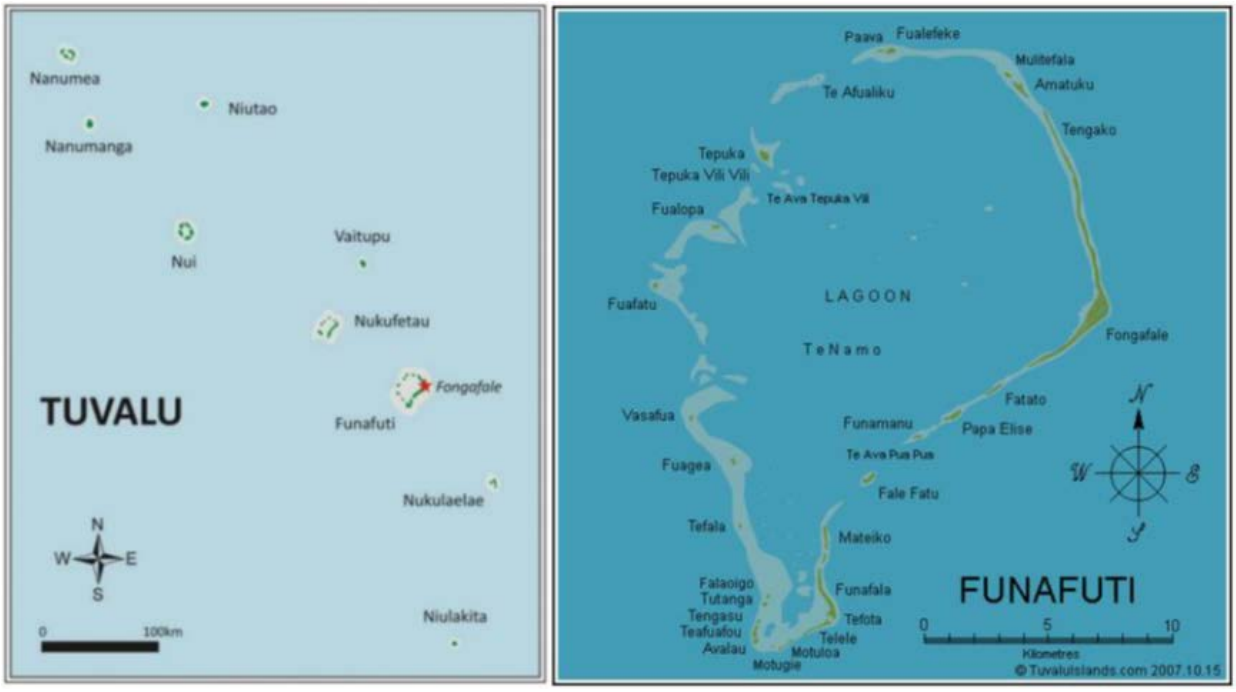

Figure 1. Map of the nation of Tuvalu

Since 1993, Tuvalu's sea level has been rising by approximately 5 mm per year.[12] As the average elevation in Tuvalu is one metre above mean sea level (MSL), with the highest elevation being less than 5 metres MSL, the islands are highly vulnerable to cyclones and tsunamis. Tuvalu is one of the most vulnerable countries in the world to climate change and rising sea levels. Projections for all emissions scenarios indicate that the annual average air

[11] Vavae, H, (2009). *The Changes to the Climate of Tuvalu*. Paper presented at the Pacific Climate Change Science Program Technical Workshop. Port Vila, Vanuatu, 12–16 October.
[12] Government of Tuvalu (2015). *Second National Communication of Tuvalu to the United Nations Framework Convention on Climate Change.* 68pp.

temperature and sea surface temperature will increase in the future in Tuvalu. The future climate of Tuvalu is predicted to have:[13]

- higher air and sea temperatures
- more extreme-rainfall days
- more very hot days
- less frequent, but more intense tropical cyclones
- continued rise in sea levels
- continued ocean acidification.

These impacts will likely affect the infrastructure, economy, community and environment of Tuvalu. Climate change for Tuvalu will have cross-cutting effects on marine, coastal, fresh water and agricultural resources, as well as on biodiversity and the economy. The effects of climate change may include:

- greater risk of disaster from extreme weather events
- increasing coastal erosion and loss of marine habitats
- declining fresh water and natural food resources
- increasing incidence of crop pests and diseases
- increasing incidence of human diseases and poverty
- increasing demand for energy.

2.1.3 Population and Culture

Tuvalu's most recent population estimate (2017) is approximately 10,507,[14] of which about 6,700 (63%) reside on Funafuti in 849 households. A typical household comprises relatives of an extended family, often with families accommodating relatives who have come to attend school or visit the main hospital or to find work.[15]

Tuvalu is dominantly Polynesian, and the island of Nui has strong cultural ties with Kiribati. The official languages spoken in Tuvalu are English and Tuvaluan. About 95% of the land in Tuvalu is indigenous customary land owned by individuals.

The reef islands and atolls of Tuvalu are identified as being part of West Polynesia. During pre-European-contact times there was frequent canoe voyaging between the islands and it is believed that the Polynesians emigrated from Samoa and Tonga into the Tuvaluan atolls, with Tuvalu providing a stepping stone for migration into the Polynesian outlier communities in Melanesia and Micronesia.[16] Tuvalu was first sighted by Europeans in 1568, during the voyage of *Álvaro de Mendaña* from Spain. Arent Schuyler de Peyster, captain of the armed brigantine *Rebecca*, passed through the southern Tuvaluan waters in May 1819; de Peyster sighted Nukufetau and Funafuti, which he named Ellice's Island after an English politician, Edward Ellice, and the owner of the *Rebecca's* cargo. Whalers subsequently visited Tuvalu infrequently because of the difficulties of landing on the atolls. Christianity was introduced to Tuvalu in 1861 and the islands came under Britain's sphere of influence in the late 19th century, when each of the Ellice Islands was declared a British protectorate in 1892.[17] The Ellice Islands were administered as a British Protectorate from 1892 to 1916, as part of the British Western Pacific

[13]https://www.pacificclimatechangescience.org/wp-content/uploads/2013/06/4_PCCSP_Tuvalu_8pp.pdf
[14]Government of Tuvalu (2015). *Tuvalu Population and Housing Min-Census 2017. Preliminary Report*. 17pp.
[15]Government of Tuvalu (2011). *Sustainable and Integrated Water and Sanitation Policy*. 34pp.
[16]Bellwood, Peter (1987). *The Polynesians – Prehistory of an Island People.* Thames and Hudson
[17]Kennedy, Donald G. (1929). Field Notes on the Culture of Vaitupu, Ellice Islands. *Journal of the Polynesian Society*. 38: 2–5.

Territories (BWPT), by a Resident Commissioner based in the Gilbert Islands. The administration of the BWTP ended in 1916, and the Gilbert and Ellice Islands Colony was established, which existed until 1976. During the Pacific War of World War Two, Funafuti was used as a base to prepare for the subsequent American seaborne liberation of the Gilbert Islands (Kiribati) that were occupied by Japanese forces. Tuvalu became fully independent within the Commonwealth on the 1st October, 1978.

2.1.4 Political System

2.1.4.1 Head of State

Tuvalu adopted a Constitutional monarchy with a parliamentary democracy when it became independent in 1978. Queen Elizabeth II of the United Kingdom is designated by Section 48 of the Constitution as Head of State, represented in Tuvalu by the Governor General who is appointed by and may be removed by the sovereign, acting with the advice of the Prime Minister. The Prime Minister is required to consult Parliament about any such appointment or removal. To be Governor General, a person must be a citizen of Tuvalu, be eligible to be elected a Member of Parliament, and be at least fifty years old. The Governor General has the power to summon, prorogue, and dissolve Parliament, on the advice of the Prime Minister. No bill becomes law until assented to be by the Governor General.

2.1.4.2 Executive

The Executive comprises the sovereign, represented by the Governor General, and the Cabinet, which is headed by a Prime Minister who is elected by the members of Parliament from among themselves. The Cabinet is collectively responsible to parliament for the performance of the executive authority of government. Part V of the Constitution establishes the Office of the Prime Minister and such number of other Ministers as determined by the Head of State on the advice of the Prime Minister.

2.1.4.3 Legislature

The Parliament of Tuvalu consists of a single chamber with 15 Members. A speaker, elected by Members of Parliament, presides at sittings. The normal life of Parliament is four years.

2.1.4.4 Judiciary

The Court system consists of the sovereign in council, Court of Appeal and the High Court, which are courts of general trial and appellate jurisdiction, and the Magistrates' Courts, Island Courts, and Land Courts, which are lower courts with limited jurisdictions.

2.1.4.5 Local Governance

The *Falekaupule* Act 1997 regulates the composition, operation, and functions of local governance. All eight islands are governed by a traditional council of elders (*Falekaupule*). The *Kaupule,* the executive arm of the *Falekaupule*, is made up of six elected members. A *Pule Kaupule* (head *Kaupule*) is elected by the *Falekaupule*. The *Kaupule* generally administer island affairs on behalf of the *Falekaupule* and have powers to levy rates for operating costs and capital developments. The *Falekaupule* is the law-making body with powers to make byelaws.

2.1.5 Economic Profile

Tuvalu is isolated and its economy is very much dependent on external economic factors including factors affecting the price of goods such as food items and oil. Its isolation, in combination with large distances from markets, affects prices of telecommunication and conducting business. Only about 35% of the population participates in the formal wage economy[18] and employment is almost exclusively within the public (government) sector. There is only limited tourism, with most visitors being consultants, officials of international and regional organizations and businesspeople.

Tuvalu's main sources of national income include regular drawdowns from the publicly owned Tuvalu Trust Fund. The Fund was established in 1987 by the Tuvalu Government to provide a safety net against fluctuations in government income. The earnings of the Tuvalu Trust Fund are used to help the government finance the gap between its annual budgeted revenue and expenditure. The Governments of Australia, New Zealand and the UK have made major contributions to the Tuvalu Trust Fund, with smaller grants coming from Japan and the Republic of Korea. The current value of the Trust Fund is A$179M.[19] Revenue from the Trust Fund has enabled the government to undertake development programs, including upgrading outer island schools and fisheries centres. Other income includes remittances from overseas workers, sale of *internet.tv* domain names and revenues from foreign vessels operating fishing activities. The value of personal remittances received in 2016 in Tuvalu was US$4,056,908.[20] Tuvalu's Exclusive Economic Zone (EEZ) covers an oceanic area of approximately 900,000km^2.

Tuvalu is classified as a "*Least Developed Country*" with a narrow economic base and lack of exploitable resources. The GDP growth rate was 4.3% in 2018 and is forecast to be 4.1% in 2019. [21] The nation's trade balance is consistently negative with imports substantially exceeding exports to cover its basic needs. Stamps are the only current export commodity. Tuvalu does not have any manufacturing, forestry or export fisheries industries, and does not export agricultural produce.[22]

From 2008 to 2015, the Asian Development Bank (ADB) provided a series of grants supporting sound macroeconomic and fiscal management, with improved public enterprise performance. These reforms have helped enhance Tuvalu's public procurement, private sector participation, long-term macroeconomic stability, and economic self-sufficiency. ADB, in collaboration with other development partners, is working toward a subsequent suite of reforms to sustain and build on these measures, with further policy-based programs planned.[23]

Transporting people and cargo between the islands of Tuvalu is critical. Nearly half of the country's small, dispersed population lives away from the capital on eight outer atoll islands. Without proper docking facilities, most of the outer islands can only be accessed by small workboats, which are dangerous for the sick, elderly, children, and people with disabilities. Funafuti hosts the country's only airport with flights running to Suva (Fiji) and back, and the only commercial port which links the eight islands. Commercial vessels also run every month or periodically to carry goods to and from Fiji. Tuvalu Telecommunications Corporation is the only telecommunication company operating in the country. Landline services are available on all islands and internet services are available on Funafuti and Vaitupu. In 2016, the ADB

[18]Government of Tuvalu (2015). *Tuvalu Population and Housing Min-Census 2017. Preliminary Report*. 17pp.
[19]https://tuvalutrustfund.tv/
[20]https://www.indexmundi.com/facts/tuvalu/indicator/BX.TRF.PWKR.CD.DT
[21]https://www.adb.org/countries/tuvalu/economy
[22]Government of Tuvalu (2016). *Department of Agriculture Sector Plan 2016 –2023*. 28pp.
[23]https://www.adb.org/sites/default/files/publication/27808/tuv-2018.pdf

approved the $13.3 million *Outer Island Maritime Infrastructure Project* to upgrade jetties on small islands to enable movement of people and goods more safely and efficiently between ship and shore.[24] This project will construct a small harbour in Nukulaelae atoll, and rehabilitate boat ramps in Nanumaga, Nui, and Niutao atolls. Additional grants of $15 million were approved in 2018 for the on-going project that will finance the construction of the harbour in Niutao to higher standards of climate resilience.[25]

2.1.6 Domestic Agriculture[26] and Fisheries

Most Tuvaluans no longer practice subsistence fishing, farming or harvest wild, mainly plant products.[27] This is especially true in Funafuti, although outer-island communities still rely to some extent on local produce including fish, shellfish and other sea foods, coconut, breadfruit, bananas, taro, pandanus, as well as pigs, chickens, as the main locally produced foods. Agricultural produce such as vegetables and livestock of pigs and poultry are limited to domestic use, but significant quantities must still be imported. Increased production and consumption of local products is a key objective of Tuvalu's National Strategy for Sustainable Development 2016-2020 (*Te Kakeega III*).[28]

In the past, the main staple food crops grown in Tuvalu included coconut, *pulaka* (giant taro), banana, breadfruit, taro, cassava, sweet potato, pawpaw and pumpkin. The agriculture sector (was) comprised of farmers with very small parcels of land, of between 0.25 and 1 hectare or less. Some of these farmers farmed in *pulaka* pits where banana, taro, sweet potato, pawpaw and cassava may be grown for household food supplies alongside the main crop, *pulaka.* Many *pulaka* pits were abandoned because of saltwater inundation due to sea level rise. The other main form of traditional farming is based on coconut trees. Anecdotal evidence and direct observation indicate that the number of farmers in Tuvalu has declined substantially, and that staple crop production has also declined significantly overall in recent years.

A significant past feature in Tuvalu was the presence of family-owned pits for the cultivation of taro and giant taro (*pulaka*). Growing *pulaka* in pits facilitates the plant's access to water. However, this practice has been largely discontinued, partially as a consequence of prolonged exposure of crops to seawater inundation and a resulting decline in production. To reduce such effects of climate change and the rising sea level, the United Nations Food and Agricultural Organisation (FAO) and the Tuvalu Government have included rehabilitation of the inundated pits in the Tuvalu National Agriculture Sector Plan 2016-2023.[29]

The Taiwan agricultural mission on Funafuti and Viatupu have maintained two vegetable market gardens since 2004, producing and selling supplies of fresh vegetables including tomatoes, capsicums, cabbages, cucumbers, spring onions, and egg plants. Vegetable seedlings are also sold to interested backyard gardeners in the Capital and agricultural advice is given when required. An agricultural extension officer from the Department of Agriculture (DoA) works as a counterpart to the Taiwan mission team leader and helps in training activities. The Taiwan agricultural mission also sends vegetable seeds to farmers and the *Kaupule* in the outer islands. The *Kaupule* in turn raise the seedlings in their demonstration plots and distribute them to interested growers. The two Taiwanese farms produce approximately

[24]https://www.adb.org/countries/tuvalu/overview
[25]https://m.marketscreener.com/news/ADB-Asian-Development-Bank-Approves-Additional-Support-for-Maritime-Infrastructure-in-Tuvalu--27259515/
[26]Government of Tuvalu (2016). *Department of Agriculture Sector Plan 2016 –2023*. 28pp.
[27]Government of Tuvalu (2016). *Tuvalu National Biodiversity Strategy and Action Plan 5th Report.* 101pp.
[28]Government of Tuvalu (2005). *National Strategy for Sustainable Development: 2005 – 2015.* 28pp.
[29]Government of Tuvalu (2016). *Department of Agriculture Sector Plan 2016 –2023*. 28pp.

500kg of produce per month at the Funafuti market garden (0.56ha) and the market garden at Vaitupu (0.8ha) respectively for Tuvaluan consumption. The farms also produce 500m^3 (270 tonnes) of compost annually (120 tonnes and 150 tonnes respectively) to produce these crops from green mulch bought from the Department of Waste Management (DWM).

There is no recent livestock population data available for Tuvalu. Local livestock farming comprises breeding and growing out of pigs, chickens and ducks using locally sourced feeds (mainly coconuts and kitchen scraps), sometimes supplemented by imported compound feeds, and breeding and fattening of pigs for meat and poultry for eggs. Most pigs in Funafuti are housed in privately owned pens located on the side of the airfield, although households further from the capital also house pigs on their properties. Human deaths from *Leptospirosis* in the Pacific have raised public awareness of the connections between sound waste management and rodent and disease vector control. Because pigs are one of many hosts to *Leptospirosis,* these deaths have raised concerns about the management of local piggeries and the wastes they generate.[30] Improved piggery management practices were introduced into Tuvalu between 2003 and 2007 with the assistance of Australian Government funding.

The FAO has also assisted the Tuvalu Government with the second phase of a successful project to develop community-based aquaculture systems and inshore fisheries management.[31] The first phase involved the procurement of materials for creating Fish Aggregating Devices (FADs), which were then built and deployed in inshore, as well as offshore areas. In cooperation with the Secretariat of the Pacific Community (SPC), training programmes covered FAD construction, fishing and milkfish farming. The current phase of the project includes establishment of a model community-based aquaculture farm in Vaitupu, and the model has been extended to the country's outer islands.

2.1.7 Environmental Conditions[32]

Environmental management in Tuvalu faces two key challenges: the numerous issues including waste management arising from the growing urbanisation of Funafuti; and the national impacts associated with climate change and sea level rise, specifically salt-water inundation of *pulaka* pits, coastal erosion and flooding, which are blamed either wholly or partly on global warming.[33] Waste management is also a significant environmental problem with direct implications for human and ecosystem health, especially in Funafuti.

The mains drivers of loss of Tuvalu's biodiversity and ecosystem services include:

1. climate change and sea-level rise;
2. impacts of extreme weather and tidal events, particularly tropical cyclones, storm waves and prolonged droughts;
3. coastal deforestation and beach erosion;
4. overexploitation of terrestrial plants and animals (overfishing);
5. invasive alien species and diseases and feral animals;
6. urban and village expansion, land clearance and land reclamation;
7. solid and liquid waste management and water pollution;
8. inadequate governance and legislation.

[30] Minshew, H. and M. Robotham (2007). Piggery Waste Management in American Samoa. United States Department of Agriculture. 10pp.
[31] http://www.fao.org/3/av270e/AV270E.pdf
[32] Government of Tuvalu (2016). *Tuvalu National Biodiversity Strategy and Action Plan 5th Report.* 101pp.
[33] Tuvalu Department of Environment (2015). *National Environment Management Strategy (2015-2020).* 26pp.

2.1.8 Biodiversity[34,35]

2.1.8.1 Flora

The indigenous terrestrial flora of Tuvalu is very poor, highly disturbed and now numerically dominated by introduced exotic species. This has been due to the selective removal of indigenous species and vegetation for expansion of settlements, construction, boatbuilding, firewood, medicine, tools and handicrafts and other purposes; and the deliberate and accidental introduction of a wide range of non-indigenous plants and some invasive weeds. This has been the result of a British colonial heritage, including over a century of planting monocultural coconut plantations; extensive habitat destruction, excavation and conversion of much of the best cultivable land from "borrow pits" to build airstrips during World War II; and rapid population growth, including the migration from outer atolls and the expansion of, the main settlement and government centre on Funafuti Atoll.[36] The resultant total number of terrestrial vascular plants reported present at some time in Tuvalu is about 362 species, of which only about 59 (16%) are possibly indigenous. The remaining 303 species (83% of the flora) are non-indigenous species that have been introduced by humans, some of which may have been, at one time or another, early aboriginal introductions by Pacific Islanders into Tuvalu. There are no endemic plant species that are unique to Tuvalu, with almost all the indigenous plants being widespread, easily dispersed pan-tropical or pan-Pacific coastal species that can survive in environments common on the atolls of the Pacific. The low number of indigenous species is an indication of the lack of habitat diversity on atolls compared with larger high islands, the difficulty of cross-ocean dispersal by plants, and the difficulty of long-term survival in the harsh atoll environment which is dominated by high salinity.

2.1.8.2 Fauna

The indigenous terrestrial vertebrate fauna of Tuvalu does not include any indigenous land mammals, amphibians or freshwater fish. There are terrestrial lizards, one of which is Tuvalu's only recorded endemic vertebrate, the Tuvalu forest gecko (*Lepidodactylus tepukapili)*, which is found on Tupuka Islet, Funafuti. Of importance are the 28 species of indigenous birds, approximately 20 of which are sea birds. Birds have also been hunted as an important traditional food source. Local terrestrial invertebrates include land or shore crabs, including the coconut crab. Tuvalu also has a range of land snails that are used to make shell leis and handicrafts, and two jumping spiders were reported as being present in Tuvalu in the late 1800s. A range of other essentially undocumented invertebrates also exist on the Tuvalu atolls.

The marine environment of Tuvalu is comprised of five main ecological zones including intertidal flats, subtidal lagoon areas, subtidal oceanside reefs and oceanic and open waters, and mangrove ecosystems. Within each of these often-overlapping zones are many combinations of habitat types, including algal flats, coral reefs, channels or reef passes, soft sandy and hard substrates or bottoms and seamounts, each with their own characteristic biological communities. All these zones are important fisheries with the intertidal flats being among the most important and increasingly vulnerable traditional fishery. Tuvalu's marine environment is the main local source of animal protein, products, such as shells, for handicraft production and revenue from licensing agreements with foreign nations fishing within Tuvalu's EEZ. Studies of Tuvalu's finfish resources, including sharks, rays and eels suggest that the total number of inshore fish and offshore species could be over 900 species, of which 500

[34]Government of Tuvalu (2016). *Tuvalu National Biodiversity Strategy and Action Plan 5th Report.* 101pp.
[35]Government of Tuvalu (2010). *Tuvalu National Biodiversity Strategy and Action Plan 2012-2016.* 75pp.
[36]Thaman, R. (2016). The flora of Tuvalu. *Atoll Research Bulletin* 611; xii-129

are recognized by Tuvaluan names. The marine invertebrate fauna includes a diversity of bivalve, gastropod and cephalopod molluscs, crustaceans, echinoderms, corals and other marine invertebrates. Almost of these species have been overfished or are in declining numbers. Tuvalu has established ten conservation areas (CA) on eight of its nine islands, only one of which has been established under formal legislation; the rest have been established by local communities and managed by traditional systems. The Funafuti Marine Conservation Area (FMCA) was established in 1996 and is managed by the *Kaupule*.

2.1.9 Water and Sanitation Management[37]

2.1.9.1 Water Management

In Tuvalu, the primary freshwater source is from household and communal rainwater storage. Tuvalu declared a state of emergency in September 2011 due to lack of fresh water supply, having recorded extremely low rainfalls in three consecutive years of drought. One large (100 m^3/day) and three small (10 m^3/day) desalination plants were subsequently funded in October 2011 and commissioned in September 2013.[38] The large desalination plant was installed on Funafuti, and the three small plants are mobile and can be shipped to the outer islands during times of extreme dry periods.

The overall available Tuvaluan ground water resources are largely unknown. The islands of Tuvalu are generally composed of very coarse coral gravels and sands. The coarse sediments cannot sustain substantial fresh groundwater lenses to the extent that exists in other atoll countries in the region. Hydrologic surveys during spring tides of groundwater quality in Fongafale Islet, Funafuti Atoll, indicate that there is no thick freshwater lens in Fongafale Islet, unlike other atoll islands of comparable size.[39] Instead, thin sheets of nearly fresh and brackish water were observed in the surficial aquifer in areas above the high-tide level and in taro swamps, respectively. Limited studies of the quality of water in Funafuti Lagoon have also been undertaken.[40,41,42] These studies suggest the lagoon is contaminated with human sewage effluent.

2.1.9.2 Wastewater and Sanitation

Almost all Tuvaluan households use either flush toilets linked to septic tanks or pour toilets linked to pit toilets. However, a study conducted by AusAID (2001) identified that 96% of septic tanks on the island were not suitably constructed. These poorly constructed septic tanks contributed largely to pollution of groundwater, lagoon and coastal areas. During ebb tides, domestic wastewater leaking from bottomless septic tanks and pit toilets runs off into the lagoonal coast, with tidal changes controlling the local pollution load of domestic wastewater,[43] causing significant water pollution near the densely populated area of Fongafale Islet on Funafuti Atoll.[44] Waterborne diseases are common and exact a significant

[37]SOPAC (2007). *National Integrated Water Resource Management Diagnostic Report Tuvalu*. 57pp.
[38]http://prdrse4all.spc.int/content/tuvalu-project-desalination-ro-system-and-solar-power-generation
[39]Nakada, S. *et al*. (2012). Groundwater dynamics of Fongafale Islet, Funafuti Atoll, Tuvalu. *Ground Water* 50, 639-44.
[40]Fujita, M., Suzuki, J., Sato, D., Kuwahara, Y., Yokoki, H., and H. Kayanne (2013). Anthropogenic impacts on water quality of the lagoonal coast of Fongafale Islet, Funafuti Atoll, Tuvalu. *Sustainability Science* 8, 381-390.
[41]Fujita, M., Ide, Y., Sato, D., Kench, P., Kuwahara, Y., Yokoki H., and H. Kayanne (2014). Heavy metal contamination of coastal lagoon sediments: Fongafale Islet, Funafuti Atoll, Tuvalu. *Chemosphere* 95, 628–634
[42]De Ramon N'Yeurt, A. and V. Iese (2015). The proliferating brown alga *Sargassum polycystum* in Tuvalu, South Pacific: assessment of the bloom and applications to local agriculture and sustainable energy. *Journal of Applied Phycology* 27, 2037-2045.
[43]Fujita *et al.* (2013). Anthropogenic impacts on water quality of the lagoonal coast of Fongafale Islet, Funafuti Atoll, Tuvalu. *Sustainability Science* 8: 381-390.
[44]Fujita *et al.* (2013). Anthropogenic impacts on water quality of the lagoonal coast of Fongafale Islet, Funafuti Atoll, Tuvalu. *Sustainability Science* 8: 381-390.

toll on the health, wellbeing and productivity of the population. Although wastewater and sanitation management in Tuvalu is left entirely in the hands of the individual households,[45] the Department of Public Works operates a septic tank pump-out service. Collected septic tank wastes are pumped directly into the ocean at the shoreline near the landfill. Between 50,000-100,000 litres (50-100m^3) of collected septic effluent is discharged annually to the ocean.

2.1.10 Waste Management[46]

2.1.10.1 Solid Waste Management

Waste management is a major environmental problem for Tuvalu, with direct implications for human and ecosystem health, especially in Funafuti. When waste is collected and disposed of properly, this helps reduce pollution of lagoon waters and slows the accumulation of waste that could lead to disease and other public health issues. Extensive past support has been provided by development partners to Tuvalu for waste management.[47] AusAID introduced municipal-scale waste management systems from 1999 to 2002 through the Tuvalu Waste Management Project, ADB provided technical assistance through the Tuvalu Effective Waste Management and Recycling Project, and subsequently, support was provided through the 8th to 10th cycles of the European Union's (EU's) European Development Fund.[48] Since then, the government's prioritisation of the waste sector has been a key driver for change. This is evident in the creation of the DWM (formerly the Solid Waste Agency of Tuvalu (SWAT)), which has an annual (donor) budget of around A$2M. The Department is mandated to oversee the management of wastes both in the main island of Funafuti and in the outer islands.

2.1.10.2 Household wastes

A 2014 study estimated that each household in Funafuti generates 23kg of wastes per week or an average of 0.37kg per person per day. A more recent waste composition survey conducted in 2017 found that the daily municipal waste generate rate was 0.42kg per person, comprising an estimated 60% organic, 15% nappies, 5% paper, and 7% plastics, with the remaining 13% comprising metals, glass, textiles and other materials.[49,50] This equates to approximately 1,030 tonnes of waste generated per year in Funafuti. A separate study conducted in the outer island of Nanumaga revealed a similar domestic waste generation rate of 0.33kg/person/day in 2010,[51] producing around 460 tonnes of waste per year on the outer islands. This equates to a total solid waste generation rate of about 1,500 tonnes per year for Tuvalu.

Household wastes are stored in 120 litre domestic waste bins. Households pay an annual waste collection fee (approximately A$80) which is incorporated into rate payments and are provided with waste collection services by the Funafuti *Kaupule. The Kaupule* operates two open-bed collection trucks and two tractor trailers to collect waste. All waste management workers receive training twice per year and are equipped with PPE.

Household wastes (including solid waste, E-waste, nappies, bulky wastes, and green wastes) are collected on Funafuti and taken to the transfer station or to the dumpsite manned by the

[45]Government of Tuvalu (2011). *Sustainable and Integrated Water and Sanitation Policy*. 34pp.
[46]https://www.adb.org/sites/default/files/publication/42659/solid-waste-management-tuvalu.pdf
[47]Tupulaga, Susan. (2014). *Report on Solid Waste Inventory for Fongafale*
[48]SPREP (2016). *Tuvalu Integrated Waste Policy and Action Plan 2017-2026*
[49]https://www.theprif.org/documents/tuvalu/waste-management/tuvalu-profile-solid-waste-and-recycling-sector
[50]Sagapolutele & Binney (2017). *Tuvalu Waste Information Baseline Report*. 109pp.
[51]Tupulaga, Susan and Wu, Yu-Chuan. (2010). *Solid Waste Survey Report Nanumaga Island*. Government of Tuvalu.

DWM. The *Kaupule* also collects wastes from schools, government buildings, churches and other institutions, and commercial establishments. They also collect non-quarantine ship wastes from foreign fishing vessels at the port. Waste collection services are monitored by the DWM, ensuring that most households and buildings are properly serviced.[52]

General, unsorted household waste is collected once per week and disposed of at the dumpsite. Nappies are collected separately three times per week and disposed in a designated area in the Funafuti dumpsite. Bulky waste and e-wastes are collected from households once per week and taken to the transfer station. Green wastes is collected separately twice per week and is shredded at the waste transfer station. A recent study estimated that 110m^3 of green waste was collected per month.[53] The estimated annual volume[54] of resultant mulched material is approximately 790 m^3 per year. This green waste is used by the Taiwanese Funafuti Market Garden to produce 120 tonnes of compost annually. A public education programme on waste separation and recycling is currently being undertaken across all islands in Tuvalu prior to the commencement (2020) of the collection of domestic wastes separated at the household level.

2.1.10.3 Used Lead Acid Batteries (uLABs)

The accumulation and disposal of used lead acid batteries (uLABs) was reported as a significant issue for Tuvalu in 2014 and 2017. As at October 2019, approximately 2,000 uLABs were stored in two 24ft shipping containers located at the transfer station awaiting export for recycling. ULABs must be shipped through Samoa to the Asia market as Tuvalu is not a signatory to the Basel Convention.

2.1.10.4 E-waste

E-waste is collected in Funafuti but is not dismantled following collection as part of a recycling programme. As at October 2019, two full 20ft shipping containers of collected E-waste were stored at the transfer station awaiting export.

2.1.10.5 Used Oil

Tuvalu imports around 30,000 litres of lubricants per year and exports 20,000 litres of used oil per year (i.e. 66% of import volumes) to Fiji's steel mill. Used oil that is not collected is used as a motorbike chain lubricant. There are currently issues around lack of insurance to cover used oil exports preventing its export to Fiji. A total of about 10,000 litres of used oil are currently (October 2019) stockpiled in IBCs on Funafuti. Each of the outer islands has an IBC for used oil collection and storage, although these IBCs containing used oil are unable to be transported back to Funafuti on the inter-island passenger boat.

2.1.10.6 Bulky Wastes

The DWM also collects bulky wastes and scrap metal. The bulky wastes and scrap metal are collected weekly, crushed at the landfill and are planned to be exported to Bangladesh when the price of scrap metal increases.

[52]SPREP (2016). *Tuvalu Integrated Waste Policy and Action Plan 2017-2026*
[53]Sagapolutele & Binney (2017). *Tuvalu Waste Information Baseline Report*. 109pp.
[54]Volume reduction through mulching (Green waste/0.6)

2.1.10.7 Asbestos

A survey of asbestos containing materials was undertaken in Funafuti in 2014 by SPREP.[55] The survey estimated that approximately 130–140 houses in Tuvalu have asbestos cladding or roofing. Asbestos containing materials were also detected in the *Sanus Service Station* and in the Meteorological Centre. The increased risk of cyclones impacting Tuvalu into the future warrants the urgent removal of this potentially dangerous material before it becomes a disaster waste. Government Officers report that significant quantities of asbestos containing building materials are contained in houses on the outer islands.[56] There is a national priority for the development of a national asbestos management strategy which includes drafting of relevant legislation, asbestos monitoring, as well as asbestos collection and export strategies and public awareness and worker training.

2.1.10.8 Healthcare wastes

Management of healthcare wastes is the responsibility of the Ministry of Health. The Princess Margaret Hospital is the only large hospital located in Tuvalu. It has 50 beds and provides primary healthcare, emergency care, surgery, ICU, radiography, inpatient, obstetric and maternity, outpatient services and allied health services. There are no private providers of healthcare services on Tuvalu. A clinic is also situated on each of the larger outer (7) islands as well on Funafuti.

A survey undertaken in 2014 under the EU/SPREP Pacific Hazardous Waste Programme (PacWaste) determined that 100 kg sharps and 100 kg healthcare waste from the hospital was generated per week and disposed of using low temperature wood-fired incineration at the Funafuti landfill site. [57] More recent surveys have supported these healthcare waste generation rates,[58] however, the hospital does not maintain waste generation records.

The seven outer islands clinics generate low quantities of healthcare waste (average of 30kg per week from each clinic),[59] which are disposed of by burning in low temperature wood fire incinerators. A high temperature healthcare waste incinerator supplied by INCINER8 Ltd, United Kingdom, was installed under PacWaste, but the installed incinerator has failed and is now inoperable. Staff reported that incinerator operator training was sub-standard, and that the incinerator was operated incorrectly, overloaded and the housing did not adequately protect it from the weather. Significant quantities of mixed healthcare waste are now (October 2019) stored around the incinerator, and the waste includes unsorted general waste as well as hazardous waste and uncontained sharps. The waste was reported to be transported to the landfill every 1-2 weeks for incineration in 44-gallon drums.

WHO conducted infection control training in 2019 and will provide more training in 2020, however other staff reported that they are not trained to handle medical waste, and that PPE are not available for waste management staff. There also appears to be a lack of infection control equipment (sharps bins and coded bags). The hospital has no protocols or equipment for the management of mercury wastes.

[55]SPREP (2014). Survey of the Regional Distribution and Status of Asbestos-Contaminated Construction Material and Best Practice Options for its Management in Pacific Island Countries. Report for the Republic of Tuvalu. 84 pp.
[56]Walter Kaua (2019). Pers comm
[57] ENVIRON Australia Pty Ltd (2014). *Baseline Study for the Pacific Hazardous Waste Management Project - Healthcare Waste Tuvalu.* 65pp
[58]Sagapolutele & Binney (2017). *Tuvalu Waste Information Baseline Report*. 109pp.
[59]Sagapolutele & Binney (2017). *Tuvalu Waste Information Baseline Report*. 109pp.

2.1.10.9 Marine Litter

It has been estimated that 0.5m^3 of marine litter per kilometre of Funafuti coastline is generated daily from local sources, largely a consequence of illegal dumping and littering along the coastline.[60] This equates to 6.5m^3 of "marine litter generation" daily for the entire island. Residents living along the shoreline and community groups collect shoreline wastes for disposal eight times per year with financial assistance from the DWM and the *Kaupule*.

2.1.10.10 Quarantine Wastes

No waste is collected from visiting aircrafts.[61] Quarantine waste is collected from the local island trading vessel travelling from Fiji four times per year and incinerated in a low temperature incinerator located at the main wharf area. Approximately 100kg of quarantine waste (largely agricultural products such as leaves from imported pineapples) are disposed of in this incinerator per year under the management of the Agriculture Department. Approximately 100kg sharps and 100kg healthcare waste from the Princess Margaret hospital are disposed of using low temperature wood fired incineration at the Funafuti landfill site.[62] An average of 210kg/week of healthcare waste is generated by the seven outer islands clinics and is disposed of locally by burning in low temperature wood fire incinerators.

2.1.10.11 Disaster Wastes

There is no system for disaster waste management in Tuvalu.

2.1.10.12 Waste Disposal

Until recently (2016), wastes were disposed of in the ocean, or in "borrow pits" around the island. Borrow pits were created in World War II when aggregate was excavated from the island to construct the airport runway. These pits on Funafuti were subsequently filled with solid wastes including plastics, aluminium cans and other metal wastes, old clothes, electronics, refrigerators, and freezers. The wastes created significant environmental and health hazards. The borrow pits were filled with dredged lagoon sand in 2016 by the New Zealand government and converted to mainly housing sites. The waste in the pits was not removed prior to infilling.[63]

Except for E-waste, green waste, used oil and LABs, collected wastes are transported to Funafuti's one official dumpsite for disposal. The main dump is a rehabilitated borrow pit, located on a strip of land 20 meters wide next to the main road, at the northern end of the island. The DWM is responsible for managing the island's dumpsite. A waste collection database is maintained by the DWM on total quantities of waste collected, but this does not include data about waste dropped off directly at the landfill or the Transfer Station by the public.

With assistance provided by the EU, the Funafuti dumpsite is being rehabilitated; and improved management practices are being introduced to extend the life of the disposal facility beyond 2025. Additional equipment, including an excavator and loader, was procured in 2013. As part of the rehabilitation plans, waste along the roadside were cleared and partially compacted, and shifted into the borrow pit. However, the rehabilitation of the dumpsite resulted in the landowners' reluctance to lease further portions of their land to expand the

[60]Sagapolutele & Binney (2017). *Tuvalu Waste Information Baseline Report*. 109pp.
[61]SPREP (2018). *Tuvalu National Action Plan to reduce releases of Unintentional Persistent Organic Pollutants 2018-2022. 39pp.*
[62]ENVIRON Australia Pty Ltd (2014). *Baseline Study for the Pacific Hazardous Waste Management Project - Healthcare Waste Tuvalu.* 65pp
[63]Faafatai Sagapolutele (2019) *Pers comm*.

dumpsite. Negotiations on leasing additional land are still ongoing, and if not successful, will cause problems in expanding the capacity of the current dumpsite or in relocating it to another suitable site. There is no feasible relocation site yet identified.

2.1.11 Waste Incineration

Quarantine and healthcare wastes are the only wastes that are deliberately incinerated in Tuvalu. Approximately 100 kg of quarantine waste (largely agricultural products such as leaves from imported pineapples) are disposed of per year in a low temperature incinerator located at the port area under the management of the Department of Agriculture. Approximately 100kg/week of sharps and 100kg/week of healthcare waste is incinerated using low temperature wood fired incineration at the Funafuti landfill site.[64]

2.1.12 Energy Supply[65]

Tuvalu has an energy supply goal to replace all diesel generation of electricity with renewable sources by 2025; and to increase energy use efficiency on Funafuti by 30%. These goals are directly linked to the nation's climate change policy and sustainable development plan.[66] To meet these goals, Tuvalu must develop around 6MW of renewable energy electricity generation capacity by 2025. To help meet this objective, electricity is being generated using renewable energy in all nine islands of Tuvalu. The system requires standby diesel generation to provide a back-up to the renewable energy supplies when prolonged weather conditions limit renewable energy generation. To date, approximately 75% of all outer island electricity production is from renewable sources (Table 4), as fuel transportation from Funafuti increases the cost of electricity generation and has environmental risks associated with potential fuel spills. Conversion or replacement of existing diesel generators to run on bio-diesel fuel is proposed to take place in the last stage of the renewable electricity conversion. It is estimated that 5% of the annual national electricity production will be eventually supplied from bio-diesel generation. Energy efficiency improvements will be initially targeted on Funafuti, which has a higher power demand *per capita* than the outer islands and consumes 95% of the electricity generated by the Tuvalu Electricity Corporation (TEC). The energy efficiency programme will include public education, energy audits and technology improvements. Currently Tuvalu is using around 1.8 million litres of diesel fuel per year to generate 6.3M kw of electricity (Funafuti: 5.9M kw pa; and the outer islands 0.34M kw pa) (Table 4).

Propane gas in refillable gas bottles is used extensively for household cooking in Tuvalu. An average of 74,200 litres pa of LPG was imported into Tuvalu between 2016-2018 for domestic cooking. Forty (40) biogas generators run on piggery waste were trialled to generate sustainable energy for cooking by 40 families living in Niulakita, Nukulaelae, Nukufetau, Vaitupu, Nui, Niutao and Funafuti.[67] If these were adopted widely into the future, it would also help the nation to reach its target of 100% energy generation from renewable sources by 2025 and reduce one of the major sources of pollution on the island. The biogas generators are also a valuable source of compost for home gardens. The programme has been criticised as often the biogas generators are not located near pig pens, creating difficulties in supplying effluent for the digester.

[64]ENVIRON Australia Pty Ltd (2014). *Baseline Study for the Pacific Hazardous Waste Management Project - Healthcare Waste Tuvalu.* 65pp

[65]Government of Tuvalu (2011). *Master Plan for Renewable Electricity and Energy Efficiency in Tuvalu*: *Enetise Tutumau 2012-2020*

[66]Government of Tuvalu (2005). *National Strategy for Sustainable Development 2005-2015*. 28pp

[67]https://www.spc.int/updates/news/2019/05/forty-biogas-digesters-installed-in-the-islands-of-tuvalu-bring-community

Table 4: Summary of Tuvalu's renewable energy supplies (June 2016)[68]

Location	No. of diesel generators previously used	Original diesel energy production (kW)	Renewable energy replacement (year connected)	% of supply from renewable sources
Nanumea	3	176	195kW PV mini-grid (2015)	90
Nanumaga	3	176	205kW PV mini-grid (2015)	90
Niutao	3	176	232kW PV mini-grid (2015)	90
Nui	3	176	60kW PV mini-grid (2015)	50
Vaitupu	3	208	410kW PV mini-grid (2015)	90
Nukufetau	3	176	77kW PV mini-grid (2015)	50
Funafuti	3	1800	756kW PV mini-grid (2015)	17
Nukulaelae	3	144	45kW PV mini-grid (2015)	50
Niulakita and Funafala			Stand-alone home system (2016)	100

PV = solar photovoltaic system

2.2 Institutional, Policy, and Regulatory Framework

2.2.1 Strategic framework

Tuvalu's environmental management framework is derived from several pieces of national legislation, policies, and strategies which are summarised in Table 5.

Table 5: Summary of Tuvalu's regulatory framework for national chemical, waste and pollution management[69]

Framework	Description of Framework	Responsible Ministry or Department
The Environment Protection Act (2008)	An overarching Act on maintaining the environment of Tuvalu.	Department of Environment
Waste Operations and Services Act (2009)	Defines specific roles and responsibilities for waste management in Tuvalu	Department of Waste Management
***Falekaupule* Act (1997)**	Allows the *Kaupule* to exercise their authority as designated waste management operators by making by-laws under the *Falekaupule* Act.	Ministry of Local Government and Agriculture
Marine Pollution Amendment Act (2017)	Makes provisions on environmental liability in relation to the prevention and remediation of environmental damage caused by oil, sewage, garbage and other pollutants	Marine Department
Pesticides Act (1990)	Controls the importation and use of pesticides	Department of Agriculture
Petroleum Act (1965)	Regulates the importation, storage and sale of petroleum	Ministry of Energy, Tourism and Transport

[68] https://www.usp.ac.fj/fileadmin/files/schools/ssed/economics/events/Pacific_Update_2016/Updated_Presentations/Plenary 5/Plenary5_Mafalu_Lotolua_Tuvalu_Elec_Corp_2016_Pac_Update.pdf
[69] SPREP (2018). *Tuvalu: review of natural resource and environment related legislation*. 17pp.

Framework	Description of Framework	Responsible Ministry or Department
Water Supply Act (1967)	Relates exclusively to matters of water supply	Ministry of Public Works and Environment
Public Health Act (1926)	Protection and advancement of public health	Ministry of Health
Customs Revenue and Border Protection Act (2014)	Control of arrival and departure of goods or persons and border protection in Tuvalu and prohibits the import of goods listed in Schedule 2. Empowers the Minister to make Regulations to prohibit the importation into Tuvalu of specified goods	Customs Department
National Strategy for Sustainable Development 2016 to 2020	The National Sustainable Development Strategy supports action on POPs management through improved management of solid waste, sewage, and liquid waste	Government of Tuvalu
National Environment Management Strategy (2015-2020)	Policy platform to support long-term planning and action on priority national environmental issues	Department of Environment
National Integrated Waste Policy and Action Plan (Waste Policy)	Allows for the development, implementation and strengthening of appropriate national waste strategies	Department of Waste Management
Energy Efficiency Act (2016)	To promote energy efficiency and energy conservation	Ministry of Energy, Tourism and Transport
Import Levy Fund Act (1997)	Establishes the Import Levy Fund, to subsidising the transport of goods to and from Tuvalu and to and from islands within Tuvalu	Department of Customs
Waste Management Act (2017)	An act to redefine the roles and responsibilities for waste management in Tuvalu and to make provision for all matters connected with the regulation and management of wastes and the provision of waste related services	Department of Waste Management
Waste Levy (Levy Deposit) Regulation (2019)	Identifies products to be levied on importation	Department of Waste Management
Single Use Plastic Legislation (2019)	Bans importation of identifies single use plastic products	Department of Waste Management

2.2.2 Existing legislation and regulations addressing POPs

2.2.2.1 The Environment Protection Act (2008)

This Act, administered by the Department of Environment, is the principal act concerning the protection and management of Tuvalu's environment. Some of the areas that the Act regulates are:

- the conduct of environment impact assessments;
- the regulation and control of pollution and wastes;
- all matters concerning the implementation of international environment related conventions;
- the protection of the biodiversity; and

- responses to climate change.

The Act has a wide range of objectives that include the following:

- coordination of the role of government in relation to environmental protection and sustainable development;
- facilitation of the compliance and implementation of obligations under any regional and international agreements or conventions;
- provision of a mechanism for the development of environmental policy and law;
- prevention, control, monitoring and response to pollution;
- reduction in the production of wastes, and at the same time, promotion of the environmentally sound management and disposal of all wastes; and
- facilitation of the assessment and regulation of environmental impacts of certain activities.

2.2.2.2 Waste Operations and Services Act (2009)

This Act outlines the roles and responsibilities for waste management in Tuvalu and provides for the collection and disposal of solid wastes and other waste-related operations and service in designated areas of Tuvalu. The Act defines specific categories of waste that need to be disposed of in defined ways, including bulk waste, hazardous waste and solid waste. Key provisions of the Act include:

- Section 4: Outlines the responsibilities for waste management. In particular, the Department of Environment is responsible for the management of waste and for the implementation of the obligations under international conventions relating to the management of hazardous wastes.
- Section 4: The regulatory control over waste dumps and waste disposal sites is to be exercised jointly by the Department of Environment, the Marine Department and the Ministry of Health depending on the type of waste, and by designated waste management operators. This function must be carried out in accordance with environmental impact assessment procedures.
- Section 7: Environmental standards relating to waste management practices and facilities may be prescribed by the Minister for Environment, and the Department of Environment is responsible for the monitoring and enforcement of the approved standards.
- Section 15: Identifies that the designated solid waste management operators are the relevant *Kaupule* for an area. The *Kaupules* may exercise their authority under this Act as designated waste management operators by making by-laws under the *Falekaupule Act*.
- The section also establishes a Solid Wastes Agency, where the need exists for additional technical and operational capacity for the proper disposal of wastes. The Agency is a designated waste management operator for the purposes of performing specific functions specified in section 16.
- Section 6: The Solid Wastes Agency shall have principal responsibility for formulating and implementing a National Wastes Strategy, and the implementation of programs and projects in support of the Strategy.

2.2.2.3 Falekaupule Act (1997)

The *Kaupule* is the local government unit in each island which is designated as the waste management operator in the waste service areas in their area of jurisdiction. The *Kaupule* may

make by-laws under the *Falekaupule* Act (1997) in relation to any matter and perform the function identified under section 15(2) of the Waste Operations and Services Act (2009).

2.2.2.4 Marine Pollution Amendment Act (2017)

The Marine Pollution Act is a comprehensive law dealing with marine pollution and the dumping and incineration of wastes at sea. The Act makes provisions on environmental liability in relation to the prevention and remediation of environmental damage caused by oil, sewage, garbage and other pollutants. The discharge or escape of pollution, voluntarily or caused by omission, is considered an offence to the country. Additionally, the Act includes important provisions on:

- reception facilities in port for disposal of oil and pollutant residues, garbage and sewage from those ships;
- dumping and incineration of waste; and
- marine casualties.

2.2.2.5 Pesticides Act (1990)

This Act controls the importation and use of pesticides. The Act provides that no person shall supply, sell, offer for sale or use any pesticide in Tuvalu which is not registered under the Act. Section 7 prohibits a person from importing any pesticide unless it is registered under the Act and he/she holds an import permit. The Act also establishes the Office of Registrar of Pesticides and a Pesticides Committee.

2.2.2.6 Petroleum Act (1965)

This Act was passed in 1965 and has been amended several times (1971, 1972, 1990 and 2009). It regulates the importation, storage and sale of petroleum. Thus, the law does not regulate the management of petroleum as a natural resource but sets some conditions that may relate to storage and similar procedures which may protect the environment. The *Petroleum (Control of Storage) Regulations* have been adopted under this Act.

2.2.2.7 Water Supply Act (1967)

The provisions of this Act relate exclusively to matters of water supply. No provision is made in relation to issues of water management, conservation or quality. The Minister appoints an "Authority", who has power to construct channels, feeders, catch-drains, reservoirs, aqueducts, pipes, filters, trenches, mounds, engines, works and machinery as are necessary for providing adequate supplies of water. Offences are prescribed in relation to the contamination of water in reserves. Section 9 prescribes several offences relating to polluting water, including the following activities if they affect the water supply:

- washing animals and clothes;
- casting dead animals and filth;
- bathing in water for human consumption;
- causing sewers or drains to run into water supplies; and
- any other thing which causes the water supply to be soiled, fouled, corrupted or injured.

2.2.2.8 Public Health Act (1926)

This Act grants the Minister the power to make regulations for the purpose of protecting and advancing public health in Tuvalu and defines offences for purposes of the Act. The matters that may be regulated by the Minister include:

- latrines, dustbins and drains;
- scavenging, cleaning and disinfecting;
- removal and disposal of nightsoil and house refuse;
- preventing the spread of infectious diseases;
- regulating the use of any rain, stream, well or water source and the prevention of water pollution;
- mosquitoes; and
- laundries.

2.2.2.9 Customs Revenue and Border Protect Act (2014)

This Act provides for the control of arrival and departure of goods or persons and border protection in Tuvalu. It also prohibits the import of goods listed in Schedule 2 and empowers the Minister to make Regulations to prohibit the importation into Tuvalu of specified goods.

2.2.2.10 Import Levy Fund Act (1997)

Subject to the provisions of the Act, an import levy is deemed to be an import custom duty imposed upon goods. Collected funds are then used to potentially subsidise the transport of goods to and from Tuvalu and to and from islands within Tuvalu.

2.2.2.11 Energy Efficiency Act (2016)

The purpose of this Act is to promote, in Tuvalu, energy efficiency, energy conservation and to give effects to certain obligations that Tuvalu has under the Climate Change Conventions and related conventions. Appliances regulated under the Act include refrigerator, air-conditioners and lights.

2.2.2.12 Import Levy Fund Act (1997)

This Act provides for the imposition of an import levy and the establishment of a special fund to receive moneys raised thereby to subsidise the transport of goods to, from and within Tuvalu.

2.2.2.13 Waste Management Act (2017)

This Act unifies waste and pollution management in Tuvalu. Under this Act, the responsibility for the regulation of wastes in Tuvalu is vested in the Department of Waste Management. The implementation of international conventions relating to the management of hazardous wastes is identified as the responsibility of the Department of Waste Management. Regulatory control over waste dumps and waste disposal sites can be exercised by: (a) designated waste management operators in accordance with their functions and powers provided for in this Act, and any other law relating to the management of wastes; and (b) the Department of Environment in accordance with environmental impact assessment procedures, and any other relevant provisions of the laws which relate to environment protection. (4) The regulation of waste disposal at sea by the dumping and incineration of wastes shall be the responsibility of the Department of Marine and Port Services under the Marine Pollution Act 1991 (as amended). Litter control measures are identified to be implemented and enforced in

accordance with regulations made under this Act, and the management of and regulatory control over medical wastes shall be the responsibility of the Ministry of Health.

2.2.2.14 Waste Management (Levy Deposit) Regulation 2019

This regulation introduces a levy deposit and refund scheme for 14 types of imported goods to support the recovery, processing, treatment and shipment of those goods at the end of their life and prescribes rules for collection and administration of the levy revenue generated. Under schedule 1 of the regulation, glass bottles, aluminium cans, and PET (polyethylene terephthalate) bottles containing certain beverages or oils are subject to a deposit amount of 10 cents per container; large appliances are subject to a deposit of TV$100 per item; small appliances to TV$30 per item; office and family vehicles to TV$300 per vehicle; motorbikes TV$200; small construction equipment TV$500; medium construction equipment TV$1,000; and heavy construction equipment TV$2,000.

Under the Regulation, importers must collect the levied items at the point of entry once the deposit has been paid, and the levy deposit must be attached to the selling price of the items. The regulation requires that levied products at the end of their life including aluminium, PET, glass computers, laptops, televisions, cars, motorbikes and solar panel batteries be properly packed and delivered for shipping for recycling. Partial refunds of the levy deposit are issued for most of the levied items returned to the Transfer Station for recycling.

2.2.2.15 Waste Management (Prohibition on the Importation of Single-Use Plastic) Regulation 2019

This Regulation introduces a ban, commencing 1st August 2019, on the importation of specific single-use plastic products including plastic bottles under 1.5 litres, plastic plates, cutlery and food wrap, plastic bags, straws, and cups.

2.2.2.16 National Strategy for Sustainable Development (*Te Kakeega III*)

Te Kakeega III National Strategy for Sustainable Development 2016 to 2020 (TKIII) is Tuvalu's national sustainable development strategy for the period 2016 to 2020. It envisions *a more protected, secure and prosperous Tuvalu; healthier people who are more engaged in national, regional and international forums; and a government fully committed to honouring Tuvalu's international commitments and respecting its partnerships*. To achieve this vision, 11 goals in 11 priority sectors are identified in TKIII. The TKIII framework supports action on POPs management through several strategies and activities (Table 6), which are primarily based around better management of solid waste, sewage, and liquid waste.

Table 6: Strategies and activities of Te Kakeega III

Goal	Milestone
Strategic Area 5: *Falekaupule* and Island Development	
Provide quality services and create more opportunities for development	• Adopt and ratify UN waste convention and implement its provisions, especially training • Conduct a survey to determine hazardous and medical waste • Waste survey to obtain data for planning • Study how to improve Funafuti dumpsite • Set up waste database • Study alternative ways to dispose of waste (e.g. waste to energy) • Feasibility study on a transfer and recycling station for Funafuti • External transfer and recycling station in outer islands • Implement Funafuti dumpsite study • Implement the Tuvalu Integrated Solid Waste Plan

Goal	Milestone
	• Write a National Waste Policy and seek Cabinet approval to guide future waste disposal
Strategic Area 9: Infrastructure and Support services	
Provide efficient, high quality infrastructure and support services	• Identify land for waste disposal in outer islands • Expand/improve waste disposal systems • Design a reticulated Funafuti sewerage system
Strategic Area 11: Migration and Urbanisation	
Mitigate the adverse impacts of internal migration and urbanisation and capitalise on opportunities offered by migration and urbanisation	• Improve solid and liquid waste collection/disposal • Strengthen environmental management controls on Funafuti to control/reduce liquid waste seepage from densely populated areas

2.2.2.17 National Environment Management Strategy 2015-2020

The National Environment Management Strategy 2015–2020 sets a policy platform to support long-term planning and action on priority national environmental issues. It identifies policy goals and strategies that fall under four thematic areas: Environmental Governance; Island Biodiversity Conservation and Management; Waste Management and Pollution Control; and Environment Awareness and Education. The strategies under the Waste Management and Pollution Control theme are all relevant to uPOPs management. The strategies are:

- Development of waste management policies, plans and legislation
- Effective and efficient enforcement of environment laws
- Upgrading of Tuvalu dumpsites
- Acquisition of garbage trucks and pollution control equipment
- Rehabilitation of borrow pits
- Formal and informal education on waste management and pollution control
- Community programmes on waste minimisation, composting and 3Rs
- Radio programmes and TV footage documentary on waste management and pollution control
- Train-the-trainers programme for waste management and pollution control practitioners
- Identification of investment opportunities from bilateral, multilateral, and international agencies for waste management and pollution control.

2.2.2.18 National Integrated Waste Policy and Action Plan (2017-2026)[70]

The Tuvalu National Integrated Waste Policy and Action Plan (Waste Policy; 2017-2026) sets a vision for "*a cleaner and healthier Tuvalu for today and the future generation".* This vision is underpinned by a mission "*to develop implement and strengthen appropriate waste strategies through concerted efforts of the Government, stakeholders and communities in order to improve the environment and the health of the people of Tuvalu*". The Waste Policy recognises that practices which contribute to uPOPs releases such as burning of green waste, and improper disposal of hazardous and liquid wastes still occur. As the Waste Policy is centred on improving the management of wastes in Tuvalu, it contains many activities which have a direct or indirect link to improving POPs management.

[70]Government of Tuvalu (2016). *Tuvalu Integrated Waste Policy and Action Plan: TOWARDS CLEANER AND HEALTHIER ISLANDS 2017 – 2026*. 75pp

2.2.3 Multilateral Environmental Agreements

Tuvalu's status in relation to key multilateral environmental agreements pertaining to the management of wastes, chemicals and hazardous substances is presented in Table 7. In becoming a Party to some of these agreements, the government has been able to demonstrate its commitment to addressing several environmental concerns.

Table 7: Tuvalu's status in relevant conventions on wastes, chemicals, and hazardous substances

Convention	Description of Convention	Tuvalu status
Stockholm Convention on POPs	Aims to protect human health and environment from the adverse effects of POPs that, when released, persist in the environment and can lead to adverse human health and ecological impacts	Party
Basel Convention on Control of Transboundary Movements of Hazardous Wastes and Their Disposal	Aims to reduce the movements of hazardous waste between nations, and specifically to prevent transfer of hazardous waste from developed to less developed countries	Not a Party
Waigani Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement of Hazardous Wastes within the South Pacific Region	The Waigani Convention Constitutes the regional implementation of the Basel Convention in the Pacific. However, unlike the Basel Convention, coverage extends to radioactive waste, and to the EEZ (200 nautical miles) of Parties	Party
Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International trade	Provides an early warning system on hazardous chemicals, and enables monitoring and controlling trade of chemicals, giving Parties power to decide which they wish to import and exclude those they cannot manage safely. There are 47 chemicals, out of which 33 are pesticides, and four are severely restricted hazardous substances.	Not a Party
Minamata Convention on Mercury	A global treaty to protect human health and the environment from the adverse effects of mercury. The convention includes a ban on new mercury mines, the phase-out of existing ones, control measures on air emissions, and the international regulation of the informal sector for artisanal and small-scale gold mining	Party
Montreal Protocol on Substances that Deplete the Ozone Layer	Protects the ozone layer by phasing out the production and consumption of a number of man-made substances responsible for ozone depletion	Party
Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (London Convention)	It covers the deliberate disposal at sea of wastes or other matter from vessels, aircraft, and platforms	Party
MARPOL 73/78: International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (Annexes I, II, III, IV, V, and VI)	Prevention of marine pollution by shipping	Party

2.2.3.1 Stockholm Convention on Persistent Organic Pollutants

Tuvalu acceded to the Stockholm Convention in 2004 and is working on its implementation through the actions undertaken under successive NIPs. The Department of Environment has day-to-day responsibility for matters relating to the Stockholm Convention.

2.2.3.2 Basel Convention

Tuvalu is a not a Party to the Basel Convention on the Control of Transboundary Movement of Hazardous Wastes and their Disposal (the Basel Convention). This convention aims to achieve the environmentally sound management of hazardous wastes by minimising transboundary movements consistent with environmentally sound and efficient management; treatment and disposal as close as possible to the source of generation; and minimisation of generation.

The Basel Convention is of importance when considering disposal of POPs and other hazardous wastes by export to treatment facilities in other countries that are Party to the Basel Convention. All exports of hazardous wastes are required to comply with stringent control procedures, including being approved by both the exporting and importing countries.

2.2.3.3 Waigani Convention

Tuvalu is a Party to the Convention to Ban the Importation into Forum Island Countries of Hazardous and Radioactive Wastes and to Control the Transboundary Movement and Management of Hazardous Wastes within the South Pacific Region (Waigani Convention). The Waigani Convention objective is to prevent the importation of hazardous and radioactive waste into the South Pacific region, to minimize production within the region and to ensure the environmentally sound management and disposal of existing wastes. As with the Basel Convention, transboundary transactions in hazardous wastes between Parties are required to comply with stringent control procedures.

2.2.3.4 Rotterdam Convention

Tuvalu is not a Party to the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. The Rotterdam Convention is a multilateral treaty to promote shared responsibilities in relation to importation of hazardous chemicals. The convention promotes open exchange of information and calls on exporters of hazardous chemicals to use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans. Signatory nations can decide whether to allow or ban the importation of chemicals listed in the treaty, and exporting countries are obliged to make sure that producers within their jurisdiction comply.

2.2.3.5 Minamata Convention

Tuvalu acceded to the Minamata Convention on the 7th June, 2019. The Minamata Convention on Mercury is an international treaty designed to protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds.

2.2.3.6 London Convention

Tuvalu is a Party to the London Convention. The "*Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972*", (the London Convention), is one of the first global conventions to protect the marine environment from human activities and has been in force since 1975. Its objective is to promote the effective control of all sources of

marine pollution and to take all practicable steps to prevent pollution of the sea by dumping of wastes and other matter.

2.2.3.7 MARPOL

Tuvalu is a Party to the International Convention for the Prevention of Pollution from Ships (MARPOL) which is the main international convention aimed at the prevention of pollution from ships caused by operational or accidental causes. It was adopted at the International Maritime Organization (IMO) in 1973. The Protocol of 1978 was adopted in response to several tanker accidents in 1976–1977. The 1978 Protocol was absorbed into the parent Convention and the combined instrument entered into force in 1983. In 1997, a Protocol was adopted to amend the Convention and a new Annex VI was added, which came into force in May 2005. The technical requirements of MARPOL are included in six separate Annexes:

- Annex I—Regulations for the Prevention of Pollution by Oil
- Annex II—Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk
- Annex III—Prevention of Pollution by Harmful Substances Carried in Sea in Packaged Form
- Annex IV—Prevention of Pollution by Sewage from Ships
- Annex V—Prevention of Pollution by Garbage from Ships
- Annex VI—Prevention of Air Pollution from Ships

Amendments are made periodically through the Marine Environment Protection Committee (MEPC) of IMO.

2.2.4 Stakeholder Roles

The roles and responsibilities of relevant government agencies in Tuvalu relevant to management of POPs and chemicals are identified in Table 8.

Table 8: Roles and responsibilities of Tuvalu Government Departments

Ministry	Department	Responsibility
Home Affairs and Rural Development		This Ministry is the governing body for waste management
Home Affairs and Rural Development	Department of Waste Management	Management of waste
Home Affairs and Rural Development	Rural Development	Has responsibility for the local government unit in each island (*Kaupule*) which is designated as the waste management operator in their particular area of jurisdiction
Local Government and Agriculture	Agriculture	Management of quarantine waste
Health and Social Welfare		Collection, treatment and disposal of medical wastes
Public Works, Infrastructure and Environment	Department of Environment (DOE)	Proper regulation and control of pollution, littering, and waste and waste dumps (including hazardous wastes) in Tuvalu Management of environmentally related International Convention responsibilities

Ministry	Department	Responsibility
Transport, Energy and Tourism	Marine Department	Regulation of waste disposal at sea under the Marine and Pollution Act 1991 together with DOE which implements the relevant international conventions
Energy, Tourism and Transport	Energy	Electricity generation and distribution through the TEC
Education, Youth and Sport	Education	Public education and curricula
Justice, Communication and Foreign Affairs	Police (and Fire)	National fire suppression
Finance	Customs	Control of imports and exports of products to and from Tuvalu

2.2.4.1 Ministry of Home Affairs and Rural Development

This Ministry is the governing body for waste management under which the Solid Waste Agency of Tuvalu and the *Kaupule* (the main providers of waste management services) operate.

2.2.4.2 Department of Waste Management

DWM (formerly the Solid Waste Agency of Tuvalu or SWAT), which sits under the Ministry of Home Affairs and Rural Development, oversees and manages the overall handling of wastes.

2.2.4.3 Department of Rural Development

The Department of Rural Development has responsibility for the *Kaupule,* the local government unit in each island which is designated as the waste management operator in the waste service areas in their area of jurisdiction.

2.2.4.4 Department of Agriculture

Responsible for quarantine wastes and agricultural pesticide use and registration.

2.2.4.5 Ministry of Health

The Waste Services and Operations Act 2009 identifies that the Ministry of Health is responsible for the management of, and regulatory control over medical wastes and that the Ministry is responsible for the collection, treatment and disposal of medical wastes.

2.2.4.6 Department of Environment

Under the Environment Act, the Department of Environment (DOE) is responsible for ensuring that there is proper regulation and control of pollution, littering, wastes (including hazardous wastes) in Tuvalu, and for taking appropriate measures to minimise the impacts of pollution, litter and wastes on the environment. The functions of the DOE in relation to pollution, litter and waste management include regulation and monitoring pollution and its effect on the environment; regulating hazardous wastes, including the disposal, storage and transboundary movement of such wastes (and other hazardous substances) in accordance with international conventions; (f) regulating waste collection and disposal systems, including landfills and waste

storage facilities; and regulating the disposal and incineration of wastes in accordance with laws applying in Tuvalu, and the international obligations binding Tuvalu.

2.2.4.7 Marine Department

The Department is responsible for the regulation of waste disposal at sea under the Marine and Pollution Act 1991 together with the Department of Environment which implements relevant international conventions.

2.2.4.8 Department of Energy

Responsible for national energy production. Tuvalu's current electricity systems consist of centralised diesel generators with associated medium and low voltage distribution networks, with renewable energy generation on the outer islands. All central electricity generators and distribution networks are owned and operated by the TEC.

2.2.4.9 Department of Education[71]

Tuvaluan education agencies are under the supervision of the Ministry of Education, Sports and Culture. The government's strategy for education aims to raise standards in teaching and learning; enhance the relevance of the curriculum; ensure adequate availability of education for special needs; and strengthen management of the education system. There are seven years of compulsory education starting at the age of six. Primary school comprises seven years and secondary six, with cycles of four and two years. There are ten state primary schools, two on the island of Vaitupu and one on each of the other eight inhabited islands. There is one state secondary boarding school on Vaitupu, with about 600 students, and one private secondary school run by the Congregational Christian Church of Tuvalu.

2.2.4.10 Fire Department

Responsible for fire suppression, including suppression of accidental landfill fires.

2.2.4.11 Customs

Responsible for control of Tuvalu's borders.

[71]http://www.cedol.org/pacific/tuvalu/

2.3 Assessment of POPs in Tuvalu

2.3.1 Assessment of POPs Pesticides (Annex A, Part I)

2.3.1.1 POPs Pesticides

A national assessment, including review of relevant documents, was conducted to determine if the pesticides listed in Annex A of the Stockholm Convention were currently used, or if they are likely to be an issue for Tuvalu because of past importation. Current (October 2019) knowledge of the use of Stockholm Convention listed chemicals in Tuvalu is summarised in Table 9.

Table 9: Status of Stockholm Convention pesticides in Tuvalu

Annex A Chemicals (elimination)	Tuvalu Status	International Chemical Use	Action Plan
Aldrin	Unlikely to be present	Applied to soils to kill termites and other insect pests. Rapidly converts to dieldrin	AP11
Chlordane	Past use in Tuvalu*	Used to control plant pests and ants	AP11
Dieldrin	Past use in Tuvalu *	Used to control plant pests	AP11
Endrin	Unlikely to be present*	Sprayed on the leaves of crops such as cotton and grains and used for rodent control	AP11
Heptachlor	Unlikely to be present	Primarily used to kill soil insects and malaria-carrying mosquitoes	AP11
Hexachlorobenzene (HCB)	Past use in Tuvalu*	Use as a fungicide in the 1940s	AP8 AP11
Mirex	Unlikely to be present	Used to control fire ants. It has also been used as a fire retardant in plastics, rubber, and electrical goods	AP11
Toxaphene	Unlikely to be present	Insecticide	AP11
Chlordecone	Not Present	No evidence of present-day manufacture or use anywhere in the world	
Alpha-hexachlorocyclohexane (α-HCH)	Unlikely to be present	Technical HCH was used as a pesticide in the 1940s	AP11
Beta-hexachlorocyclohexane (β-HCH)	Unlikely to be present*	Technical HCH was used as a pesticide in the 1940s	AP11
Lindane (ϒ-HCH)	Unlikely to be present*	Used for head lice control	AP11
Pentachlorophenol and its salts and esters (PCP)	Unlikely to be present	Used as a wood preservative but phased out in the 1980s and 1990s	AP11
Technical endosulfan and its related isomers	Unlikely to be present	Broad-spectrum insecticide currently used world-wide	AP11
Pentachlorobenzene (PeCB)	Unlikely to be present	Previously used as an intermediate in pesticide manufacture and as a fire retardant	AP11

*Detectable in air and/or breast milk samples collected in the (2010-2011) GMP

An assessment of the original nine Stockholm Convention pesticides carried out as part of the POPs in PICs project completed in 2003 found that none of the nine chemicals were present on the island.[72] The POPs pesticides HCB, chlordane, dieldrin and DDT were previously approved for use in Tuvalu but there is no information available on the quantities that were used in the past.[73] The pesticides were formally withdrawn from use in 1995 upon a recommendation from the SPC that biological agents be used instead to target the specific pest to be eliminated. The presence of the additional seven pesticide chemicals listed after 2003 in Tuvalu is unknown but are unlikely to be present in Tuvalu.

Tuvalu does not have a chemical production industry and as such does not produce any of the fifteen pesticide chemicals listed in Annex A, Part 1. Tuvalu has no intention to deliberately import any of these POPs chemicals into the country for use. There is enough generic legislation in place that would control or prohibit the deliberate importation of these chemicals into the country. However, a national priority is to review the Pesticides Act (1990). Participation in the GMP has shown that low concentrations of several POPs residues (chlordane, dieldrin, endrin, HCB, HCH) were detectable in air or breast milk samples (Appendix 5). Continued participation in the GMP will assist in the future monitoring of the presence and potential impact of these chemicals in Tuvalu.

2.3.1.2 Other pesticides imported and used in Tuvalu

Tuvalu had a total of 19.6 litres and 93.92 kg of non-POPs pesticides stockpiled on island (October 2019). General household pesticide use is low in Tuvalu and limited to a small number of products to control or repel insects (Table 10). This finding is supported by data collated from articles for sale at stores located around Funafuti. The Department of Agriculture, Health Department and Taiwan Mission (Table 10) were identified as the only importers of pesticides into Tuvalu[74]. Due to the small scale of farming and cultivation of crops in-country and the Department of Agriculture's emphasis on pesticide-free agriculture, no current applications for importation of pesticides have been received by the Department of Agriculture. However, the Department will confiscate any reported pesticide which is imported without approval. Agriculture Officers report that the Department of Agriculture holds a number of pesticides in the wharf area, including the insecticides listed in Table 10. Minimal protective equipment (boots only) is supplied to operators spraying diazinon for pest eradication in imported containers. The importation of pesticides by the Taiwan Mission is organised through the embassy of Taiwan in Tuvalu, and no inventory of imported pesticides was maintained by the Department of Agriculture and Health Department. The Mission (see Section 2.1.6) keeps comprehensive records of the use of non-Stockholm listed insecticides for use in its market gardens (Table 10).

A Health Department representative stated that the amount of pesticides imported for mosquito control to minimise Dengue outbreaks was small to avoid obsolete stock and was predicated on response to the management of outbreaks.

No specific site or system for pesticide container disposal exists in Tuvalu. Used containers are treated as 'normal waste' and disposed of to landfill. Containers are usually rinsed prior to disposal. No specialised facilities exist in Tuvalu for the handling, storage and transportation

[72]SPREP (2003). Tuvalu POPs Project Country Plan. SPREP. 12pp
[73]Government of Tuvalu (2008). *National Implementation Plan*
[74] SPREP (2017). *Pesticide Container Management in the Pacific Tuvalu Baseline Survey Report*. 25pp.

of hazardous materials and pesticides, and none for the treatment and disposal of hazardous wastes.

Table 10: Non-Stockholm pesticides in current use in Tuvalu (2019)

Product	Active Ingredient(s)	Pesticide Use	Stock Held
Malthion	Organophosphate	Public health mosquito control	Past use
Temphos	Organophosphate	Public health mosquito control	Past use
Aqua Resigen	Synthetic Permethrin	Public health mosquito control	Past use
Sumilarv	Pyriproxyfen	Public health mosquito control	Past use
Pentacarb	Carbamate	Public health mosquito control	Current use 0.2kg in stock
Barricade 500EC	Pyrethroid	Agriculture	Past use
BiFenthrin 8 SC	Bifenthrin	Agriculture	Current use 1 litre in stock
Antoff	Fipronil	Agriculture	Current use 75kg in stock
Diazinon 80EC	Diazinon	Agriculture (quarantine)	Current use 15 litre in stock
Trimed Lure fruit-fly attractant	t-Butyl-2-methyl-4-chlorocyclohexanecarboxylate	Agriculture (quarantine)	Current use 2 litre in stock
Mancozeb	Dithane 80%WP (dithiocarbamate fungicide)	Taiwanese Mission Market Garden	Current use 6.48kg in stock
Amistar	Azoxystrobin 250 g/l SC (strobilurin fungicide)	Taiwanese Mission Market Garden	Current use 0.36kg in stock
Benomyl	Benlate 50% WP (benzimidazole fungacide)	Taiwanese Mission Market Garden	Current use 1.26kg in stock
Imidacloprid	Imidacloprid 9.6% SL (neonicotinoid insecticide)	Taiwanese Mission Market Garden	Current use 1.56kg in stock
Bacillus	*Bacillus thuringiensis* 70% WP	Taiwanese Mission Market Garden	Current use 0.72kg in stock
Permethrin	3-phenoxybenzyl (1RS)-cis-trans-3-(2,2-dichlorovinyl)-2,2-dimethylcyclopropanecarboxylate 10% EC (Pyrethroid insecticide)	Taiwanese Mission Market Garden	Current use 1.6 litre in stock
Paraquat	Paraquat 2% SL (dimethyl-4, 4 bipyridinium dichloride)	Taiwanese Mission Market Garden	Current use 8.34kg in stock
Mortein Naturguard	Permethrin Transfluthrin	Household insecticide	
Tropical Strength Mosquito Repellent	Diethytanluamide Bicycloheptane dicarboromicide	Personal insect repellent	
Repellex	Picarion	Personal insect repellent	
Zenden	WP20080148	Personal insect repellent	
Cockroach Trap	Unlabelled		
Mortein Powerguard	D trans allethron	Personal insect repellent	
B&W Mosquito Coil	Dimefluthrin	Insect repellent	
Mortein Fast Knockdown	Unlabelled	Household insecticide	

Product	Active Ingredient(s)	Pesticide Use	Stock Held
Household Aphid Spray	Pyrethrum	Household garden spray	

2.3.2 Assessment of Polychlorinated Biphenyls (PCBs) (Annex A, Part II)

PCBs are industrial chemicals previously used as coolants and lubricants in electrical equipment (such as transformers and capacitors), hydraulic fluids, and additives in paint, carbonless copy paper, plasticisers and dye carriers. PCBs were used in these applications as they do not burn easily and are good insulators. PCBs were produced in several countries and most production was phased out by the 1990s. PCBs have previously been used in Tuvalu as transformer fluids. The POPs in PICs project detected one PCB contaminated transformer containing 324 kg (381 litres) of contaminated oil.[75] Several other units were tested as positive in field tests, but it is unknown if these were subsequently confirmed. The contaminated transformer and its oil (total gross weight of 800kg) was removed from Tuvalu to Australia for destruction in 2006.[76] Waste oil was observed leaking into the ground from stored oil drums at the TEC in 2008, and it was concluded that there was a high possibility that PCB contamination of soil has occurred.[77]

Twelve (12) old transformers and eight switch gear units are currently stored undercover at TEC. The oil has been drained from the transformers into twelve 220-litre drums. The drums are in poor condition and are stored outside without protection from the elements. The oil tested positive to field strip tests for PCBs in 2017, but no follow up confirmatory testing done. TEC workers have not received training or protective gear, and this is a priority for the organisation. New on-line transformers supplied by Japan, are 2 years old and gas (SV6) filled. These transformers are leaking gas and starting to fail, and there is no local maintenance knowledge for these new types of transformers. The local energy sector is moving rapidly towards solar and wind generation.

A thorough inventory of potentially PCB-containing oil and equipment stockpiles and in-service equipment needs to be conducted prior to their decommissioning. Worker training, PPE and awareness training concerning equipment that may contain PCBs is a high priority.

The GMP has detected PCBs in air and breast milk samples collected in Tuvalu in 2010 and 2011 (Appendix 5). Continued participation in the GMP will assist in the future monitoring of the presence and potential impact of these chemicals in Tuvalu.

2.3.3 Assessment of Polybromodiphenyl Ethers (POP-PBDEs), HBB (Annex A Part I) and HBCD (Annex A Part I and Part VII)

2.3.3.1 POP-PBDEs

The POP-PBDEs are a group of industrial chemicals that have been used since the 1970s as additive flame retardants in a wide range of (mainly) consumer products including electrical and electronic equipment, furniture and mattresses, textiles, and carpets, and vehicles. They include hexabromodiphenyl ether (hexaBDE), heptabromodiphenyl ether (heptaBDE),

[75]SPREP (2003). *Tuvalu POPs Project Country Plan. 12pp*
[76]Slatter, Ashton and Griffin (2006). *Clean Up of Persistent Organic Pollutants in Pacific Island Countries. ISWA. 12pp*
[77]Government of Tuvalu (2008). *National Implementation Plan* (NIP)

tetrabromodiphenyl ether (tetraBDE), and pentabromodiphenyl ether (pentaBDE). PBDEs were produced with three different degrees of bromination and marketed as:

- commercial pentaBDE (c-PentaBDE), in which tetraBDE and pentaBDE were the most abundant congeners;
- commercial octaBDE (c-OctaBDE) in which hexaBDE and heptaBDE were the most abundant congeners; and
- commercial decaBDE (c-DecaBDE).

It is believed that the production of c-PentaBDE and c-OctaBDE ended in 2004, whilst production of c-DecaBDE continues. Although c-DecaBDE has not been found to contain POP-PBDEs, it can form POP-PBDEs by debromination during its life cycle, thus representing an important reservoir of POP-PBDEs.[78] The presence of any of these POP-PBDEs in Tuvalu will be the result of importation of articles containing the chemicals, a large proportion of which may end up in waste dumps and landfills.

No direct information is available on the presence or use of POP-PBDEs in Tuvalu. However, it is highly likely that POP-PBDEs have entered the country in manufactured articles. These POP-PBDEs may be present in plastic components of common household and office goods, such as computers and electrical appliances, and in furniture fabrics and textiles, and in foamed plastics and rubbers such as that used in furniture, mattresses, carpet underlays, car seats, and in foamed building insulation. There is no accessible historic (customs) information available about imports of electrical and electronic equipment and motor vehicles that will eventually become waste in Tuvalu,[79] although two years of very basic information were able to be released by the Customs Department in 2019 (Table 11). The national customs information system is currently being modernised with donor funding.

Table 11: Computer, TV and motor vehicle and motorbike imports into Tuvalu, 2017 and 2018

HS Tariff	Description	2017	2018
	New cars	23	37
	Second-hand cars	30	30
	Motorbikes (<250cc)	397	323
84.71	Computers	484	280
85.28	TVs/Monitors	105	133

2.3.3.1.1 Electrical and Electronic Equipment Sector[80]

In the absence of more accurate data on imports of CRT TVs, monitors and flat screen TVs, as well as the number of CRT TVs, monitors, and flat screen TVs in use and current WEEE quantities, an estimation of the POP-PBDEs could not be undertaken. However, POP-PBDEs are only expected to be contained in second-hand imports of electronic equipment as international production ceased in 2004.[81] Given the high cost of importing items into Tuvalu, there can be expected to be minimal quantities of second-hand goods imported into Tuvalu,

[78]UNEP (2017). *Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants.* 105pp
[79]Leney (2018). *Review of e-waste Related Activities in the Pacific Islands*. SPREP. 70pp
[80]Leney, A. (2018). Review of e-waste Related Activities in the Pacific Islands. 70 pp.
[81]UNEP (2017). *Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants.* 105pp

and many electronic items that come in will be bought in new by Tuvaluan residents following trips overseas. At the end of their service life, electronic products containing POP-PBDEs are likely to be disposed of in landfills, and introduction of improved national e-waste management practices will practically manage this issue in Tuvalu.

2.3.3.1.2 Transport sector

Commercial pentaBDE (c-pentaBDE) in which tetraBDE and pentaBDE are the most abundant congeners, was widely used in cars, buses and trucks to treat flexible polyurethane foams for seats, head rests, car ceilings, and acoustic systems. C-OctaBDE has also been used to some extent in plastic vehicle parts including steering wheels, dashboards, and door panels.[82] The number of vehicles imported into Tuvalu is very low (Table 11) due to the low demand created by a small national population, a preference for cheap Korean motorbikes (<250cc engine capacity) that are imported in high numbers and the small size of the land area. The average life of a car in Tuvalu is in the order of five to ten years after arrival in the country due to corrosion. There is no age restriction on imported vehicles and no vehicle inspection is required for an imported vehicle. At the end of their service life, vehicles are likely to be disposed of in the local landfill. Due to the lack of information on the number and year of manufacture of vehicles imported, in use/registered and reaching end of life, an estimation of POP-PBDEs was not possible. In the absence of data, introduction of improved national bulky waste management practices will practically manage this issue in Tuvalu.

Ideally, end of life (EOL) vehicles would be collected and wrecked for spares, before being stripped out, the interior plastic elements shipped offshore for disposal, and the metal parts recycled. The highest value in an EOL vehicle is the recoverable spare parts, but these must be removed reasonably soon after the vehicle becomes disused, or else local corrosion will render any potential spares useless. EOL vehicles will also deposit quantities of waste oils and paints into the local environment as they degrade. Stockpiling EOL vehicles into a car dump can be done using the deposit refund system introduced under the Waste Management (Levy Deposit) Regulation 2019, with a deposit paid at import that is refunded several years later when the EOL vehicle is handed in for stripping for parts and export of scrap.

2.3.3.2 Assessment of Hexabromobiphenyl (HBB) (Annex A, Part I)

HBB was used as a flame retardant in three main commercial products: ABS thermoplastics (used in business machine housings, and the industrial and electrical sectors), flexible polyurethane foam for automotive upholstery, and coatings and lacquers. The available data indicate that the USA was the sole producer of HBB, producing approximately 5,400 tonnes of the chemical between 1970 and 1976. It is further believed that most HBB-containing materials were disposed of decades ago and it is therefore of little relevance to Tuvalu. Due to the similarity in use between HBB and POP-PBDEs, any minor amount of HBB that may be present will be addressed through national POP-PBDEs management measures.[83]

[82]Stockholm Convention Secretariat (2017). *Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants*
[83]Stockholm Convention Secretariat (2017). *Guidance for the inventory of polybrominated diphenyl ethers (PBDEs) listed under the Stockholm Convention on Persistent Organic Pollutants*

2.3.3.3 Assessment of Hexabromocyclododecane (HBCD) (Annex A, Part I and Part VII)

HBCD has been on the world market since the late 1960s and has been produced mainly in China, the European Union, and USA. It is used as a flame-retardant additive to reduce ignition of flammable polymers and textiles in buildings, vehicles or electrical and electronic equipment (EEE). The main application (90%) of HBCD is in expanded polystyrene (EPS) and extruded polystyrene (XPS) foams (both often referred to by the trademarked name, Styrofoam), which are used widely as insulation boards in building and construction. A smaller proportion of EPS and XPS is used in textile applications, including residential and commercial furniture and vehicle upholsteries, draperies and wall coverings. HBCD may also be added to high impact polystyrene (HIPS, used in electrical and electronic equipment such as audio-visual equipment cabinets and refrigerator lining), latex binders, adhesives, and paints.

Tuvalu does not manufacture HBCD, but it may be present in products and articles imported prior to 2014. The quantities of HBCD imported into Tuvalu are unknown. At the end of their service life, products containing HBCD are likely to be disposed of in landfills, so in the absence of information, improved national waste management practices, will practically manage this issue in Tuvalu.

2.3.4 Assessment of Hexachlorobutadiene (HCBD) (Annex A, Part I)

HCBD was produced intentionally from a by-product generated during the manufacture of chlorinated solvents, and unintentionally during the production of certain organochlorines. It was used for several technical and agricultural applications including as heat transfer fluid in transformers, and as a fumigant, pesticide, seed dressing, fungicide, and biocide (UNEP 2017). Tuvalu does not manufacture chlorinated solvents, thus the potential presence of HCBD in Tuvalu would be due to imported products containing the chemical, including in transformer, heat exchange and hydraulic fluids. The tests to detect PCBs in transformers would also detect HCBD, and therefore measures to address PCBs in Tuvalu will also be effective for HCBD.

2.3.5 Assessment of Polychlorinated Naphthalenes (PCNs) (Annex A, part I)

PCNs, which are structurally like PCBs, consist of 75 possible compounds in eight homologue groups, seven of which are listed in the Stockholm Convention. Due to structural similarities to PCBs, PCNs were often intentionally produced for use in similar industrial and consumer applications as PCBs, including in transformer fluids, cable insulation, fluids in capacitors and condensers, wood preservation, and as an additive in paints and dye carriers (UNEP 2017). PCNs were mainly used between 1920 and 1960 but have been used in certain applications until early 2000. In most applications, PCNs have not been produced or used for over 30 years and it can be assumed that most PCN-containing products with short lifetimes (e.g. textiles, papers, lubricants, cutting oils and grease) have already been disposed of. Some PCN-containing products (e.g. PCN-treated wood, paint) produced decades ago may still be in use today, for example in building construction, and painted ships and bridges (UNEP 2017, p18). PCNs are also unintentionally formed and released together with dioxins and furans in thermal processes. There is no known information available about the presence of PCNs in Tuvalu. Unintentionally produced PCNs are not separately addressed in this NIP as PCN emissions will be reduced by the same measures applied to reduce dioxins and furans.

2.3.6 Assessment of Short Chain Chlorinated Paraffins (SCCPs)

Chlorinated paraffins of various chain lengths, including SCCPs, have been used since the 1930s as a plasticizer in rubber, sealants, coatings, textiles, leather fat, paints, adhesives, flame retardants for plastics, and high-pressure lubricants. Production has decreased globally but they are still produced. Technically feasible alternatives are now commercially available for all uses. SCCPs are persistent in the air and undergo long-range transport. Many SCCPs can accumulate in biota. They lead to significant adverse environmental and human health effects. They are persistent and bioaccumulate, are toxic to aquatic organisms, and are possible human carcinogens. SCCP have substituted PCBs and PCNs in a wide range of open applications (e.g. paints, coatings, sealants, plastic additive/flame retardant, rubber, lubricants, and metal working fluids).

Because of their long-term and widespread use and their persistence, SCCPs will probably be present in Tuvalu, although probably at very low concentrations given that worldwide production has been reduced. As SCCPs are still being produced, they may still be potentially present in products that are being imported. Their earlier widespread use will mean they are probably also present in breakdown products from old waste dumping areas. In the absence of information, improved waste management practices will effectively manage this chemical in Tuvalu.

2.3.7 Assessment of DDT (Annex B, Part II)

DDT was widely used during World War II to protect soldiers and civilians from malaria, typhus, and other diseases spread by insects. After the war, DDT continued to be used to control disease and it was sprayed on a variety of agricultural crops, especially cotton. DDT continues to be applied against mosquitoes in several countries to control malaria. Its stability, persistence, and its widespread use have meant that DDT residues can be found worldwide.

DDT was previously approved for use in Tuvalu for the vector control of Dengue Fever but there is no information available on the quantities that were used in the past.[84] The pesticide was formally withdrawn from use in 1995 upon a recommendation from the SPC that biological agents be used instead to target the specific pest to be eliminated. A range of vector control insecticides are used in its place (Table 10). The POPs in PICs project (2003) and the 2008 NIP did not detect any DDT stockpiles in Tuvalu. Currently, there is no intention to use or import DDT in Tuvalu. The pesticide has been detected in air and/or breast milk monitoring in 2010-2011 in Tuvalu (Appendix 5) and given the ubiquitous nature of the worldwide distribution of DDT, monitoring for its presence in environmental matrices in Tuvalu should continue to be regularly undertaken as part of the GMP.

2.3.8 Assessment of Perfluorooctane Sulfonic Acid (PFOS), its salts and Perfluorooctane Sulfonyl Fluoride (PFOS) (Annex B, Part III)

PFOS, its salts, and PFOS-F are industrial chemicals widely used in electrical and electronic parts, fire-fighting foam, medical imaging (principally X-ray photography), hydraulic fluids, toners and printing inks, coatings and coating additives, and in textiles and upholstery for their water and oil repellent properties. They are also the unintended degradation product of certain chemicals. The current global production of PFOS is estimated at 200 tonnes/year,[85]

[84] Government of Tuvalu (2008). *National Implementation Plan*

[85] UNEP (2017). *Guidance for the inventory of perfluorooctane sulfonic acid (PFOS) and related chemicals listed under the Stockholm Convention on Persistent Organic Pollutants*. 125 pp

none of which occurs in Tuvalu. However, PFOS-related substances may be present in imported products, including fire-fighting equipment and foams (aqueous film forming foam, AFFF), and aviation hydraulic fluid.

PFOS along with its salts and PFOS-related compounds, were added to Annex B of the Stockholm Convention in May 2009. This requires countries to act to "restrict the production and use" of these chemicals. At COP9 in May 2019, the list of specific exemptions was reduced to the production and use in metal plating (hard-metal plating) only in closed-loop systems and in firefighting foam for liquid fuel vapour suppression and liquid fuel fires (Class B fires) in installed systems, including both mobile and fixed systems and, the list of acceptable purposes was reduced to the production and use for insect baits with sulfluramid (CAS No. 4151-50-2) as an active ingredient for control of leaf-cutting ants from Atta spp. and Acromyrmex spp. for agricultural use only. Alternatives to PFOS-containing foam should be used "where available, feasible and efficient". Moreover, each Party that has registered for an exemption pursuant to Article 4 for the use of PFOS, its salts and PFOSF for fire-fighting foam shall: (a) ensure that fire-fighting foam that contains or may contain PFOS, its salts and PFOSF shall not be exported or imported except for the purpose of environmentally sound disposal; (b) not use fire-fighting foam that contains or may contain PFOS, its salts and PFOSF for training; (c) not use fire-fighting foam that contains or may contain PFOS, its salts and PFOSF for testing unless all releases are contained; (d) by the end of 2022, if it has the capacity to do so, restrict uses of fire-fighting foam that contains or may contain PFOS, its salts and PFOSF to sites where all releases can be contained; (e) make determined efforts designed to lead to the environmentally sound management of fire-fighting foam stockpiles and wastes that contain or may contain PFOS, its salts and PFOSF.

The Tuvalu Fire Service operates one airfield fire suppression tanker containing 400 litres of AFFF, and two smaller conventional tankers equipped with venturi nozzles to mix foam directly from 25-litre containers of AFFF. The Fire Service also store 375 litres of AFFF at the fire and police headquarters located by the airfield. The foam used by the fire service is Foamfilm 916K AFFF Foam Liquid Concentrate (Active ingredient 2-(2-butoxyethoxy)ethanol CAS No.112-34-5)[86] and is diluted at 6% with fresh or saline water prior to use. Stocks held were manufactured on 4th January, 2008 by Kerr Fire Fighting Chemicals, Liverpool (www.kerrfirefighting.com), and have a shelf life of at least 10 years.[87] All foam was purchased from New Zealand in 2008 from an unknown supplier. A description of the foam is attached at Annex 6. Kerr Filmfoam 916K does not contain PFOS or any longer chain PFAS, but it does contain “Fluorinated Surfactants”, which should not be sprayed on the ground as these are persistent.[88]

The fire service conducts regular training using foam or water. Training is carried out at the northern end of the airfield on grass, on the ocean side of the island. Around 25 litres of foam concentrate enter the environment during each training session. The last time foam was used in a training exercise was January 2019. It is likely future training will utilise less foam as stocks are declining and are expensive to purchase. As the AFFF typically has a shelf-life of 10 years, the current stocks may need to be appropriately disposed of soon. There is no current support for the disposal of expired AFFF in Tuvalu. Approximately 125 litres of original AFFF concentrate has been used by the fire service in training and fire suppression activities since 2008. Significant quantities of foam were used to extinguish accidental landfill fires by the fire service in 2019. The foam was sprayed directly onto the dumpsite and then likely entered the

[86]Kerr Fire: FilmfoamC6 916 AFFF 6%
[87]Kerr Fire: FilmfoamC6 916 Safety Data Sheet
[88] Government of the Cook Islands (2019). *National Implementation Plan*.

ground water under the dumpsite. The landfill and the grassed area at the northern end of the airfield should be considered contaminated sites with respect to fluorinated surfactants.

2.3.9 Assessment of release of unintentional produced chemicals (uPOPs) (Annex C)

uPOPs are formed as the result of incomplete combustion of materials containing chlorine, or as the by-products of chemical reactions, and include:

- polychlorinated dibenzo-p-dioxins (dioxins) and dibenzo-furans (furans);
- hexachlorobenzene (HCB);
- Hexachlorobutadiene (HCBD);
- polychlorinated biphenyls (PCBs);
- pentachlorobenzene (PeCB); and
- polychlorinated naphthalenes (PCNs).

Under the Stockholm Convention, Parties must take measures to reduce the unintentional release of these chemicals, with the goal of continuous minimisation and, where feasible, ultimate elimination. A uPOPs Action Plan for Tuvalu was completed in 2018.[89] This current NIP uPOPs assessment builds on and complements this previous work.

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 (unintentionally produced) POPs. This means that efforts to address dioxins and furans under this uPOPs Action Plans will be deemed sufficient to address all Annex C POPs.

2.3.9.1 Description of the uPOPs[90]

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. 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.

[89]Richards (2018). *Tuvalu National Action Plan to reduce releases of Unintentional Persistent Organic Pollutants 2018-2022*. 39pp
[90]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.

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 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 naphthalene's (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.

2.3.9.2 Sources of uPOPs in Tuvalu

There are a number of potential sources of uPOPs emissions in Tuvalu (Table 12). Estimates of the releases of uPOPs from these sources were derived in 2008 (Table 13). This was repeated in 2017 (Table 14) and in 2019 (Table 15) using the 2013 UNEP Toolkit, using activity data derived from contemporary desktop reviews and on ground investigations.

Table 12: Potential priority sources of uPOPs emissions in Tuvalu

Source category	Activity
Waste incineration	• Municipal waste incineration • Quarantine waste incineration • Medical waste incineration • Waste wood & biomass incineration

Heat & power generation	• Diesel generators • Domestic cooking (biomass)
Transport	• 2- & 4-Stroke petrol engines • Diesel engines
Open burning processes	• Waste dump burning • Accidental house fires • Domestic waste burning
Miscellaneous	• Tobacco smoking • Wood burning for copra production • Fish smokehouses
Disposal & landfills	• Landfill hazardous wastes • Landfill mixed wastes • Landfill domestic wastes • Sewage disposal • Composting • Used oil disposal
Contaminated sites & hotspots	• Accidental fires • PCB containing equipment • Waste incinerator operation sites • Dumpsites

Table 13. Tuvalu uPOPs estimated emissions summary (2008)[91]

Group	Source Groups	Annual Releases (g TEQ/a)				
		Air	Water	Land	Product	Residue
1	Waste Incineration	0.1546		NA	NA	0.0148
2	Metal Production	0.0	0.0	0.0	0.0	0.0
3	Heat and Power Generation	0.4348	ND	NA	NA	ND
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	0.07602	ND	0.04	NA	0.0736
7	Production of Chemicals and Consumer Goods	0.0	0.0	0.0	0.0	0.0
8	Miscellaneous	0.000001	NA	NA	NA	NA
9	Disposal	NA	0.0001	NA	NA	0.0242
10	Composting	NA	ND	NA	0.0157	NA
1-10	**Total**	**0.665**	**0.0001**	**0.04**	**0.0157**	**0.1126**
	Grand Total			**0.8334**		

Table 14. Tuvalu estimated uPOPs emissions summary (2017)[92]

Group	Source Groups	Annual Releases (g TEQ/a)

[91]Government of Tuvalu (2008). *National Implementation Plan*. 103pp
[92]Richards (2018). *Tuvalu National Action Plan to reduce releases of Unintentional Persistent Organic Pollutants 2018-2022*. 39pp

		Air	Water	Land	Product	Residue
1	Waste Incineration	0.0809	0.0	0.0	0.0	0.0751
2	Metal Production	0.0	0.0	0.0	0.0	0.0
3	Heat and Power Generation	0.0480	0.0	0.0	0.0	0.005–0.084
4	Production of Mineral Products	0.0	0.0	0.0	0.0	0.0
5	Transportation	0.0005	0.0	0.0	0.0	0.0
6	Open Burning Processes	0.0120	0.0	0.0003	0.0	0.0
7	Production of Chemicals and Consumer Goods	0.0	0.0	0.0	0.0	0.0
8	Miscellaneous	0.0	0.0	0.0	0.0	0.0038
9	Disposal	0.0	0.0006	0.0	0.0170	0.0590
10	Identification of Potential Hot-Spots					
1-10	**Total**	**0.1415**	**0.0006**	**0.0003**	**0.017**	**0.142–0.222**
	Grand Total			**0.302–0.381**		

Table 15. Tuvalu estimated uPOPs emissions summary (2019)

Group	Source Groups	Annual Releases (g TEQ/a)				
		Air	Water	Land	Product	Residue
1	Waste Incineration	0.853	0	0	0	0.004
2	Metal Production	0	0	0	0	0
3	Heat and Power Generation	0	0	0	0	0
4	Production of Mineral Products	0	0	0	0	0
5	Transportation	0	0	0	0	0
6	Open Burning Processes	0.008	0	0	0	0
7	Production of Chemicals and Consumer Goods	0	0	0	0	0
8	Miscellaneous	0	0	0	0	0
9	Disposal	0	0	0	0.001	0
10	Identification of Potential Hot-Spots					
1-10	**Total**	**0.861**	**0**	**0**	**0.001**	**0.004**
	Grand Total			**0.866**		

2.3.9.3 Comparison of uPOPs inventories

Total uPOPs emissions for Tuvalu were calculated to be below 1 g TEQ/a in all three assessments, however the primary source of the uPOPs emissions varied significantly between the three assessments. In 2008, the main source of uPOPs generation was reported to be from the heat and power sector. In contrast, the major uPOPs contributor in 2019 was estimated to be from (healthcare) waste incineration. Regular waste collection services are now (2019) in operation on all Tuvalu islands, and this has significantly reduced the amount of open burning practiced in the community. The progressive transition to renewable energy

generation has also significantly reduced the emission of uPOPs from this source, although this has been offset by significantly increased diesel consumption used in regular water police patrol operations in Tuvalu's EEZ.

1. Waste Incineration

Poor management of hazardous healthcare waste (including syringes, live vaccines and cultures, laboratory samples, body parts and fluids, and sharps) poses occupational and public health risks to patients, health workers, waste handlers, waste transporters and communities.[93] In addition, healthcare waste disposal via low temperature incineration is estimated to be the second largest contributor to Pacific uPOPs releases, accounting for 17% of the emissions reported by PICs in their NIPs. Healthcare waste can contain high concentrations of organic (polyvinyl chloride and specific pharmaceuticals) and inorganic (saline solution and body fluids) chlorine that may alter combustion characteristics and enhance PCDD/PCDF formation in lower temperature burns. Under these conditions, stack emissions can include both "conventional" pollutants such as particulate matter, sulfur oxides, nitrogen oxides, volatile organic compounds and carbon monoxide, as well as dioxins and furans. The incinerator ash will also usually contain dioxins, furans and heavy metals. Progressive installation and enforcement of best available technology for healthcare waste destruction (i.e. double incinerator chamber, and 850-1100°C incineration) is essential to minimise formation of dioxins and furans from this source in Tuvalu.

The Princess Margaret Hospital is the only hospital on Tuvalu. It has 50 beds and provides primary healthcare, emergency care, surgery, ICU, radiography, inpatient, obstetric and maternity, outpatient services and allied health services. There are no private providers of healthcare services on Tuvalu. A PacWaste survey undertaken in 2014 determined that 100kg sharps and 100kg healthcare waste from the hospital was incinerated per week using low temperature wood fired incineration at the landfill site.[94] Two hundred and ten (210) kg of healthcare waste are generated weekly from the seven outer islands and incinerated in low temperature incinerators. A total of 21,320kg of healthcare waste is currently incinerated per annum using low temperature incineration in Tuvalu.

Quarantine wastes (largely food items) from the local Tuvalu trade boat regularly transiting from Fiji are destroyed using low temperature incineration at the port. Wastes are incinerated four times per year following each boat trip from Fiji. Approximately 100kg of quarantine waste is destroyed annually.

2. Heat and Power Generation

Use of conventional fuel sources for power generation and heating results in emissions of uPOPs (primarily to the air) from a range of sources including fossil fuel power plants; household cooking with biomass (wood, coconut husks/shells); and from household cooking with fossil fuels (gas). Overall, uPOPs emissions from heat and power generation sources contribute approximately 10% of the total uPOPs emissions reported from Pacific Islands.

Power generation from renewable sources is a major mode of electricity generation in Tuvalu. However, approximately 1.8 million litres of diesel was imported in 2018 for the generation of 6.289 MW of electricity. It is expected that diesel fuel consumption for electricity generation will decrease into the future as Tuvalu approaches a 100% solar power generation target. (uPOPs generation from diesel generation of electricity is included in transportation uPOPs calculations).

LPG gas in refillable gas bottles is used extensively for household cooking in Tuvalu. 109,000 litres and 22,500 litres of LPG were imported into Tuvalu in 2017 and 2018 respectively for

[93]SPREP (2013). *Pacific health care waste: A regional management strategy and action plan 2013-2015*. SPREP, Apia, Samoa.
[94]ENVIRON Australia Pty Ltd (2014). *Baseline Study for the Pacific Hazardous Waste Management Project - Healthcare Waste Tuvalu.* 65pp

domestic cooking. On average, 3.214 TJ/year of energy is created from LPG combustion for household cooking.

3. Transportation Emissions

uPOPs emissions from transport (road and off-road vehicles) result from incomplete combustion of fuel in engines. The presence of dioxins in car exhaust was first reported in 1978, although the exact magnitude of dioxin in vehicles emissions remains uncertain. Worldwide, motor vehicle emissions can account for up to 12% of total national annual national dioxin emissions. The levels of dioxins and furans in exhaust gases emitted from vehicles depend on many factors including the type of engine, its maintenance condition and age, technologies of emission reduction applied (catalysts), type and quality of fuel (gasoline, diesel, heavy fuel oil, biofuel), driving conditions, and ambient conditions.[95] Based on the available data, uPOPs emissions from transportation comprise about 0.1% of total reported emissions, or 115mg TEQ/year in the Pacific.

The number of motor cars imported into Tuvalu is very low due to the low demand created by a small national population, a preference for inexpensive Korean motorbikes (<250cc engine capacity) that are imported in high numbers, and the small size of the land area. Approximately 3.36M litres of diesel and 1.03M litres of unleaded petrol were imported into Tuvalu in 2018 for transportation and electrical generation purposes.

4. Open Burning

Open burning is by far the largest contributor to uPOPs emissions in the Pacific, contributing around 63% of the total reported emissions.[96] Open burning includes uncontrolled burning of biomass (agricultural crop residues including sugarcane which may or may not have been treated with pesticides; forests; and grasslands); and waste (mainly domestic or municipal solid waste burned in landfills, dumps, backyards, public spaces). The resulting uPOPs are primarily released directly to air and land, with indirect releases to water if rainfall washes away the uPOPs contaminated ash particles into receiving waters. Fires on open dumpsites and backyard burning (in backyards and public spaces) are still common occurrences in the Pacific, especially in areas that lack access to reliable waste collection services.

Domestic open burning is not practiced in Tuvalu, a consequence of the regular green and domestic waste collections across the islands. All cooking is undertaken using LPG and there is no agricultural burning undertaken. Accidental landfill fires have been a significant issue in the past, and the most recent fire at the landfill occurred in 2019 during a drought with the fire burning for over a week and incinerating an estimated 205,000kg of waste.[97] The landfill fire was eventually extinguished by the fire brigade. The fire brigade undertook fire-fighting duties without access to breathing apparatus and used AFFF foam to extinguish the fire.[98]

5. Public cigarette and cigar smoking

Total reported emissions of dioxins from sources including drying of biomass, crematoria, smoke houses, dry cleaning residues, and tobacco smoking account for 171mg TEQ/year, or 0.2% of the total reported dioxin emissions from Pacific Island countries. Tobacco leaf naturally contains both organic carbon and chloride ions (regardless of the presence or absence of pesticide residues or chemical/flavouring additives in the tobacco) and consequently, as for any thermal process, smoking of cigarettes and cigars produces dioxins.

[95]UNEP (2012). *Toolkit for Identification and Quantification of Dioxins and Furans and Other Unintentional POPs*
[96]Richards (2015). *Pacific Regional Action Plan to Reduce Unintentional Persistent Organic Pollutants*. 34pp
[97]Mr Walter Kaua, Director Department of Waste Management (2019). Pers comm.
[98]Mr H. Halovaala, Fire Captain (2019) Pers com.

Investigations of popular brands of cigarettes gave "emissions" of 0.1-1.0pg I-TEQ/cigarette.[99,100] Cigars are estimated to release higher dioxin emission of approximately 0.3 pg I-TEQ. Essentially, this means that dioxin intake from smoking could be up to one third of that coming from food, and smokers are likely to have a measurably elevated dioxin intake compared to non-smokers. Non-smokers are also likely to be exposed to dioxins from passive intake of cigarette smoke. Smokers also place themselves at significant health risk from the many other toxic and carcinogenic components present in cigarette smoke.

Tuvalu customs data for tobacco imports is presented in Table 16. Based on this data, it is estimated that tobacco for over 17,600,000 cigarettes was imported into Tuvalu over a two-year (2017-2018) period and represents a significant public health risk.

Table 16. Tuvalu tobacco import data (2017-2018)

	2017		2018	
	Weight (kg)	Number	Weight (kg)	Number
Cigarettes	7,296	7,296,000	5,470	5,470,015
Tobacco	3,100	3,100,000	1,730	1,730,000
TOTAL	**10,396**	**10,396,000**	**7,200**	**7,200,015**

6. Waste disposal

Waste disposal is not a source of uPOPs, but rather a pathway whereby uPOPs from other sources already present in the waste becomes concentrated and is released to air, water and land.[101] Based on the available data, waste disposal and landfilling contribute approximately 9% of the total reported uPOPs releases in Pacific island countries. Waste disposal to land is the predominant method of residual solid waste disposal in Tuvalu. It is particularly important that waste management practices are implemented to ensure that polystyrene packaging and building materials, leather, fabric, upholstery and carpets, floor polish, photographic film, denture cleaners, shampoos, paints, and carpet cleaners and fire-fighting foams are stored and disposed of safely. This will help ensure that wastes potentially containing uPOPs, POP-PBDEs, HBCD and PFOS are contained and safely managed.

7. Composting

The two Taiwanese farms produce 500m^3 (270 tonnes) of compost annually from green mulch bought from the Department of Waste Management.

8. Sewage discharges

Collected septic tank wastes are pumped directly into the ocean at the shoreline near the landfill. Between 50,000 (50m^3) and 100,000 litres (100m^3) of collected septic effluent is discharged annually to the ocean.

[99] Ball M, Päpke O & Lis A (1990). Polychlordibenzodioxine und Polychlordibenzofurane in Zigarettenrauch. *Beitr Tabakforsch Int* 14: 393–402

[100] Löfroth G & Zebühr L (1992). Polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) in mainstream and sidestream cigarette smoke. *Bull Environ Contam Toxicol* 48: 789-94.

[101] UNEP (2012). *Toolkit for Identification and Quantification of Dioxins and Furans and Other Unintentional POPs. 445pp*

9. Used Oil

Tuvalu imports around 30,000 litres of lubricants per year and exports 20,000 litres of used oil per year (i.e. 66% of import volumes) to Fiji for combustion as an alternative fuel in a steel mill. Used oil that is not collected and exported is used as a motorbike chain lubricant.

2.3.9.3 Improved management of E-waste

E-waste is made from sophisticated blends of plastics, metals, and other materials and may contain a range of hazardous substances including heavy metals (such as mercury, cadmium and lead), Brominated Flame Retardants (BFRs, including those that are listed under the Stockholm Convention) and other substances. Consequently, planned management and disposal of e-waste in Tuvalu is important for the maintenance of long-term community and environmental health. The e-wastes of concern are those items containing a significant portion of circuit boards, or with external cases that may contain brominated flame retardants (POP-PBDEs and HBCD) such as television and computer housings. It is critical that e-waste is not burnt to prevent production of uPOPs.

National e-waste generation rates are increasing rapidly due to the recent introduction of televisions, computers and mobile phones. These items are technically straightforward to recycle, but the challenge is initially collecting them for export. This will require a dedicated system targeted at e-waste management, and a clear pathway to communicate to the public that e-waste should be recycled. Primary processing (i.e. partial dismantling) of e-waste before export may compact export volumes. The transfer station would be an appropriate collection point for e-waste and a good base for the recycling effort. No shredding of plastic cases or circuit boards or burning of cables to remove insulation must take place, to minimise releases of uPOPs from the recycling operations. BFRs, typically of the POP-PBDE class of chemicals, should not be widespread in electronic consumer goods imported into Tuvalu. Furthermore, equipment compliant with the European Union (EU) Directive on Restriction of Hazardous Substances in Electrical and Electronic Equipment should not contain BFRs, and this is likely the case with e-waste that might be collected in the future in Tuvalu.

2.3.9.4 National frameworks implemented by trained and empowered officials

A number of high-level strategies, which explicitly address uPOPs management, are required to successfully reduce uPOPs emissions at the national level. This includes development and enforcement of national policies, strategies, plans and legislation, and strengthening of institutional arrangements to support and promote best practice waste management, including uPOPs emission reduction. Regular collection, collation and release of data related to uPOPs management practices is also critical to maintain this process.

2.3.9.5 Improved public awareness and worker safety and training

Implementation of best practice occupational health and safety measures for formal and informal workers in the waste management sectors, and improved public awareness of the health impacts of uPOPs are priority management initiatives for national uPOPs reduction. This includes dissemination of information about resource recovery programmes that increase e-waste recycling and composting rates. It is also important that open burning of waste continues to be minimised in Tuvalu through ongoing public education campaigns and continuing green waste collection.

2.3.9.6 Projected uPOPs emissions

Tuvalu's uPOPs emissions are likely to decrease into the future based on on-going waste management programmes. This includes support for implementation of Tuvalu's Integrated Waste Policy and Action Plan (2016). Other activities currently being implemented, or forecast will also reduce future uPOPs emissions are summarised in Table 17.

Table 17: Qualitative assessment of projected uPOPs emissions in Tuvalu post 2019

Source Group	Source Group Description	Likely future trend in uPOPs emissions
1	Waste incineration	Decrease due to improved healthcare waste incineration
2	Metal production	Not relevant to Tuvalu
3	Heat and Power	Decrease due to attainment of national renewable electricity generation targets
4	Mineral product production	Not relevant to Tuvalu
5	Transportation	The Tuvalu National Energy Policy (2009) calls for promoting public awareness about good transport management practices such as vehicle tuning and fuel conservation measures. If implemented, these measures will reduce uPOPs emissions. However, use of diesel in marine operations is expected in increase with the extended use of a Police surveillance vessel donated by the Australian Government
6	Open Burning	Decrease in uPOPs emissions likely due to improvements in waste management landfill practices that minimise risk of landfill fires
7	Production of consumer and chemical goods	Not relevant to Tuvalu
8	Miscellaneous	Implementation of measures to reduce smoking rates would decrease uPOPs emissions
9	Disposal	Decrease in uPOPs emissions likely due to improvements in solid, liquid and hazardous waste management anticipated under the NIP
10	Identification of Potential Hotspots	Decrease in uPOPs emissions likely due to the identification of potential hot-spots and progressive site safeguarding and remediation

Table 18: Tuvalu uPOPs management priority summary

No	uPOPs Chemical (listed alphabetically)	Use	Annex	Tuvalu use or unintentional production	Action required	Chemical use
11	Hexachlorobenzene (HCB)	Pesticide and by product	A & C	None known	uPOPs Management	First introduced in 1945 to treat seeds, HCB kills fungi that affect food crops.
12	Hexachlorobutadiene (HCBD)	Industrial chemical	A & C	None known	uPOPs Management	No longer internationally produced. HCBD was used as intermediate in the chemical industry
17	Pentachlorobenzene (PeCB)	Pesticide and Industrial chemical	A & C	None known	uPOPs Management	No longer internationally produced
19	Polychlorinated biphenyls (PCBs)	Industrial chemical	A & C	Detected in the past in electrical transformers	uPOPs Management	Used as heat exchange fluids, in electric transformers and capacitors
20	Polychlorinated naphthalenes (PCNs)	Industrial chemical	A & C	None known	uPOPs Management and Improved Waste Management	Combustion (primarily waste incineration) is considered the most significant current source. Releases from former uses (PCN or impurities of technical PCB) contained in landfills or old appliances (stockpiles) are plausible but difficult to assess
27	Polychlorinated dibenzo-p-dioxins (PCDDs)	By products	C	Release inventories for dioxins and furans should be updated at least once every 5 years (Article 5)	uPOPs Management	There are 75 different dioxins. These chemicals are produced unintentionally due to incomplete combustion, as well during the manufacture of pesticides
28	Polychlorinated dibenzofurans (PCDFs)	By products	C	Release inventories for dioxins and furans should be updated at least once every 5 years (Article 5)	uPOPs Management	There are 135 different types of furans. These chemicals are produced unintentionally due to incomplete combustion, as well during the manufacture of pesticides

2.3.10 Information on the state of knowledge on stockpiles, contaminated sites and wastes, identification, likely numbers, relevant regulations, guidance, remediation measures, and data on releases from sites

Contaminated sites are believed to be a potential issue in Tuvalu, although the extent of the problem is yet to be fully determined. Preliminary investigations under the 2008 NIP enabling project identified numerous potentially contaminated sites, which required full characterisation to assess the actual contamination risk.[102] These investigations were not undertaken. Potentially contaminated sites that may exist in Tuvalu include:

2.3.10.1 Potentially contaminated sites - Vaitupu[103]

Buried heavy equipment was identified on Vaitupu. According to residents, a Japanese company building the Vaitupu wharf in 1998 buried all heavy equipment in three areas on the island, including under the football field.

2.3.10.2 Potentially contaminated sites - Nanumea[104]

On the island of Nanumea, seven hundred 44-gallon drums of World War II waste were identified. The drums contained hydrocarbons, either oil or kerosene and are leaking into the sea. Anecdotal evidence (2008) from residents indicated that the fish in this area are poisonous.

2.3.10.3 Potentially Contaminated site - Funafuti Landfill

Accidental landfill fires have been a significant issue in the past in Funafuti, and the most recent fire at the landfill occurred in 2019 during a drought with the fire burning for over a week and incinerating an estimated 205,000kg of waste.[105] The landfill fire was eventually extinguished by the fire brigade. The fire brigade undertook fire-fighting duties without access to breathing apparatus and used AFFF foam to extinguish the fire.[106] It is likely that the landfill site is contaminated with fire-fighting foam as well as with uPOPs generated by a long history of uncontrolled landfilling.

2.3.10.4 Potentially Contaminated site - Tuvalu International Airfield Funafuti

The fire service conducts regular training using foam at the northern end of the airfield on grass, on the ocean side of the island. Around 25 litres of foam concentrate enter the environment during each training session. The last time foam was used in a training exercise was January 2019. Kerr Filmfoam 916K does not contain PFOS or any longer chain PFAS but does contain persistent “Fluorinated Surfactants”, and the airport training ground will have to be regarded as contaminated as a consequence.

2.3.10.5 Potentially contaminated site - TEC Funafuti

Waste oil was observed leaking into the ground from stored oil drums at the TEC in 2008, and it was concluded that there was a high possibility that PCB contamination of soil has occurred.[107] Twelve (12) old transformers and eights switch gears are currently stored undercover at TEC. The oil has been drained from the transformers into twelve 220lt drums. The drums are in poor condition and are stored out in the open. The oil tested positive to field strip tests for PCBs in 2017, but no follow up confirmatory testing done. It is possible the soil in the vicinity of the drums is contaminated with PCBs.

[102]Government of Tuvalu (2008). *National Implementation Plan*. 103pp
[103]Government of Tuvalu (2008). *National Implementation Plan*. 103pp
[104]Government of Tuvalu (2008). *National Implementation Plan*. 103pp
[105]Mr Walter Kaua, Director Department of Waste Management (2019). Pers comm.
[106]Mr H. Halovaala, Fire Captain (2019) Pers com.
[107]Government of Tuvalu (2008). *National Implementation Plan* (NIP)

2.3.10.6 Other hazardous materials

2.3.10.6.1 Asbestos Containing Materials

A survey of asbestos containing materials was undertaken in Tuvalu in 2014 by SPREP.[108] The survey estimated that approximately 130–140 houses in Tuvalu have asbestos cladding and/or roofing. Asbestos containing materials were also detected in the *Sanus Service Station* and in the Meteorological Centre. Government Officers have reported that significant quantities of asbestos containing building materials are contained in houses on the outer islands.[109] There is a national priority for the development of a national asbestos management strategy which includes drafting of relevant legislation, asbestos monitoring, as well as asbestos collection and export strategies and public awareness and worker training.

2.3.10.6.2 Used oil[110]

A 2018 review of used oil management in the Pacific indicated that Pacific Energy South West Pacific Ltd (Pacific Energy) is the sole lubricant importer to Tuvalu and that the TEC is the main national consumer of lubricants. Tuvalu theoretically generates around 3,500 litres of used oil per year, of which 70% is usually exported to Fiji's steel mill.[111] Uncollected used oil is used as a motorbike chain lubricant. There are currently issues around lack of insurance to cover used oil exports preventing its export to Fiji. Around 10,000 litres of used oil are currently (2019) stockpiled in IBCs on Funafuti. These are stored at the transfer station (4,000 litres); the TEC (1,700 litres) and at Pacific Energy (2000 litres). Around 20,000 litres of used oil are exported to Fiji each year by the Department of waste Management/Pacific Energy. Each of the outer islands has an IBC for used oil collection and storage, although these IBCs containing used oil are unable to be transported to Funafuti on the inter-island passenger boat for health and safety reasons.

2.3.10.6.3 Used lead acid batteries

Approximately 2,000 uLABs are currently (2019) stored in two 24ft shipping containers located at the transfer station awaiting export for recycling. All outer islands now largely rely on solar generation for electricity production and have batteries and backup diesel generators. Solar lead acid batteries have a 10 to 15-year life span, and the first batteries were installed in the outer islands in 2009, with installations being completed in 2015. Battery banks installed on the outer islands range from 45 to 400kWh. These batteries will be likely to sequentially reach the end of their service-life from around 2020 and will need to be transported offshore for recycling. At this time, uLABs must be shipped through Samoa as Tuvalu is not a signatory to the Basel Convention.

2.3.10.6.4 School Laboratory Chemicals

There is one state secondary boarding school on Vaitupu, with about 600 students, and one private secondary school run by the Congregational Christian Church of Tuvalu, located in Funafuti. There are no laboratories associated with the Funafuti secondary school. The State-run boarding school has 4 laboratories used by 140 students in years 10-13 (Form 4-17). School laboratories require refurbishment to safely store chemicals and do not have a chemical management system in place. Staff are not experienced in chemical disposal and require training in best practice chemical management and disposal techniques.

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[108]SPREP (2014). *Survey of the Regional Distribution and Status of Asbestos-Contaminated Construction Material and Best Practice Options for its Management in Pacific Island Countries.* Report for the Republic of Tuvalu. 84 pp.
[109]Walter Kaua (2019). Pers comm
[110]Haynes *et al*. (2018). *Desktop review of used oil management data.* SPREP. 21pp
[111]Haynes (2018). *Desktop review of Pacific used oil data*. 21 pp.

2.3.11 Summary of future production, use, and releases of POPs – requirements for exemptions

As a country that does not produce chemicals, Tuvalu has no plans to intentionally produce any of the POPs chemicals. In addition, Tuvalu does not have any plans to import any of these chemicals for use or release in the country and as such, no exemptions are required.

2.3.12 Existing programmes for monitoring releases and environmental and human health impacts, including findings

Tuvalu participated in the first GMP, which analysed POPs in air and human breast milk samples in 2010 and 2011 respectively. The results are presented in Table 19. Only limited national use of this data has occurred. Tuvalu is currently participating in the second GMP which will analyse POPs in air, water and human breast milk samples. No results are yet available for this current monitoring period, and difficulties in securing funding to allow transport of collected samples to analysis laboratories have occurred, compromising the programme. Samples of butter, eggs, fish and chicken have also been collected for analysis, and this should be reviewed as most of these items are imported and are not produced locally. Monitoring under the GMP is a high national priority and should be revised, supported and continued.

Table 19. Summary of GMP Results for Tuvalu, 2010-2011

Chemical	Air Sampling (2010) (pg m^{-3})	Breast Milk (2011) (ng g^{-1} fat)
Aldrin	<LOQ	<LOQ
Chlordane	6.6 (gamma chlordane)	<LOQ
Sum of 6 DDTs	189.9	91.0
Dieldrin	15.6	0.7
Endrin	4.4	<LOQ
Heptachlor	<LOQ	<LOQ
HCB	13.6	3.6
Sum 2 Heptachlorepoxides (cis+trans)		0.5
Mirex	<LOQ	<LOQ
2,3,7,8 TCDD	<LOQ (fg/m^3)	0.5
2,3,7,8 TCDF	2.8 (fg/m^3)	0.3
Sum 17 PCDDs/Fs	83.6 (fg/m^3)	39.4
Sum of 6 PCBs	25.9	7.8
Sum of 12 PCBs		1671 (pg/g fat)
Toxaphene	ND	<LOQ
Alpha-HBCD		0.7
Gamma-HBCD		<LOQ
Alpha-HCH	<LOQ	<LOQ
Beta-HCH	<LOQ	1.8
BDE		<LOQ
Gamma-HCH	13.7	<LOQ
Endosulphan		<LOQ

<LOQ = less than the limit of quantification; ND = Not Detected.

2.3.13 Current level of information, awareness, education and communication among target groups; existing systems to communicate such information to the various groups

The POPs in PICs Project and NIP development in 2003 and 2008 respectively were assessed as increasing the knowledge and awareness of POPs issues in Tuvalu. This was achieved through running workshops with communities, businesses, local corporations, women's groups and government Ministries discussing POPs issues; and through the development, production and distribution of an information pamphlet and posters on POPs. The UNEP/GEF-PAS Pacific POPs Release Reduction Project had a component in Tuvalu, and this project could be usefully extended to make the public more aware of the health risks of uPOPs (and other chemicals) contained in cigarette smoke. A major education and training programme is required to improve healthcare workers management of healthcare wastes and TEC workers require training in the management of potentially PCB contaminated equipment and oils. The DWM conducts community education and awareness programmes on improved community waste management and recycling four times per year across all islands. Additional information about POPs could be easily incorporated into this programme at little additional cost.

2.3.14 Mechanism to report under Article 15 on measures taken to implement the provisions of the Convention reporting and for information exchange with other Parties to the Convention

Due to the limited technical capacity, Tuvalu has not sent any reports to the Stockholm Convention Secretariat.[112] Tuvalu is planning to submit its first report after the submission of this updated NIP. Tuvalu attends COP meetings where the national status of chemical management is disseminated. A more integrated mechanism to manage Stockholm Convention requirements is required into the future, and this is addressed in Action Plan One.

2.3.15 Relevant activities of non-governmental stakeholders

A number of community groups are engaged in environmental issues. These include schools, youth groups, island community associations, athletic teams, church youth groups and the Tuvalu Association of Non-Governmental Organisations (TANGO). Environmental week (June) is the major national focus on promoting environmental issues and this is often combined with national biodiversity days. These promotions provide opportunities for children, youth and community members to engage in environmental discussions and actions.

2.3.16 Overview of technical infrastructure for technical infrastructure for POPs assessment, measurement, analysis, alternatives and prevention measures, research and development – linkage to international programmes and projects

Tuvalu has no suitable laboratory to test for POPs. Facilities for the analysis of POPs are available in Hawaii, Australia or New Zealand. It is recommended that a small facility be established to manage sampling, packaging and offshore shipment of collected POPs samples. On-going training should be provided to a selected number of officers with an appropriate background to help build the national basis of pesticide and industrial POPs monitoring expertise in the country. Tuvalu should continue to engage and participate in the GMP.

[112] http://ers.pops.int/eRSodataReports2/ReportSC_Submit_Status.html

2.3.17 Overview of technical infrastructure for POPs management and destruction

There is currently no infrastructure to manage and destroy POPs in Tuvalu. All materials for disposal or destruction would need to be shipped to Hawaii, Australia or New Zealand.

2.3.18 Identification of impacted populations or environments, estimated scale and magnitude of threats to public health and environmental quality, and social implications for workers and local communities

The potential threat posed to Tuvalu from POPs is expected to be extremely low due to the absence of these chemicals on the island. Any reduction in the number of accidental dumpsite fires, further advances in meeting national renewable energy targets, reduction in reliance on motorbikes for transportation and joy riding (i.e. begin walking or bike riding where practical) and a reduction in national cigarette smoking rates would reduce this exposure still further.

2.3.19 Details of any relevant system for the assessment and listing of new chemicals

The Pesticide Act (revised 2008) prohibits the supply, sale, or use of any pesticide in Tuvalu which is not registered under the Act. The Act also establishes the Office of Registrar of Pesticides that is responsible for the administration of the Pesticides Committee (which membership includes Public Health, Agriculture, pesticide importers and users), the maintenance of a Register of Pesticides and the regulation of the import of pesticides.

In assessing an application to import a new pesticide, the Committee has powers to (a) direct that a pesticide be registered for up to five years and to stipulate conditions for import, transport, storage, distribution, sale, supply, use and disposal of pesticides; or (b) defer consideration of the application pending provision of additional information from the applicant; or (c) decline the application, informing the applicant of the reasons. For the assessment and listing of other new chemicals (besides pesticides) there is currently no legislative framework in place in Tuvalu.

2.3.20 Details of any relevant system for the assessment and regulation of chemicals already in the market

The Pesticide Act (revised 2008) is the only legislation dealing with national chemical management. It prohibits the supply, sale, or use any pesticide in Tuvalu which is not registered under the Act. The Act also establishes the Office of Registrar of Pesticides that is responsible for the administration of the Pesticides Committee (which includes membership includes Public Health, Agriculture, pesticide importers and users), the maintenance of a Register of Pesticides and the regulation of the import of pesticides. The Pesticide Act also has provisions for the appointment of pesticide inspectors to investigate breaches of the Act. Where the committee considers that: (a) there is no need in Tuvalu for the use of a pesticide; or (b) the continued use of a registered pesticide is ineffective; or (c) the use of a pesticide gives rise or is likely to give rise to an unacceptable hazard to the people or environment of Tuvalu, the committee shall cancel or suspend the registration of a pesticide. Currently in Tuvalu there is no legislative framework governing the assessment and regulation of other chemicals (besides pesticides) already on the market.

2.4 Implementation Status

Tuvalu developed its first NIP in 2008 to address management of the 12 initial POPs. This current NIP represents the first update to the initial NIP, and it covers the 28 POPs chemicals listed under the

Stockholm Convention as at December 2019. Table 20 presents the progress made since 2008 in completing original NIP Action Plan actions.

Table 20. National progress summary (2007-2019) of NIP activities

Action	Action Plan Components (2008)	Implementation Status (2019)
Strategy for National Coordination, management, reporting, information exchange and public information and awareness and education	1. Employ a permanent national coordinator to implement the NIP and other related chemicals initiatives 2. Establish and maintain a POPs library and database 3. Provide information support to main chemical users including secondary and tertiary schools and encourage including units of chemical management especially related to POPs in curricula 4. Convene interagency and multi-stakeholder workshops to identify roles and how NIP implementation activities can fit into existing and future sectoral strategic plans 5. Develop a recommendation to become a Party to the Rotterdam Convention 6. Coordinate NIP activities across government, to gather, disseminate and store information on POPs 7. Strengthen enforcement of provisions in the Waigani Convention 8. Report on (NIP) activities as determined by the COP	1. No action. Priority to employ an officer with responsibility for management of all chemical issues. Management of oil spill response a national priority 2. No action. Appointment of Data Manager planned 3. No action 4. No action 5. Progress being made by the DWM 6. No action 7. Management of Waigani Convention has been transferred to the DWM. Customs Officers need training in Convention requirements 8. No Action
Assessment with respect to Annex A, part I chemicals (POPs pesticides)	9. Improve recording, monitoring and enforcement of the current controls over pesticides 10. Train DOE staff in identification and OH&S associated with hazardous waste handling and repackaging 11. Repackage chemicals in the Elisefou agriculture store on Vaitupu and ship offshore for disposal	9. No Action. No resources or capacity to manage requirements of the Pesticide Act 10. No Action 11. No Action. Pesticides no longer present at this site
Assessment with respect to Annex A, part II chemicals (PCBs)	12. Training on the use of field test kits, test in-use transformers and switch gears 13. Quantify the amount of PCB contaminated oil (if any) remaining in Tuvalu 14. Sample soil in the immediate vicinity of PCB-contaminated oil, and test the samples for PCBs 15. Establish and implement a system of safe handling, storage and transport of PCB contaminated equipment 16. Export, eliminate and destroy all PCBs, PCB-containing materials and PCB waste no later than 2010	12. No Action 13. No Action 14. No Action 15. No Action 16. No Action
Strategy for the Reduction and Elimination of the release of Unintentional POPs (uPOPs)	17. Include methods to reduce uPOPs in related national policies including the National Solid Waste Management Strategy 18. Vehicle Emissions Action Plan 19. Programme on medical wastes 20. Include BAT/BEP the National Solid Waste Management Strategy for open burning and educate stakeholders	17. No Action 18. No Action. Vehicle imports not regulated 19. PacWaste intervention completed but has not achieved any measurable improvement in healthcare waste management 20. SWAT (DWM) has undertaken extensive public engagement since 2008
Strategy for the Reduction and Elimination of Releases from Stockpiles and Contaminated Sites	21. Train staff in the assessment of contaminated sites using the field-based Risk Screening System and environmental sampling 22. Undertake detailed assessments of potentially contaminated sites in Tuvalu by 2008 23. Develop management plan for highly contaminated sites by end of 2008 24. Develop cost estimates and obtain funds by mid-2009 to remediate or clean up contaminated sites 25. Remediation of highly contaminated sites by end of 2010 26. Undertake public awareness to help identify additional contaminated sites	21. No Action 22. No Action. Hospital waste disposal site should also now be considered a potential hazardous site 23. No Action 24. No Action 25. No Action 26. No Action
Strategy for Research, Development and Monitoring	27. Train staff from Department of Environment in the collection of air and human breast milk samples, and in the interpretation of results 28. Assist the University of the South Pacific in the collection of air and water samples	27. Environment staff assisted in GMP sampling in 2018 28. See above
Strategy for increased capacity	29. Train staff on effective control of the importation of hazardous chemicals including enforcement of import restrictions, detection of illegal imports and on managing information on pesticide imports 30. Increase government and public awareness of the POPs issue through education, training and public information campaigns	29. No Action 30. Quarterly waste management public awareness campaigns and GEFPAS POPS awareness campaign completed

3. Gender Dimensions relevant to NIP implementation[113]

3.1 Background

Susceptibility to the impacts of chemicals is a consequence of both exposure and biological factors. Chemical exposure depends on many diverse factors including geographical location and behavioural patterns, and biological factors that can include physiological differences between women and men, age, and nutritional status[114].

3.2 The Gender Dimension

While exposures to chemicals pose a constant risk, there are windows of susceptibility for both women and men when these exposures can have critical effects regarding development and disease. Some chemicals have been shown to have different physiological impacts depending on the sex of the person. However, there is only limited data on how different gender roles differentially expose men and women to hazardous chemicals[115]. Pregnancy, and lactation are windows of susceptibility for women where they can transfer toxic chemicals to their children[116]. PCBs, organochlorine pesticides, PFCs, phenols, PBDEs, phthalates, polycyclic aromatic, hydrocarbons (PAHs) and perchlorate are detectable in almost all tested pregnant women[117]. For both girl and boy infants, the weeks just before and after birth are high-risk, as is puberty for both. Foetal, infant, adolescent periods are windows of susceptibility for men where several disorders can occur at different periods throughout life as a result of exposure to a given endocrine disrupting chemical (EDCs) (or mixture) at one of these periods[118].

3.3 Chemical Exposure

Men and women are often exposed to differing concentrations and types of toxic chemicals and they have different health reactions to this exposure. Thus, gender is a critical component to consider when formulating policies and programmes in the area of sound management of chemicals (SMC)[119]. One way to consider the gender differences in exposures is by looking at the occupation and domestic roles of men and women.

3.4 Occupational Exposure

Of concern is the exposure of workers in areas where chemical use is rapidly expanding, including electronics, textiles, construction, agriculture, and services such as cleaning, maintenance,

[113]BRS Conventions at Gender Action Plan of the Secretariat of the Basel, Rotterdam and Stockholm conventions (BRS-GAP) for 2016-2017 Updated version http://www.brsmeas.org/Gender/BRSGenderActionPlan/tabid/3652/language/en-US/Default.aspx

[114] European Chemicals Agency (ECHA) definition at https://echa.europa.eu/chemicals-in-our-life/hottopics/chemical-mixtures-and-the-cocktail-effect

[115]SAICM (2017). Gender and the sound management of chemicals and waste: Paper prepared for the intersessional process considering the Strategic Approach and the sound management of chemicals and waste beyond 2020. SAICM/IP.2/1. 21pp

[116]Ostojic and Natalija (2016). UNDP "Health Risks and Impacts of Hazardous Chemicals in Products on Women and Children"

[117]Woodruff, T. J., Zota, A. R., & Schwartz, J. M. (2011). Environmental Chemicals in Pregnant Women in the United States: NHANES 2003–2004. *Environmental Health Perspectives*,119(6), 878-885. doi:10.1289/ehp.1002727

[118]Diamanti-Kandarakis, E., Bourguignon, J., Giudice, L. C., Hauser, R., Prins, G. S., Soto, A. M., Zoeller, R., &Gore, A. C. (2009). Endocrine-Disrupting Chemicals: An Endocrine Society Scientific Statement. *Endocrine Reviews*, 30(4), 293-342. doi:10.1210/er.2009-0002

[119]Tyrkko and Gaba (2011). Energy & Environment Practice Gender Mainstreaming Guidance Series Chemicals Management. UNDP. 28pp

hairdressing, manicure and pedicure[120,121]. While men and women are generally both involved in all these professions, women tend to have a higher level of informal employment than men, and therefore less access to benefits and social protection, low representation and more occupational hazards[122].

3.5 Domestic Exposure

Personal care products such as soaps, creams, deodorants, shampoos, and cosmetics contain many chemicals that impact women and men differently. Women and men often have separate personal care products, with women and girls more likely to use more personal items per day than men, increasing dermal exposure to toxins. Safety data is lacking for most chemicals in personal care products (which may include lead, toxic metals, parabens, triclosan phthalates, mineral oils, nanomaterials and formaldehyde[123]). Many chemicals found in cosmetics have been linked to breast cancer, asthma, allergies, and reproductive disorders[124]. Domestic work using household cleaning products can lead to exposure to a wide range of chemicals. Common cleaning substances, such as bleaches, ammonia and various cleaning fluids containing solvents, may cause irritation of eyes and lungs, give off poisonous gases when combined with each other, and - in the case of some cleaning solvents - are suspected carcinogens[125]. As well, a perception of reduced severity can result in little attention to the chemicals used in for example, cleaning, cooking, drinking water and food packaging[126].

3.6 Gender Dimension within the Tuvalu NIP

The Secretariat of the Basel, Rotterdam, and Stockholm (BRS) Conventions have integrated gender equality into their activities through a Gender Action Plan (2016). One of the Plan's objectives includes *promotion of the consideration of gender issues in hazardous chemicals and waste management at the national and regional levels*[127]. This NIP update has been utilized to incorporate gender-considerations into revised implementation plans. Specifically, this can help:

- Raising awareness of the linkages between chemical exposures, the effects on human health and the environment, and gender differences in risks and impacts; and
- Promote a multi-stakeholder approach to ensure the participation of women and vulnerable populations in policy development and decision-making processes.

For Tuvalu, Table 21 highlights the key national chemical management issues and their possible linkages to gender.

Table 21. Gender aspects of chemical exposure in Tuvalu

Chemical of Concern	Key Activities	Output/Outcome
• Mosquito control chemicals • Wood-fired cooking (uPOPs generation)	Raise awareness of the linkages between chemical exposures, the effects on human health and the environment, and gender differences in risks and impacts (AP9.23, AP11.2, AP11.10)	Improved support for minimising exposure to pesticides, and reduced uPOPs exposure among women

[120] Ostojic and Natalija (2016). UNDP Health Risks and Impacts of Hazardous Chemicals in Products on Women and Children
[121]Scientific American at https://www.scientificamerican.com/article/these-4-chemicals-may-pose-the-most-riskfor-nail-salon-workers/
[122]WECF (2015). Women and Chemicals: the impact of hazardous chemicals on women
[123]Women in Europe for a Common Future (2015). Women and Chemicals: the impact of hazardous chemicals on women
[124]Ostojic and Natalija (2016). UNDP "Health Risks and Impacts of Hazardous Chemicals in Products on Women and Children
[125]WHO (1999). Women and Occupational Health: issues and policy paper for the global commission on women's health
[126]UNEP (2016). Global Gender and Environment Outlook. UN Environment, Nairobi, Kenya
[127]BRS Conventions at Gender Action Plan of the Secretariat of the Basel, Rotterdam and Stockholm conventions (BRS-GAP) for 2016-2017 Updated version http://www.brsmeas.org/Gender/BRSGenderActionPlan/tabid/3652/language/en-US/Default.aspx

• Tobacco smoking (uPOPs generation) • Chemicals present in consumer products (PFCs, EDCs)	Promote a multi-stakeholder approach to ensure the participation of women in policy development and decision-making processes (AP1.2, AP3.1)	Gender perspectives are incorporated into environmental decision-making
	Strengthening the focus on developing, collecting and analysing national gender-disaggregated data, indicators and other information (AP13.7, AP13.9)	Increased understanding of gender roles in relevant sectors

4. Socio-economic Assessment

4.1 Background

Socio-economic impact analysis is one of the key components of the complex management process in which risks resulting from environmental contamination by chemicals are identified and assessed[128]. The aim of socio-economic analysis within the field of chemical risk management is to assist the decision-making process by making explicit the implications of choosing one risk management option over another. Within the NIP context, this helps inform decision makers of the social and economic costs and benefits of reduction in POPs use and exposure through implementation of the Stockholm Convention requirements[129]. A transparent socio-economic analysis can help inform decision makers and stakeholders of what will be involved in terms of positive and negative effects, both across social groups and across the economy[130]. A risk assessment helps characterise the risk posed by chemical exposure (to humans and to the environment) and a socio-economic analysis evaluates change within the socio-economic situation based on various combinations of potential risk mitigation measures. In the context of risk management of chemical exposure, the social and economic impacts may include impacts on human health; impacts on the environment; and impacts on economic development[131,132]. Whilst all three aspects are important, the minimisation of the impact of POPs chemicals on human health is typically paramount, especially for the general population and for workplace exposure[133].

4.2 Assessment methodology

Typically, an analysis of the socio-economic impact of POPs management under the Stockholm Convention will encompass:

1. The characterisation of the societal problems leading to POPs use (identified during the NIP baseline)
2. The characterization of the impacts of POPs use (identified during the NIP baseline)
3. The assessment of the impacts (positive or negative) of producing or using specific POPs (identified during the NIP baseline)
4. The analysis of alternative/best practice management options (identified during the NIP baseline)
5. The analysis of the economic and social effects and the cost of POPs reduction or phase-out
6. Recommendations on meeting the social and economic cost of controlling or banning POPs

[128]Zvonko *et al.* (2015). Assessment of the Socio-economic Impact of the Chemicals Environmental Contamination. *International Review* (1-2), 113-18.
[129]UNEP (2014). *Interim guidance for developing a national implementation plan for the Stockholm Convention*. 51pp
[130]UNEP (2017). Guidance on Socio-Economic Assessment for National Implementation Plan Development and Implementation under the Stockholm Convention. 70pp
[131]Zvonko *et al.* (2015). Assessment of the Socio-economic Impact of the Chemicals Environmental Contamination. *International Review* (1-2), 113-18.
[132] Brnjaš *et al.* (2015). Socio-economic aspect of hazardous chemicals environmental impacts. *3rd International Conference. New Functional Materials and High Technology NFMaHT*, Tivat, Montenegro.
[133]Brnjaš *et al.* (2015). Socio-economic aspect of hazardous chemicals environmental impacts. *3rd International Conference. New Functional Materials and High Technology NFMaHT*, Tivat, Montenegro.

4.3 Tuvalu socio-economic assessment

A systematic qualitative analysis, where the relative magnitude, significance and relative importance of the risks, costs and benefits are described but not quantified was used to complete the Tuvalu NIP assessment (Table 22). Management of PCBs and uPOPs is predicted to increase national chemical management costs. In contrast, national management of all other Stockholm listed chemicals will have no immediate direct cost implications for the nation. This is largely due to the ongoing funding of improved waste management operations in all islands of Tuvalu through the EDF11 funding envelope.

Table 22. Tuvalu Stockholm POPs socio-economic assessment summary

Stockholm Chemical(s)	Proposed NIP Management Action	Environmental Benefit	Human Health Benefit	Relative Cost Implication*
POPs pesticides	• Maintain national ban on importation of listed POPs pesticides • Continue monitoring under GMP	Protects the environment from impacts of POPs	Protects human health from potential effects on endocrine and immune systems, liver, reproductive system and the cancer impacts of POPs	No additional cost
Agricultural pesticides	• Continue limited use in Taiwanese Market gardens of specific horticulture pesticides	Localises and minimises environmental release of horticultural pesticides	Minimises national human exposure to horticultural pesticides	No additional cost
Mosquito vector control insecticides	• Continue vector control on an "as need" basis based on routine insect larval monitoring	Minimises environmental release of carbamate-based insecticide	Minimises national human exposure to insecticide Minimises risk of Dengue outbreak	No additional cost (insecticide provide at no cost by WHO)
PCBs	• Testing of potentially contaminated oil and soils at TEC • Clean up and disposal of PCB contaminated substances as necessary • Continue monitoring under GMP	Prevent further loss of PCBs to soil and groundwater	Prevents any further exposure of TEC workers to PCBs	Testing, and if present, site clean-up and offshore transport of PCB contaminated materials and equipment will be expensive (AP 5.3.3)
POP-PBDEs	• Improved domestic waste management • Improved E-waste management • Improved EOL vehicle management • Continue monitoring under GMP	Prevent further loss of PBDEs to soil and groundwater		• No immediate additional cost (improved waste management practices funded by the EU) • Implementation of an ADF will increase cost of domestic purchase of electrical, electronic equipment and motor vehicles
HBB	• Improved domestic waste management • Improved E-waste management • Improved EOL vehicle management	Prevent further loss of HBB to soil and groundwater		Costed under POP-PBDE management costs

HBCD	• Improved domestic waste management	Prevent further loss of HBCD to soil and groundwater		Costed under POP-PBDE management costs
HCBDs	• Testing of potentially contaminated oil and soils at TEC • Clean up and disposal of HCBD contaminated substances as necessary	Prevent further loss of HCBDs to soil and groundwater		Costed under PCB management actions (including uPOPs reductions)
PCNs	• Minimise uPOPs releases from low temperature waste incineration and open burning	Minimise loss of dioxins, furans and other uPOPs to the environment	Minimise exposure to dioxins, furans and other uPOPs	Costed under uPOPs management
SCCPs	• Improved domestic waste management	Prevent further loss of PBDEs to soil and groundwater		Costed under improved waste management practices
DDT	• Maintain national ban on importation of listed POPs pesticides • Continue monitoring under GMP	Prevent loss of DDT to soil and groundwater, impacts on fauna	Prevents human exposure to DDT	DDT not used in malaria vector control. No additional cost
PFOS and PFOSF	• Maintain national ban on importation of listed POPs • Continue monitoring under GMP	Prevent loss of PFOS to soil and groundwater, impacts on fauna	Prevents human exposure to PFOS	PFOS not used in national fire suppression. No additional cost
uPOPs	• Maximise renewable energy generation rates • Minimise open burning • Continue monitoring under GMP • Increase Ewaste recycling rates • Minimise low temperature waste incineration • Minimise cooking with wood fired stoves • Increase motor vehicle pollutant emission standards • Minimise national tobacco smoking rates	Minimise uPOPs generation and loss to environment	Minimise human exposure to uPOPs emissions	• Reduced household electricity costs • No additional waste disposal costs • Decreased community medical intervention cost • Increased healthcare waste disposal costs • Increased household cooking costs • Increased motor vehicle purchase costs • Increased tobacco prices

*Green: no additional cost; Orange: eventual cost increase; Red: immediate cost increase

5. Strategy and Action Plan

5.1 Policy Statement

Tuvalu recognises the national and global environmental and public health risks of POPs and other hazardous chemicals and wastes, and is committed to taking national action to reduce and eliminate the consumption and unintentional releases of these chemicals, in accordance with its obligation as a Party to the Stockholm Convention, and its responsibility as a global citizen.

The Tuvaluan Government also recognises that economic development will likely lead to an increase in the importation of chemicals and articles potentially containing POPs, and if improperly managed, chemicals will potentially have immediate and prolonged adverse impacts to the national environment and health of Tuvaluans.

Faced with these realities, the Tuvaluan Government believes that a core focus of the NIP must be to improve the management of all chemicals and wastes in the country, in order to protect human health and the environment. The revision and subsequent implementation of this NIP helps to achieve a clear pathway for the management of POPs and thereby reduce the potential economic and environmental costs that result from their mismanagement.

Building on the initial NIP implementation process, the Government is committed to addressing identified shortcomings and to strengthen the updated NIP implementation process, focusing on enhancing co-operation and co-ordination among stakeholders. The Government is committed to the implementation of this NIP through the lead agency, the Department of Environment. The Government endorses this NIP to reaffirm its commitment to addressing the national management of POPs in accordance with its obligations under the Stockholm Convention.

The Tuvaluan Government it is aware that POPs management is just a small part of national chemicals and waste management. It is the Government view that an integrated approach that utilises financial and human resources more efficiently for national chemicals and waste management would assist in attracting interested donors in this area of endeavour. The Government will identify and attempt to attract additional funding to successfully implement the NIP and Stockholm Convention by matching Tuvalu's priorities with those of potential donor areas including SDGs, climate changes, and biodiversity protection activities.

5.2 Implementation Strategy

The implementation strategy of this NIP is based around six key strategies as detailed below.

Strategy 1: Create appropriate legal and institutional frameworks to manage POPs. Tuvalu requires a modern legal and institutional framework that could provide the basis for complying with national obligations under the Stockholm Convention. This strategy presents measures to prohibit the importation, manufacture and use of Annex A POPs; better regulate the importation, distribution and use of new chemicals; regulate, manage and minimise waste incineration and open burning processes; and provide greater oversight and coordination of national chemicals management.

Strategy 2: Improve data collection and management of POPs. While this NIP has identified minor sources and quantities of POPs in Tuvalu, further work is needed to identify and quantify additional sources of POPs, particularly those contained in waste disposal sites and from far-field sources.

Accurate and updated data helps to inform policy- and decision-making and provides the basis for monitoring the effectiveness of such policies and decisions. Improved data also helps Tuvalu to meet its reporting obligations under the Stockholm Convention and other wastes and chemicals conventions. Moreover, appropriately interpreted data and information underpins the transfer of information in appropriate and easy-to-understand formats to target groups under Strategy 5.

Strategy 3: Institute sound management of POPs. The sound management of POPs is key to minimising, and ultimately avoiding, the adverse health, environmental, and economic impacts associated with mismanagement of POPs. This strategy seeks to ensure the implementation of best practices to reduce, and where possible eliminate, the environmental release of POPs and other hazardous chemicals. It addresses the entire chemical management chain, from importation, through to transportation, storage, use, and disposal.

Strategy 4: Develop national human capacity for POPs management. The management of POPs and other chemicals is a specialised and sometimes technical area, which requires knowledgeable and capable human resources to effectively implement management strategies and sustain successful implementation outcomes. This strategy seeks to develop a critical mass of human capacity in a range of sectors involved in POPs chemicals management including health, environment, waste, and customs services. Human capacity needs to be developed not only in technical aspects of POPs and other chemicals management, but also in areas such as environmental communications, environmental project management, contract management, project/program monitoring and evaluation. This requires targeted short- to medium-term capacity development activities, supported by longer-term activities that seek to embed capacity development in relevant subject matters into the culture of responsible institutions and organisations.

Strategy 5: Raise stakeholder awareness levels for POPs management. Full cooperation and participation of stakeholders in POPs management initiatives is critical to the success of such initiatives. People are more likely to support and comply with laws, procedures, guidelines, and requirements for POPs management if they understand the consequences of action and inaction and the personal impact of those consequences. This requires targeted short- to medium-term awareness campaigns supported by longer-term initiatives that embed good practice implementation into the national culture, until best practice implementation becomes routine, accepted practice.

Strategy 6: Improve implementation, monitoring, evaluation and reporting of NIP activities. Many of the activities of the previous Tuvalu NIP have not been implemented. This strategy seeks to address some of the previous implementation issues, for example, by requiring NIP activities to be embedded into the corporate work plans and budgets of relevant government departments, and by requiring implementation of awareness campaigns targeting politicians, Ministry of Finance officials, and other high-level decision makers and potential champions.

These six strategies have been used to shape 11 Action Plans, which are described in detail in the subsequent sections.

5.3 Action Plans, including respective activities and strategies

Eleven Action Plans (AP1 to AP11, Table 21) totalling AUD$2,779,500 have been identified in this NIP, to enable the Tuvalu Government to meet its obligations as a Party to the Stockholm Convention (Table 21). As part of the annual work planning and budgeting process, the Department of Environment will select relevant Action Plan items to be implemented in the financial year, and endeavour to incorporate these items into its annual work programme and budget.

1. Institutional and Regulatory Strengthening Action Plan
2. POPs Pesticides Action Plan
3. PCBs/PCNs/SCCPs Action Plan
4. POP-PBDEs and HBCD Action Plan
5. PFOS, its salts and PFOSF Action Plan
6. DDT Action Plan
7. uPOPs Action Plan
8. Contaminated Sites Action Plan
9. Public Awareness, Information and Training Action Plan
10. Monitoring, Evaluation and Reporting Action Plan
11. Technical and Financial Assistance Action Plan

Table 21: Summary of Action Plans to implement the revised NIP

Action plan	NIP component	Cost ($AUD)
AP1	Institutional and regulatory strengthening measures	131,000
AP2	POPs Pesticides Action Plan	530,000
AP3	PCBs/PCNs/SCCPs Action Plan	387,000
AP4	POP-PBDEs and HBCD Action Plan	395,000
AP5	PFOS, its salts and PFOSF Action Plan	248,000
AP6	DDT Action Plan	30,000
AP7	uPOPs Action Plan	358,000
AP8	Contaminated Sites Action Plan	176,000
AP9	Public Awareness, Information and Training Action Plan	77,500
AP10	Monitoring, Evaluation and Reporting Action Plan	392,000
AP11	Financial and Technical Assistance Action Plan	55,000
Total Action Plan costs		**2,779,500**

5.3.1 Institutional and Regulatory Strengthening Action Plan (Action Plan 1)

Activity	Responsibility	Timeframe and Budget (AUD)					Budget comments
		2020	2021	2022	2023	2024	
1. Improve national oversight of POPs and other chemicals in Tuvalu							
Institutional Measures							
1.1. Establish a National Chemical Unit within DoE to serve as the National Focal Point	DoE	5,000	5,000	5,000	5,000	5,000	Operating costs
1.2. Prepare a National Chemical Profile on chemical management	DoE	20,000					Consultant fees
1.3. Establish a centralised system for licensing and permitting chemical imports and use	DoE, DoA	10,000					Develop using existing government human resources
1.4. Train Customs, Agricultural and Environment Officers in the detection and classification of potentially illegal imports and exports of POPs and other non-approved chemicals and wastes	DoE, Customs	20,000					Consultant fees
1.5. Assess the national context for becoming a Party to the Basel and Rotterdam Conventions	DoE	1,000					Reviewers fees
2. Establish a comprehensive legal and administrative system to manage all chemical related issues in Tuvalu							
Regulatory Measures							
2.1. Review and update waste management regulations to improve management of potentially POPs containing wastes	DoE, DWM	10,000					Legal consultant
2.2. Review and update legislation, regulations and protocols to improve management (importation controls, transport, storage, application and disposal) of all imported chemicals (including Stockholm listed chemicals)	DoE, DoA, Customs	10,000					Legal consultant
2.3. Investigate and commence actions to allow Tuvalu to become a signatory to the Basel Convention	DoE	20,000					Legal consultant
3. Improve engagement with the agricultural sector and retailers on POPs and chemical related issues in Tuvalu							
Education and Awareness Activities							
3.1. Establish an industry liaison group to coordinate and drive (in association with Government Agencies) implementation of relevant NIP activities in their respective sectors	DoE, DoA, DWM	5,000		5,000		5,000	Initial consultations, domestic travel, meeting facilitation, etc
TOTAL		**101,000**	**5,000**	**10,000**	**5,000**	**10,000**	

5.3.2 POPs Pesticides Action Plan (Action Plan 2)

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
4 To eliminate releases of POPs pesticides							
Regulatory measures							
4.1 Update existing regulations to restrict/address all listed pesticides by banning and regulation of all listed POPs pesticides	Refer to Activity 2.2						
4.2 Develop regulatory measures to combat illegal traffic of banned pesticides and counterfeit pesticides	Refer to Activity 2.2						
4.3 Develop/update the regulatory framework for good agricultural practice, IVM and organic farming	Refer to Activity 2.2						
Environmentally sound management measures							
4.4 Update the POPs pesticides inventory annually	DoE						Utilise existing resources
4.5 Establishing of an empty pesticide container collection and management system to address the use and recycling of pesticides empty containers	DoE, DWM, DoA	10,000	5,000	5,000	5,000	5,000	
4.6 Strengthen the inspection of pesticide imports by Customs (market survey, sales, storage, usage and disposal including counterfeit and illegal pesticides)	DoA, DoE	100,000	100,000	100,000	100,000	100,000	Staffing costs
Capacity building measures							
4.7 Train Customs Officers on the detection of POPs pesticides and on checking exports for compliance with the Basel (and Waigani) Conventions	Refer to Activity 1.4						
	TOTAL	**110,000**	**105,000**	**105,000**	**105,000**	**105,000**	

5.3.3 PCBs/PCNs/SCCPs Action Plan (Action Plan 3)

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
5 To eliminate releases of PCBs/PCNs/SCCPs							
Regulatory measures							
5.1 Ban the importation, manufacture, reuse, recycling, and export (except export for environmentally sound waste management) of PCBs and PCNs in closed and open application, including SCCPs in open applications	Refer to Activity 2.2						
5.2 Developing legislative framework, policies and measures to control and manage PCB/PCN in closed and open applications, including penalties/fines for the improper management of PCB/PCN containing equipment	Refer to Activity 2.2						
5.3 Prohibit the landfill disposal and burning of PCB and PCN-containing equipment and oils	Refer to Activity 2.1						
5.4 Develop and implement incentives for electric utilities to comply with the phase-out of PCB/PCN containing equipment	TEC, DoE, DWM	10,000					POPs Consultant
5.5 Define a national PCB/PCN elimination plan, including the responsibilities and timelines for institutions and companies for PCB/PCN containing waste management and disposal	TEC, DoE, DWM	10,000					POPs Consultant
5.6 Strengthening the control/inspection for PCB/PCN containing equipment still in use, and any existent interim storages	TEC, DoE, DWM	10,000					POPs Consultant
Environmentally sound management measures							
5.7 Supply PCB/PCN test kits to enable testing of all transformers for PCB/PCN contamination	DoE, TEC	2,000					One off action
5.8 Prepare comprehensive inventory of PCBs/PCNs containing equipment, including PCBs/PCNs/SCCPs in open applications	DoE	20,000					POPs Consultant
5.9 Arrange for the containment and offshore shipment of any PCB/PCN contaminated oil and equipment	DoE, TEC	50,000					One off action
5.10 Investigate and where necessary, remediate PCB/PCN contaminated sites at the Tuvalu Electricity Corporation (TEC), Funafuti	DoE, TEC	200,000					One off action
5.11 Assess and promote sustainable alternatives for PCBs, PCNs and SCCPs in closed and open applications	TEC	15,000					POPs Consultant
Capacity building measures							

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
5.12 Train Customs Officers on meeting Basel and Waigani Convention export requirements, as well as in the identification of illegal imports of PCB/PCN contaminated oils/equipment	Refer to Activity 1.4						
5.13 Train Environment Department and TEC specialists in PCB/PCN/SCCP testing, containment and contaminant management, including transformer oil management	DoE, TEC	15,000		15,000		5,000	POPs Consultant
5.14 Train waste management industry workers on environmentally sound management of PCBs/PCNs in open and closed applications, including SCCPs open applications	DWM, DoE	15,000		15,000		5,000	POPs Consultant
	TOTAL	**347,000**		**30,000**		**10,000**	

5.3.4 POP-PBDEs and HBCD Action Plan (Action Plan 4)

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
6 To eliminate releases of POP-PBDEs and HBCD							
Regulatory measures							
6.1 Ban the importation, manufacture, reuse, recycling, and export (except export for environmentally sound waste management) of POP-PBDEs, HBB and HBCD	Refer to Activity 2.2						
6.2 Restrict the importation of vehicles and electrical and electronic products manufactured between 1975 and 2004 as these may contain elevated concentrations of POP-PBDEs	Refer to Activity 2.2						
Institutional measures							
6.3 Develop and maintain a directory of regional and international facilities with the capability for environmentally sound disposal of POP-PBDEs and HBCD containing materials/articles	DoE, DWM	2,000	2,000	2,000	2,000	2,000	Operating costs
6.4 Develop strategies for the registration of electronic devices, vehicles, and materials, including wastes containing POP-PBDEs, as well as insulation materials containing HBCD, entering in Tuvalu	DoE, DWM	20,000	5,000	5,000	5,000	5,000	Operating costs
Environmentally sound management measures							
6.5 Undertake a national inventory of EEE/WEEE	DoE, DWM	10,000					POPs Consultant
6.6 Identify and quantify existing POP-PBDEs containing product/articles stockpiles in use and in storage	DoE, DWM	10,000					POPs Consultant
6.7 Establish secure temporary storage at the landfill facility for e-wastes, while waiting for final destruction	DWM	20,000	5,000	5,000	5,000	5,000	Operating costs
6.8 Develop and implement a national e-waste management program, which includes sustainable financing measures for environmentally sound management and disposal	DWM, DoE	50,000	50,000	5,000	5,000	5,000	Operating costs
6.9 Undertake a national inventory of vehicles/end of life vehicles (EOL), by year of manufacture	DoE, DWM	10,000					POPs Consultant
6.10 Identify and quantify the POP-PBDEs quantities in WEEE and ELVs	DoE, DWM	10,000					POPs Consultant
6.11 Establish secure storage at the landfill facility for EOL vehicles, prior to export for recycling	DWM	20,000					One off action
6.12 Develop and implement a national end-of-life vehicle management program, which includes sustainable financing measures for environmentally sound management and disposal	DWM, DoE	50,000	50,000	5,000	5,000	5,000	Operating costs

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
6.13 Identify and quantify existing HBCD containing products/article stockpiles in use and in storage	DWM, DoE	5,000					POPs Consultant
6.14 Promote the implementation of BAT/BEP for use of building insulation materials containing HBCD	DoE	5,000					
Capacity building measures							
6.15 Train waste management workers in environmentally sound management of POP-PBDEs and HBCD wastes	DWM, DoE	5,000					POPs Consultant
6.16 Train Customs Officers on the detection of articles containing POP-PBDEs and HBCD and on checking exports for compliance with the Basel (and Waigani) Conventions	Refer to Activity 1.4						
6.17 Build knowledge and capacity for management of POP-PBDEs and HBCD impacted materials and waste categories	DWM						Existing resources
Education and awareness measures							
6.18 Deliver public education and health campaigns on POP-PBDEs and HBCD sources management (e-waste, used motor vehicle and construction and demolition waste management) in collaboration with other agencies	Refer to Activity 11.2						Existing resources
6.19 Raise awareness of relevant stakeholders (policy makers, authorities, industry, recyclers, and public) on POP-PBDEs and HBCD containing products/articles/wastes management and disposal practices	DoE, DWM						Existing resources
	TOTAL	**217,000**	**112,000**	**22,000**	**22,000**	**22,000**	

5.3.5 PFOS, its salts and PFOSF Action Plan (Action Plan 5)

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
7 To reduce and ultimately eliminate releases of PFOS, its salts and PFOSF							
Regulatory measures							
7.1 Ban the importation, manufacture, use, and export (except export for environmentally sound waste management) of PFOS and PFOS-containing articles	Refer to Activity 2.2						
Institutional measures							
7.2 Identify safer alternatives to aqueous film-forming foams (AFFF) containing PFOS, its salts and PFOSF	Fire Service	10,000					Consultant costs
7.3 Develop and maintain a directory of regional and international facilities capable of the environmentally sound disposal of PFOS, its salts and PFOSF contaminated articles and foams	Refer to Activity 6.3						Costed under Activity 6.3
7.4 Supply adequate PPE to Fire Fighting Officers including breathing equipment and training in its use		50,000	30,000	30,000	30,000	30,000	
Environmentally sound management measures							
7.5 Undertake a national inventory of articles potentially containing PFOS, its salts and PFOSF	DoE	10,000					
7.6 Establish storage areas at the landfill site for PFOS-containing articles/wastes and foam, prior to export for final disposal	DWM	20,000	5,000	5,000	5,000	5,000	Operating costs
7.7 Establish a secure operational storage area for AFFF at the Tuvalu fire station	Fire Service	10,000	2,000	2,000	2,000	2,000	Operating costs
7.8 Investigate and remediate (as necessary) the potentially contaminated fire training site at the northern end of the Tuvalu airfield	Refer to Activity 10.3 and 10.8						
Capacity building measures							
7.9 Train Customs Officers on the detection of PFOS-containing products and on checking exports for compliance with the Basel Convention	Refer to Activity 1.4, 5.12						
	TOTAL	**100,000**	**37,000**	**37,000**	**37,000**	**37,000**	

5.3.6 DDT Action Plan (Action Plan 6)

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
8 To reduce and ultimately eliminate releases of DDT							
Regulatory measures							
8.1 Ban the importation and use of DDT and DDT-containing mixtures	Refer to Activity 2.1						
Institutional measures							
8.2 Establish a national position on the efficacy of use of specific chemicals for mosquito vector control	Ministry of Health	10,000				10,000	Consultant Fees
Environmentally sound management measures							
8.3 Complete a review of the scientific and medical literature connected with the efficacy of different mosquito control strategies	Ministry of Health	10,000					
8.4 Undertake routine monitoring of DDT concentrations in air, sediment, human breast milk and food items under the GMP	Refer to Activity 13.7						Costed under the GMP
Capacity building measures							
8.5 Implement routine chemical management training for public health workers engaged in mosquito control	Refer to Activity 11.4						
8.6 Train Customs Officers on the detection of DDT and DDT-containing products and on checking exports for compliance with the Basel and Waigani Convention	Refer to Activity 1.4, 5.12						
	TOTAL	**20,000**				**10,000**	

5.3.7 uPOPs Action Plan (Action Plan 7)

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
9 Progressive reduction in releases from unintentional production of POPs							
Regulatory measures							
9.1 Establish a policy and legal framework for reduction and minimisation of unintentional POPs formation within an integrated pollution prevention and control approach identify emission standards or limits for uPOPs for sources and in environmental media and food	Refer to Activity 2.2						
9.2 Develop comprehensive waste management regulations, including prohibition on open burning of waste and associated infringement penalties	Refer to Activity 2.1						
9.3 Implement tobacco initiatives in compliance with national obligations under the WHO Framework Convention on Tobacco Control[134] and the Tobacco Control Act 2010	Ministry of Health	10,000	10,000	10,000	10,000	10,000	Education and awareness
9.4 Restrict the importation of motor vehicles without pollution control technology	Refer to Activity 2.2						
9.5 Enforce appropriate standards for septic tank installation and servicing	DWM	20,000	20,000	20,000	20,000	20,000	
Institutional measures							
9.6 Implement a national waste management strategy that promotes environmentally sound waste management	DWM	30,000	50,000	40,000	30,000	20,000	Funded by the EU
9.7 Develop and enforce the implementation of national landfill management guidelines that include measures to prevent waste generation and landfilling, and to reduce the occurrence of dump fires and restrict public access to waste tipping faces	DWM, DoE	10,000	2,000	2,000	2,000	2,000	Develop by 2021 Consultancy and maintenance costs
9.8 Introduce an Advanced Recycling Fee on vehicles to pay for end-of-life recycling costs	DWM, DoE	50,000	10,000	10,000	10,000	10,000	Consultancy and implementation costs
9.9 Development of an integrated database of national pollutant releases (e.g. dioxin/uPOPs, mercury, greenhouse gases) and/or of a pollutant releases transfer register (PRTR)	DoE	10,000	10,000	10,000	10,000	10,000	
9.10 Participate in the Global Monitoring Plan (GMP) of POPs in order to obtain information on trends and comparisons with other Pacific countries in the region	Refer to Activity 13.7						
Environmentally sound management measures							

[134] http://apps.who.int/iris/bitstream/10665/42811/1/9241591013.pdf?ua=1

Activity		Responsibility	Timeframe and Budget (AUD)					Comments
			2020	2021	2022	2023	2024	
9.11	Update the uPOPs inventory annually	DoE	1,000	1,000	1,000	1,000	1,000	
9.12	Implement relevant recommendations of PacWaste for healthcare waste management in Tuvalu	Ministry of Health	50,000	50,000	20,000	20,000	20,000	Not included in NIP Costs
9.13	Upgrade the quarantine incinerator to minimise uPOPs releases	DoA	60,000					
9.14	Implement BAT/BEP for the operation of healthcare and quarantine waste incinerators to manufacturer's specifications	DoA, Health	5,000	5,000	5,000	5,000	5,000	Not included in NIP Costs
9.15	Designate areas in the landfill for safe reclamation of recyclable materials	DWM						
9.16	Require holders of environmental permits relating to wastes and chemicals to collect and report data specific to their sector (e.g. quantity of wastes incinerated, and average incineration temperatures for healthcare waste incineration)	DoE, DoA	2,000	2,000	2,000	2,000	2,000	
9.17	Promote the adoption of BAT/BEP in the waste management sector and open burning to minimise uPOPs releases	DWM						
9.18	Maintain and promote 5-year national composting programme	DWM	5,000	5,000	5,000	5,000	5,000	
9.19	Maintain and promote adoption of renewable energy generation practices	Energy						
9.20	Investigate and implement a national used battery recycling programme	DWM, TEC						Not funded under the NIP
Capacity building measures								
9.21	Provide uPOPs-related training at regular intervals to environment, waste, agriculture and health workers to enable them to provide a minimum level of sound waste management advice to communities during normal duties	Refer to Activity 11.4, 11.5, 11.6, 11.10						
9.22	Develop, distribute and raise awareness of guidelines on selection and use of PPE in the waste and chemical management sector	DWM, DoA						
Education and awareness measures								
9.23	Deliver public education and health campaigns on uPOPs prevention, in collaboration with other agencies (e.g. health, transportation)	Refer to Activity 11.10. 11.11						
		TOTAL	**158,000**	**50,000**	**50,000**	**50,000**	**50,000**	

5.3.8 Contaminated Sites Action Plan (Action Plan 8)

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
10 To reduce POPs releases from contaminated sites							
Regulatory measures							
10.1 Amend the legislation if required, to require proponents of development proposals or chemical import licences to demonstrate what infrastructure will be put in place to ensure safe storage and containment of chemicals and wastes	Refer to Activity 2.2						
10.2 Develop and enforce regulations requiring chemical and hazardous waste facilities to develop oil and chemical spill response plans and procedures	DoE, Marine	5,000	5,000	5,000	5,000	5,000	
Institutional measures							
10.3 Establish a national contaminated site registry/inventory	DoE, DWM	1,000					
10.4 Develop and implement a chemicals compliance inspection program to assess compliance of chemical storage practices with best practices.	DoE, DoA	5,000	500	500	500	500	Operating costs
10.5 Develop/update legislation to set criteria for determining contaminated sites for relevant POPs, including on liability (polluter pays principle).	Refer to Activity 2.2						
10.6 Develop methodology to identify and prioritize POPs contaminated sites considering available guidance documents.	DoE						
Environmentally sound management measures							
10.7 Contain and remove asbestos contaminated materials from Tuvalu	DoE						Not included in NIP costs
10.8 Investigate landfill and airfield contamination with AFFF	DoE, DWM	10,000					Consultancy. Remediation costs will depend on assessment findings
10.9 Investigate and where necessary, remediate PCB/PCN contaminated sites at the TEC, Funafuti	Refer Action 6.1						
10.10 Investigate and where necessary remediate the hydrocarbon (either oil or kerosene) contaminated site at Nanumea	DoE						Consultancy
10.11 Where possible, restrict activities on, and public access to potentially contaminated sites, based on the risks and level of contamination	DoE	1,000		1,000		1,000	
10.12 Maintain and monitor used oil recycling activities and ensure regular shipment offshore of collected used oil for recycling	DoE, DWM						

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
10.13 Secure POPs contaminated sites, and were feasible progressively remediate contaminated sites commencing with the highest priority sites	DoE						Not included in NIP costs
Capacity building measures							
10.14 Provide relevant officers with accredited training in field investigation and contaminated site assessment techniques	DoE	10,000		10,000		10,000	
Education and awareness measures							
10.15 Educate communities in proximity to contaminated sites of the potential health impacts and actions to minimise exposure to the contamination	DoE, DWM	20,000	20,000	20,000	20,000	20,000	Operating costs
	TOTAL	**52,000**	**25,500**	**36,500**	**25,500**	**36,500**	

5.3.9 Public Awareness, Information and Training (Action Plan 9)

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
11 To cultivate a level of awareness and capacity in stakeholders that reduces POPs releases and supports implementation of the NIP							
Regulatory measures							
11.1 Require holders of chemical import/export permits, and environmental permits to report activity data to DoA at regular intervals (e.g. quarterly or semi-annually)	DoA	1,000	1,000	1,000	1,000	1,000	Operating costs
Institutional measures							
11.2 Establish a training and outreach unit within DoE dedicated to provision of training (including training identified in this NIP) to government, public and private sector stakeholders	DoE	5,000	5,000	5,000	5,000	5,000	Operating costs
Capacity building measures							
11.3 Train specialist government staff in GMP practices and procedures	DoE, DoA	2,000	2,000	2,000	2,000	2,000	Operating costs
11.4 Provide training to waste management workers, hospital, agriculture and teaching staff on safe handling, storage and disposal of chemicals and other hazardous wastes	DoE, DoA, DoH, Education						WHO currently delivers this training in Tuvalu
11.5 Implement the activities to raise awareness and training for inspectors and customs, on POPs substances and POPs containing materials/articles	DoE, Customs						
Education and awareness measures							
11.6 Conduct an annual national "Chemicals in Tuvalu" forum to raise high-level political awareness of POPs and chemical management issues in Tuvalu	DoE	5,000	5,000	5,000	5,000	5,000	Operating costs
11.7 Conduct regular awareness campaigns on used oil recycling	DoE, DWM	500	500	500	500	500	
11.8 Developing a school curriculum to include POPs and the effects of hazardous chemicals to ensure long term public awareness and education	DoE, Education	10,000					
11.9 Deliver public education and health campaigns on PBDE sources management (e-waste, used motor vehicle management) in collaboration with other agencies	DoE						
11.10 Prepare and promote education and training materials on POPs & hazardous chemicals tailored for target groups (policy makers, industry, public, curricula) considering available materials and translate selected materials into national language	Doe						
11.11 Compile and disseminate information materials available on alternatives to POPs	DoE						
	TOTAL	**23,500**	**13,500**	**13,500**	**13,500**	**13,500**	

5.3.10 Monitoring, Evaluation and Reporting Action Plan (Action Plan 10)

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
13 To ensure timely implementation and continuing relevance of the NIP over its implementation period							
Institutional measures							
13.1 Embed activities from this NIP into relevant departmental work plans and budgets to ensure implementation	DoE, DoA, Customs, DoH	2,000	2,000	2,000	2,000	2,000	Operating costs
13.2 Prepare an annual progress report of NIP implementation against the NIP Action Plans	DoE	1,000	1,000	1,000	1,000	1,000	Operating costs
13.3 Revise NIP activities as needed to, for example, to reflect changing priorities and emerging issues	Refer Activity 1.1						
13.4 Provide periodically training on reporting obligations and reporting format and data collection and compilation processes	Refer to Activity 1.1						
13.5 Compile information for reporting (qualitative and quantitative)	Refer to Activity 1.1						
13.6 Submit four-yearly national reports and other reports (POP-PBDEs, DDT and PFOS continued need, PCBs elimination progress) to the Stockholm Convention Secretariat	DoE	1,000				1,000	
13.7 Review and implement Tuvalu sampling plans for ambient concentrations of POPs (including PCBs and PFOS) in air, land, water, food, animals and humans within the GMP framework	DoE	5,000	5,000	5,000	5,000	5,000	Operating costs
13.8 Establish a small facility to be used as a focal point for collecting and storing pesticide and POPs samples before overseas analysis	DoE	10,000					
13.9 Commence and maintain a national database on POPs and other chemical management	DoE	50,000	50,000	50,000	50,000	50,000	Operating costs
13.10 Undertake regular asbestos air sampling with a focus in high risk residential areas	DoE	50,000	10,000	10,000	10,000	10,000	Consultant fees
	TOTAL	**119,000**	**68,000**	**68,000**	**68,000**	**69,000**	

5.3.11 Technical and Financial Assistance Action Plan (Action Plan 11)

Activity	Responsibility	Timeframe and Budget (AUD)					Comments
		2020	2021	2022	2023	2024	
14 To reduce and ultimately eliminate use and releases of all Stockholm listed chemicals							
Institutional measures							
14.1 Complete assessment of technical and financial requirements to complete all Tuvalu NIP Action Plans	DoE	20,000					Consultant fees
14.2 Prioritise Action Plan activities for which technical and financial assistance is needed, considering potential synergies of the prioritised activities	DoE	10,000					Consultant fees
14.3 Complete an assessment of potential financial and technical assistance sources/donors, to complete NIP implementation, including the conditions that may apply to successful funding applications	DoE	15,000					Consultant fees
14.4 Apply for financial assistance to complete NIP Action Plans from identified donors and funding sources	DoE	10,000					Consultant fees
	TOTAL	**55,000**					

Annex 1: Record of Stakeholder and Public Consultation

Name	Position	Title	Email
Mr Walter Kaua	Acting Director	Department of Waste Management	Available on request
Ms Emily EE. Elia	Waste Regulatory Officer	Department of Waste Management	
Ms Miriama Uluiviti Taukiei	Waste Operational Officer	Department of Waste Management	
Mr Faafetai Sagapolutele	ADB Consultant		
Ms Tilia Tima	Assistant Environment Officer	Department of Environment	
Mr Faoliu Teakau	Assistant Environment Officer	Department of Environment	
Mr Reuben Kausea	Information Knowledge Management Officer	Department of Environment	
Mr Evolini Mami	Plant Protection Officer	Department of Agriculture	
Mr Selotia Tausi	Acting Senior Extension Officer	Department of Agriculture	
Mr Semisi Tonga	Assistant Quarantine Officer	Department of Agriculture	
Mr Namoto Kelisiano	Generation Manager	TEC	
Mr Polu Tanei	Renewable Energy Manager	TEC	
Mr Yuan -Hung Lo	Coordinator Technical Mission Taiwan	Taiwanese Mission	
Mr Shin-Kuan Chan	Agriculture Specialist	Taiwanese Mission	
Mr Tuilagi Teii	Director	Customs	
Mr Vine Sosene	Infection Control Manager	Princess Margaret Hospital	
Mr Laava Halo	Constable	Fire Department	
Mr Fakailoga Eliseti	Head Fire Department	Fire Department	
Mr Brian Ionatana	Local Government Officer	Dept Rural Development	
Mr Richard Gorkrun	Senior Forecaster	Meteorological Services	
Ms Betty Melton	Energy Inspector	Department of Energy	
Mr Leota Patiale	General Manager	Pacific Energy	
Mr Siaosi Tepoga	Marine Officer	Department of Maritime and Port Services	
Ms Auiluma Lotoala	Policy Officer	TANGO	

Annex 2: POPs Chemicals

Chemical	Date listed	Pesticide	Industrial chemical	By product
Annex A chemicals (elimination)				
Aldrin	May 2004	●		
Chlordane	May 2004	●		
Chlordecone	May 2009	●		
Decabromodiphenyl ether (commercial mixture, c-decaBDE	May 2017		●	
Dieldrin	May 2004	●		
Endrin	May 2004	●		
Heptachlor	May 2004	●		
Hexabromobiphenyl	May 2009		●	
Hexabromocyclododecane (HBCDD)	May 2013		●	
Hexabromodiphenyl ether & heptabromodiphenyl ether (Hexa BDE& Hepta BDE)	May 2009		●	
Hexachlorobenzene (HCB)	May 2004	●	●	●
Hexachlorobutadiene (HCBD)	May 2015		●	●
Alpha-hexachlorocyclohexane (α-HCH)	May 2009	●		
Beta-hexachlorocyclohexane (β-HCH)	May 2009	●		
Lindane (Ɣ-HCH)	May 2009	●		
Mirex	May 2004	●		
Pentachlorobenzene (PeCB)	May 2009	●	●	●
Pentachlorophenol and its salts and esters (PCP)	May 2015	●		
Polychlorinated biphenyls (PCBs)	May 2004		●	●
Polychlorinated naphthalenes	May 2015		●	●
Short-chain chlorinated paraffins (SCCPs)	May 2017		●	
Technical endosulfan and its related isomers	May 2011	●		
Tetrabromodiphenyl ether (tetraBDE) and pentabromodiphenyl ether (pentaBDE)	May 2009		●	
Toxaphene	May 2004	●		
Annex B chemicals (restriction)				
DDT	May 2004	●		
Perfluorooctane sulfonic acids and salts (PFOS) and Perfluorooctane sulfonyl fluoride (PFOS-F)	May 2009	●	●	
Annex C chemicals (unintentional production)				
Hexachlorobenzene (HCB)	May 2004			●
Hexachlorobutadiene (HCBD)	May 2017			●
Pentachlorobenzene (PeCB)	May 2009			●
Polychlorinated biphenyls (PCBs)	May 2004			●
Polychlorinated dibenzo-p-dioxins (PCDD)	May 2004			●
Polychlorinated di-benzofurans (PCDF)	May 2004			●
Polychlorinated naphthalenes	May 2015			●

Annex 3: uPOPs generation in Tuvalu

Source category	Activity rate	Annual release (g TEQ/year, unless stated otherwise)					
1. Waste incineration	tonnes/year	Air	Water	Land	Product	Fly ash	Bottom Ash
Quarantine waste	0.1	0	0	0	0	0	0
Medical waste	21.32	0.853	0	0	0	0	0.004
Waste wood/biomass							
Animal carcasses							
Total	**21.42**	**0.853**	**0**	**0**	**0**	**0**	**0.004**
2. Ferrous and non-ferrous metal production	tonnes/year	Air	Water	Land	Product	Residue	
Iron and steel plants							
Foundries							
Hot dip galvanising plants							
Copper production							
Aluminium production							
Lead production							
Zinc production							
Brass and bronze production							
Magnesium production							
Thermal non ferrous metal production (e.g. Nickel)							
Thermal wire reclamation and e-waste recycling							
3. Heat and power generation	Terajoules/ year	Air	Water	Land	Product	Residue	Ash (tonnes/ year)
Fossil fuel power plants		0	0	0	0	0	0
Biomass power plants							
Household cooking with biomass							
Household cooking with propane	3.2138	0	0	0	0	0	0
Total							
4. Production of mineral products	tonnes/year	Air	Water	Land	Product	Residue	
Cement kilns							
Lime							
Brick							
Glass							
Asphalt mixing							
Total							

Source category	Activity rate	Annual release (g TEQ/year, unless stated otherwise)					
5. Transport	tonnes/year	Air	Water	Land	Product	Residue	
4-Stroke engines	761	0	0	0	0	0	
2-Stroke engines							
Diesel engines – regular diesel	2,853	0	0	0	0	0	
Heavy oil fired engines							
Total		**0**	**0**	**0**	**0**	**0**	
6. Open burning processes	tonnes/year	Air	Water	Land	Product	Residue	
Biomass burning (forest fires)							
Open burning of domestic waste							
Waste dump fires	205	0.008	0	0.0	0	0	
Total		**0.008**	**0**	**0.0**	**0**	**0**	
7. Production/use of chemicals and consumer goods	tonnes/year	Air	Water	Land	Product	Residue	
Pulp and paper mills							
Chlorinated inorganic chemicals							
Chlorinated aliphatic chemicals							
Chlorinated aromatic chemicals							
Other chlorinated and non-chlorinated chemicals							
Petroleum refining							
Textile plants							
Leather plants							
Total							
8. Miscellaneous processes	tonnes/year	Air	Water	Land	Product	Residue	
Drying of biomass							
Crematoria							
Smoke houses							
Dry cleaning							
Tobacco smoking	7.2	0.000	0.000	0.000	0.000	0.000	
Total		**0**	**0**	**0**	**0**	**0**	
9. Waste disposal & composting	tonnes/year	Air	Water	Land	Product	Residue	
Landfills and waste dumps	1,486	0.000	0.000	0.000	0.000	0.007	
Sewage/sewage treatment							
Open water dumping	100	0.000	0.000	0.000	0.000	0.000	
Composting	270	0.000	0.000	0.000	0.001	0.000	
Waste oil disposal	17.628	0.000	0.000	0.000	0.000	0.000	
Total		**0.861**	**0**	**0**	**0.001**	**0**	**0.004**
Grand total				**0.866**			

Annex 4: POPs background information

Aldrin

Listed under Annex A

A pesticide applied to soils to kill termites, grasshoppers, corn rootworm, and other insect pests, aldrin can also kill birds, fish, and humans. In one incident, aldrin-treated rice is believed to have killed hundreds of shorebirds, waterfowl, and passerines along the Texas Gulf Coast when these birds either ate animals that had eaten the rice or ate the rice themselves. In humans, the fatal dose for an adult male is estimated to be about five grams. Humans are mostly exposed to aldrin through dairy products and animal meats.

Chlordane

Listed under Annex A

Used extensively to control termites and as a broad-spectrum insecticide on a range of agricultural crops, chlordane remains in the soil for a long time and has a reported half-life of one year. The lethal effects of chlordane on fish and birds vary according to the species, but tests have shown that it can kill mallard ducks, bobwhite quail, and pink shrimp. Chlordane may affect the human immune system and is classified as a possible human carcinogen. It is believed that human exposure occurs mainly through the air.

Chlordecone

Listed under Annex A

Chlordecone is a synthetic chlorinated organic compound, which was mainly used as an agricultural pesticide, miticide and fungicide. It had been used extensively in the tropics for the control of banana root bore. Currently, no use or production of the chemical is reported.

Decabromodiphenyl ether (commercial mixture, c-decaBDE)

Listed under Annex A

DecaBDE is used as an additive flame retardant and has a variety of applications including in plastics/polymers/composites, textiles, adhesives, sealants, coatings and inks. DecaBDE containing plastics are used in housings of computers and TVs, wires and cables, pipes and carpets. Commercially available decaBDE consumption peaked in the early 2000's, but c-decaBDE is still extensively used worldwide. The decaBDE is highly persistent, has a high potential for bioaccumulation and food-web biomagnification, as well as for long-range transport. Adverse effects are reported for soil organisms, birds, fish, frog, rat, mice and humans.

Dieldrin

Listed under Annex A

Used principally to control termites and textile pests, Dieldrin has also been used to control insect-borne diseases and insects living in agricultural soils. Its half-life in soil is approximately five years. The pesticide aldrin rapidly converts to Dieldrin, so concentrations of Dieldrin in the environment are higher than dieldrin use alone would indicate. Dieldrin is highly toxic to fish and other aquatic animals, particularly frogs, whose embryos can develop spinal deformities after exposure to low levels. Dieldrin residues have been found in air, water, soil, fish, birds, and mammals, including humans. Food represents the primary source of exposure to the general population.

Endrin

Listed under Annex A

This insecticide is sprayed on the leaves of crops such as cotton and grains. It is also used to control rodents such as mice and voles. Animals can metabolize endrin, so it does not accumulate in their fatty tissue to the extent that structurally similar chemicals do. It has a long half-life, however, persisting in the soil for up to 12 years. In addition, endrin is highly toxic to fish.

The primary route of exposure for the general human population is through food, although current dietary intake estimates are below the limits deemed safe by world health authorities.

Heptachlor

Listed under Annex A

Primarily used to kill soil insects and termites, heptachlor has also been used more widely to kill cotton insects, grasshoppers, other crop pests, and malaria-carrying mosquitoes. It is believed to be responsible for the decline of several wild bird populations, including Canadian Geese and American Kestrels in the Columbia River basin in the US. Laboratory tests have also shown high doses of heptachlor to be fatal to mink, rats, and rabbits, with lower doses causing adverse behavioural changes and reduced reproductive success. Heptachlor is classified as a possible human carcinogen. Food is the major source of exposure for humans, and residues have been detected in the blood of cattle from the US and from Australia.

Hexabromobiphenyl (HBB)

Listed under Annex A

Hexabromobiphenyl is no longer produced or used in most countries. Hexabromobiphenyl is an industrial chemical that was used as a flame retardant, mainly in the 1970s as a component of: acrylonitrile-butadienestyrene (ABS) thermoplastics for constructing business machine housings and in industrial (e.g. motor housing), and electrical (e. g. radio and TV parts) products; as a fire retardant in coatings and lacquers, and in polyurethane foam for auto upholstery.

Hexabromocyclododecane (HBCD)

Listed under Annex A

HBCD is currently used in four principal product types: expandable polystyrene (EPS), extruded polystyrene (XPS), high impact polystyrene (HIPS) and in polymer dispersions for coating textiles. By far the dominant use is in expandable polystyrene, which is often referred to as Styrofoam. This is used for insulation in buildings and refrigerated trucks and containers, as a fill and shape material in concrete construction, in packaging, and as the filling material for bean bags. The HBCD is usually present at levels of about 0.5 to 2%. The chemical is not used for food-based applications, such as seafood boxes and clamshell food containers (as used with some takeaway food). Use in textile applications and electric and electronic appliances is smaller. HBCD is used a flame-retardant additive, providing fire protection during the service life of vehicles, buildings or articles, as well as protection while stored. At the end of their service life, products containing HBCD are likely to be disposed of in landfills, incinerated, recycled, or remain as waste in the environment. Insulation boards form the majority of HBCD containing waste. Packaging waste was found to be the main contributor to potential releases to soil due to uncontrolled landfill or compost, recycling of empty paper packaging, substances going to unknown destinations and the unprotected storage of packaging.

Hexabromodiphenyl ether and Heptabromodiphenyl ether

Listed under Annex A

Hexabromodiphenyl ether and heptabromodiphenyl ether are the main components of commercial octabromodiphenyl ether. They are used as flame retardant additives typically in housings of office equipment and business machines. Other uses include nylon and low-density polyethylene, polycarbonate, phenol-formaldehyde resins and unsaturated polyesters and in adhesives and coatings.

Hexachlorobenzene (HCB)

Listed under Annex A and Annex C

First introduced in 1945 to treat seeds, HCB kills fungi that affect food crops. It was widely used to control wheat bunt. It is also a by-product of the manufacture of certain industrial chemicals and exists as an impurity in several pesticide formulations. In high doses, HCB is lethal to some animals and, at lower levels, adversely affects their reproductive success. HCB has been found in food of all types.

Hexachlorobutadiene (HCBD)

Listed under Annex A and Annex C

HCBD was used as intermediate in the chemical industry or as a product. It was applied as a solvent (for rubber and other polymers); as a “scrubber” to recover chlorine containing gas or to remove volatile organic components from gas; as hydraulic, heat transfer or transformer fluid; or in gyroscopes. HCBD was also used in the production of aluminium and graphite rods.

Alpha and Beta Hexachlorocyclohexane (HCH)

Listed under Annex A

These two 'chemicals' are listed separately under the Convention, but in practice they are normally only encountered together as the commercial mixture of HCH isomers. The Convention listing for Hexachlorocyclohexane covers the alpha and beta isomers, and the Listing for Lindane covers the gamma isomer. Alpha-HCH and beta-HCH were not intentionally produced or commercialised but were produced as the main constituent of technical HCH (in the 1940s) which was used as an organochlorine insecticide. Technical HCH consists of 70 % alpha-HCH, 7 % beta-HCH and 13 % gamma-HCH (Lindane). There has been a gradual replacement of technical HCH by Lindane.

Lindane (gamma-HCH)

Listed under Annex A with a specific exemption for use as a human health pharmaceutical for control of head lice and scabies as second line treatment

Lindane is the common name for the gamma isomer of hexachlorocyclohexane (HCH). Lindane has been used as a broad-spectrum insecticide for seed and soil treatment, foliar applications, tree and wood treatment and against ecto-parasites in both veterinary and human applications. Human health pharmaceutical use for control of head lice and scabies is still allowed as a specific exemption under the Convention. It is applied usually in the form of shampoos or lotions, with the Lindane typically present at a concentration of around 1%.

Mirex

Listed under Annex A

This insecticide is used mainly to combat fire ants, and it has also been used against other types of ants and termites. It has also been used as a fire retardant in plastics, rubber, and electrical goods. The main route of human exposure to Mirex is through food, particularly meat, fish, and wild game. Direct exposure to Mirex does not appear to cause injury to humans, but studies on laboratory animals have caused it to be classified as a possible human carcinogen. It is considered to be one of the most stable and persistent pesticides, with a half-life of up to 10 years.

Pentachlorobenzene (PeCB)

Listed under Annex A and Annex C

PeCB was used in PCB products, in dyestuff carriers, as a fungicide, a flame retardant and as a chemical intermediate e.g. for the production of quintozene. PeCB is also produced unintentionally during combustion, thermal and industrial processes. It is also present as an impurity in products such as solvents or pesticides.

Pentachlorophenol (PCP) and its salts and esters

Listed under Annex A with specific exemptions for use in utility poles and cross-arms

Pentachlorophenol (PCP) is an organochlorine compound primarily used as an oil-based wood preservative. PCP is currently allowed worldwide only for wood preservation uses. By 1990s, widespread use was discontinued in most countries and at present it is banned in a number of countries. PCP consumption for wood preservation appears to concentrate in Canada and the USA (restricted to industrial use only), whereas Na-PCP appears to be mainly used in India, mainly for wood preservation purposes.

Polychlorinated biphenyls (PCBs)

Listed under Annex A with specific exemptions and under Annex C

These compounds are used in industry as heat exchange fluids, in electric transformers and capacitors, and as additives in paint, carbonless copy paper, and plastics. Of the 209 different types of PCBs, 13 exhibit a dioxin-like toxicity. Their persistence in the environment corresponds to the degree of chlorination, and half-lives can vary from 10 days to one-and-a-half years. PCBs are toxic to fish, killing them at higher doses and causing spawning failures at lower doses. Research also links PCBs to reproductive failure and suppression of the immune system in various wild animals, such as seals and mink. PCBs also suppress the human immune system and are listed as probable human carcinogens.

(Poly) Chlorinated Naphthalenes

Listed under Annex A and C with specific exemptions for use in the production of polyfluorinated naphthalenes, including octafluoronaphthalene

PCN have been used mainly for their chemical stability, including low flammability, their (electrically) insulating properties

and recalcitrance, including resistance to biodegradation and biocidal function. PCN have historically been used as wood preservatives, paints and engine oils additives, heat exchange fluids, high-boiling point specialty solvents, engine crank case additives and ingredients in motor tune-up compounds, in capacitors and for cable insulation, chemical-resistant gauge fluids, instrument seals and colour dispersions. While the use of PCN has ceased, they are also present in PCB formulations and are unintentionally produced during combustion processes and in industrial installations. PCN are also unintentionally generated during high-temperature industrial processes in the presence of chlorine. Of the known releases, combustion (primarily waste incineration) is considered the most significant current source.

Short-chained chlorinated paraffins

Listed under Annex A

Chlorinated paraffins are produced by chlorination of straight-chained paraffin fractions and are complex mixtures of certain organic compounds containing chloride: polychlorinated n-alkanes. The chlorination degree of CPs can vary between 30 and 70 wt %. SCCPs can be used as a plasticizer in rubber, paints, adhesives, flame retardants for plastics as well as an extreme pressure lubricant in metal working fluids. SCCPs are sufficiently persistent in air for long range transport to occur and appear to be hydrolytically stable. Many SCCPs can accumulate in biota. It is concluded that SCCPs are likely, as a result of their long-range environmental transport, to lead to significant adverse environmental and human health effects. The production of SCCPs has decreased globally as jurisdictions have established control measures.

Endosulfan and its related isomers

Listed under Annex A with a specific exemption

Endosulfan is an insecticide that has been used since the 1950s to control crop pests, tsetse flies and ecto-parasites of cattle and as a wood preservative. As a broad-spectrum insecticide, endosulfan is currently used to control a wide range of pests on a variety of crops including coffee, cotton, rice, sorghum and soy.

Tetrabromodiphenyl ether & pentabromodiphenyl ether (commercial pentabromodiphenyl ether)

Listed under Annex A with a specific exemption for use as articles containing these chemicals for recycling

Penta-BDE is a brominated flame retardant that inhibits or suppresses combustion in organic material. It has been used mainly was as a fire retardant in polyurethane foams for automotive seats and fittings and in the foams used for domestic furniture, mattresses and carpet underlay, and to a smaller extent non-foamed flexible polyurethane in casings and electric and electronic equipment including computer casings. Use of PBDEs in electrical and electronic appliances was phased out from 1 July 2006.

Toxaphene

Listed under Annex A

This insecticide is used on cotton, cereal grains, fruits, nuts, and vegetables. It has also been used to control ticks and mites in livestock. Toxaphene was the most widely used pesticide in the US in 1975. Up to 50% of a toxaphene release can persist in the soil for up to 12 years. For humans, the most likely source of toxaphene exposure is food. While the toxicity to humans of direct exposure is not high, toxaphene has been listed as a possible human carcinogen due to its effects on laboratory animals.

DDT

Listed under Annex B with acceptable purpose for disease vector control

DDT was widely used during World War II to protect soldiers and civilians from malaria, typhus, and other diseases spread by insects. After the war, DDT continued to be used to control disease, and it was sprayed on a variety of agricultural crops, especially cotton. DDT continues to be applied against mosquitoes in several countries to control malaria. Its stability, its persistence (as much as 50% can remain in the soil 10-15 years after application), and its widespread use have meant that DDT residues can be found everywhere; residual DDT has even been detected in the Arctic. Perhaps the best known toxic effect of DDT is egg-shell thinning among birds, especially birds of prey. Its impact on bird populations led to bans in many countries during the 1970s. Although its use had been banned in many countries, it has been detected in food from all over the world. Although residues in domestic animals have declined steadily over the last two decades, food-borne DDT remains the greatest source of exposure for the general population. The short-term acute effects of DDT on humans are limited, but long-term exposures have been associated with chronic health effects. DDT has been detected in breast milk, raising serious concerns about infant health.

Perfluorooctane sulfonic acid (PFOS), its salts and perfluorooctane sulfonyl fluoride (PFOS-F)

Listed under Annex B with a range of acceptable purposes

Perfluorooctane sulfonic acid (PFOS) is a highly fluorinated substance which can act as a highly effective repellent of both oil and water. These properties have provided PFOS with a wide variety of uses, for example PFOS has been used for the protection of paper, leather, fabric, upholstery and carpets, as a surfactant in the mining industry, and in floor polishes, photographic film, denture cleaners, shampoos, surface coatings (paints), and carpet cleaners. PFOS has also been used as an insecticide, specifically as bait for leaf-cutting ants, red fire ants and termites and as a component of fire-fighting foams. PFOS and PFOS-related substances can be released to the environment at their manufacture, during their use in industrial and consumer applications and from disposal of the chemicals or of products or articles containing them after their use. Acceptable purposes for the use of the chemical include: Photo-imaging, photo-resist and anti-reflective coatings for semi-conductor, etching agent for compound semi-conductor and ceramic filter, aviation hydraulic fluids, metal plating (hard metal plating) only in closed-loop systems, certain medical devices (such as ethylene tetrafluoroethylene copolymer (ETFE) layers and radio-opaque ETFE production, in-vitro diagnostic medical devices, and CCD colour filters), fire-fighting foam, insect baits for control of leaf-cutting ants.

Polychlorinated dibenzo-p-dioxins (PCDD)

Listed under Annex C

These chemicals are produced unintentionally due to incomplete combustion, as well during the manufacture of pesticides and other chlorinated substances. They are emitted mostly from the burning of hospital waste, municipal waste, and hazardous waste, and also from automobile emissions, peat, coal, and wood. There are 75 different dioxins, of which seven are considered to be of concern. One type of dioxin was found to be present in the soil 10 - 12 years after the first exposure. Dioxins have been associated with a number of adverse effects in humans, including immune and enzyme disorders and chloracne, and they are classified as possible human carcinogens. Laboratory animals given dioxins suffered a variety of effects, including an increase in birth defects and stillbirths. Fish exposed to these substances died shortly after the exposure ended. Food (particularly from animals) is the major source of exposure for humans.

Polychlorinated dibenzofurans (PCDF)

Listed under Annex C

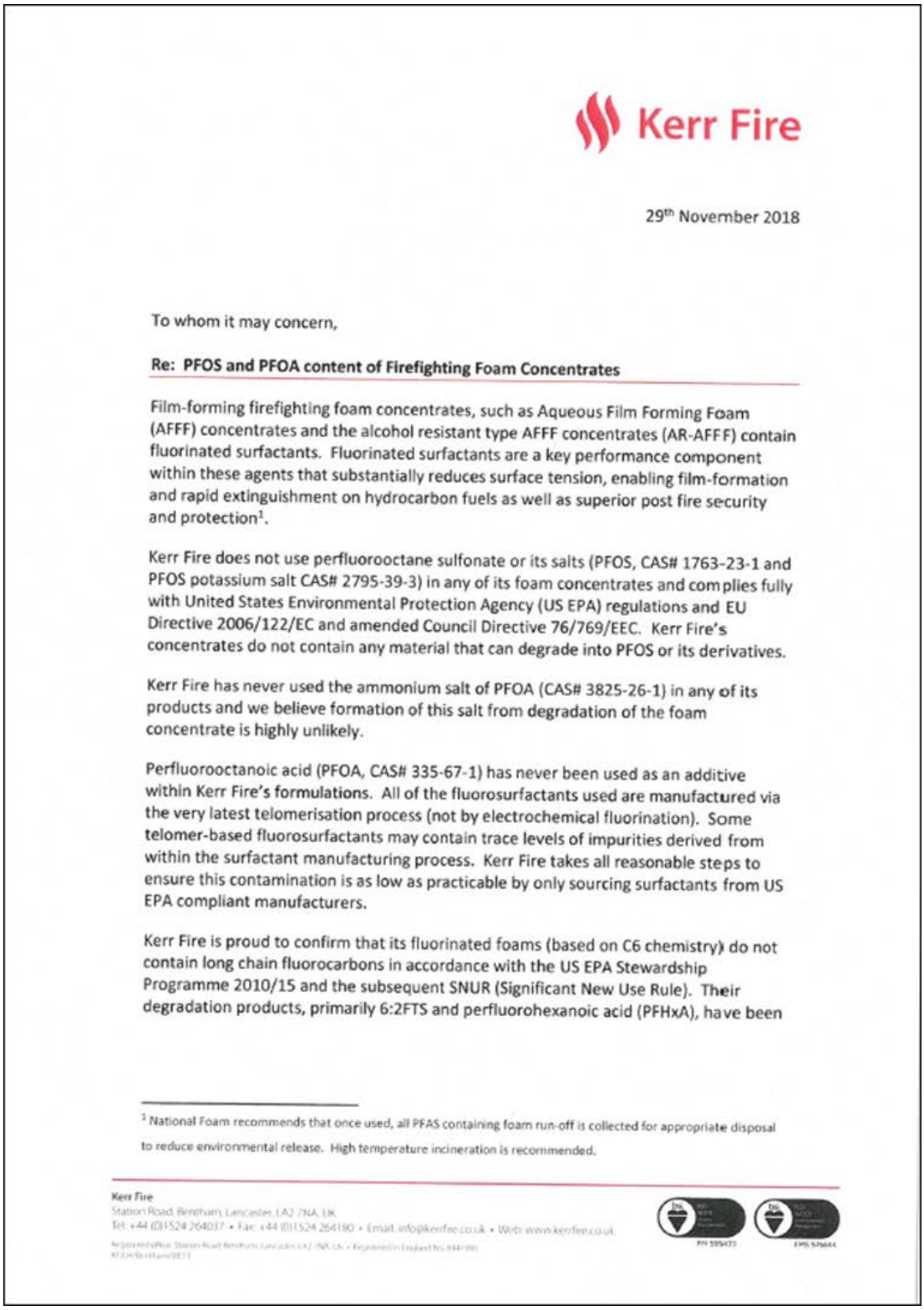
These compounds are produced unintentionally from many of the same processes that produce dioxins, and also during the production of PCBs. They have been detected in emissions from waste incinerators and automobiles. Furans are structurally similar to dioxins and share many of their toxic effects. There 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.

Annex 5: Tuvalu GMP results, 2010-2011

Chemical	Air Sampling (2010) (pg m^{-3})	Breast Milk (2011) (ng g^{-1} fat)
Aldrin	<LOQ	<LOQ
Chlordane	6.6 (gamma chlordane)	<LOQ
Sum of 6 DDTs	189.9	91.0
Dieldrin	15.6	0.7
Endrin	4.4	<LOQ
Heptachlor	<LOQ	<LOQ
HCB	13.6	3.6
Sum 2 Heptachlorepoxides (cis+trans)		0.5
Mirex	<LOQ	<LOQ
2,3,7,8 TCDD	<LOQ (fg/m^3)	0.5
2,3,7,8 TCDF	2.8 (fg/m^3)	0.3
Sum 17 PCDDs/Fs	83.6 (fg/m^3)	39.4
Sum of 6 PCBs	25.9	7.8
Sum of 12 PCBs		1671 (pg/g fat)
Toxaphene	ND	<LOQ
Alpha-HBCD		0.7
Gamma-HBCD		<LOQ
Alpha-HCH	<LOQ	<LOQ
Beta-HCH	<LOQ	1.8
BDE		<LOQ
Gamma-HCH	13.7	<LOQ
Endosulphan		<LOQ

<LOQ = less than the limit of quantification; ND = Not Detected

Annex 6: Foamfilm 916K AFFF Foam Liquid Concentrate



Kerr Fire

29th November 2018

To whom it may concern,

Re: PFOS and PFOA content of Firefighting Foam Concentrates

Film-forming firefighting foam concentrates, such as Aqueous Film Forming Foam (AFFF) concentrates and the alcohol resistant type AFFF concentrates (AR-AFFF) contain fluorinated surfactants. Fluorinated surfactants are a key performance component within these agents that substantially reduces surface tension, enabling film-formation and rapid extinguishment on hydrocarbon fuels as well as superior post fire security and protection[1].

Kerr Fire does not use perfluorooctane sulfonate or its salts (PFOS, CAS# 1763-23-1 and PFOS potassium salt CAS# 2795-39-3) in any of its foam concentrates and complies fully with United States Environmental Protection Agency (US EPA) regulations and EU Directive 2006/122/EC and amended Council Directive 76/769/EEC. Kerr Fire's concentrates do not contain any material that can degrade into PFOS or its derivatives.

Kerr Fire has never used the ammonium salt of PFOA (CAS# 3825-26-1) in any of its products and we believe formation of this salt from degradation of the foam concentrate is highly unlikely.

Perfluorooctanoic acid (PFOA, CAS# 335-67-1) has never been used as an additive within Kerr Fire's formulations. All of the fluorosurfactants used are manufactured via the very latest telomerisation process (not by electrochemical fluorination). Some telomer-based fluorosurfactants may contain trace levels of impurities derived from within the surfactant manufacturing process. Kerr Fire takes all reasonable steps to ensure this contamination is as low as practicable by only sourcing surfactants from US EPA compliant manufacturers.

Kerr Fire is proud to confirm that its fluorinated foams (based on C6 chemistry) do not contain long chain fluorocarbons in accordance with the US EPA Stewardship Programme 2010/15 and the subsequent SNUR (Significant New Use Rule). Their degradation products, primarily 6:2FTS and perfluorohexanoic acid (PFHxA), have been

[1] National Foam recommends that once used, all PFAS containing foam run-off is collected for appropriate disposal to reduce environmental release. High temperature incineration is recommended.

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shown not to be bioaccumulative and also exhibit low toxicity according to global regulatory standards[2].

Kerr Fire's products are formulated to offer superior performance with the lowest level of fluorinated surfactants to best address possible environmental concerns.

For and on behalf of Kerr Fire,
Yours Sincerely,

David Plant
Global Product Manager – Firefighting Chemicals

[2] DuPont (2012) "DuPont Surface Protection Solutions: Product Stewardship Detail."

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Annex 7: Tuvalu Summary Statistics

Parameter	Funafuti	Outer islands	Total
Population (2019)[135]	6,025	5,621	11,646
No of dwellings (2019)[136]	849	777	1,626
Average no persons per household	7	7	
Estimated total septic effluent discharged pa (2019)	50,000-100,000 lts (100m^3)		
Average solid waste generation rate (kg/person/day; 2017)[137]	0.42	0.33	
Total household waste generation (kg pa)	1,027,110	458,553	1,485,663
Green (organic) waste generation rates (m^3 pa)	1,320		
Green mulch production (m^3 pa)	790		
Compost generation rates at the Taiwanese Market Gardens (2019)	200m^3 (120 tonnes)	300 m^3 (150 tonnes)	500 m^3 (270 tonnes)
Estimated number of registered motor vehicles (2019)	7400		
LPG Imports (2018)	65,750kg		
Diesel imports (2018)	3,356,700Lts		
Oil imports (2018)	28,978Lts		
Petrol Imports (2018)	1,029,432 Lts		
Electricity generated with diesel (2018)			6,289,065 KW

[135]https://data.worldbank.org/indicator/SP.POP.TOTL?locations=TV
[136]Government of Tuvalu (2018). *Tuvalu Population and Housing Min-Census 2017. Preliminary Report*. 17pp.
[137]Sagapolutele & Binney (2017). *Tuvalu Waste Information Baseline Report*. 109pp.