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SPREP
Secretariat of the Pacific Regional Environment Programme

PacWastePlus
PACIFIC WASTE MANAGEMENT

This initiative is supported by **PacWastePlus**-a 72 month project funded by the European Union (**EU**) and implemented by the Secretariat of the Pacific Regional Environment Programme (**SPREP**) **to sustainably and cost effectively improve regional management of waste and pollution.**

## Volume 2: Literature Review

# RESEARCH REPORT - ASSESSMENT OF ALTERNATIVES TO SINGLE-USE DISPOSABLE DIAPERS

April 2022

**Reducing Environmental Effects while Considering Social and Economic Factors**

Research report to assist decision making - analysis of current single-use disposable diaper practices in the Pacific, and a review of viable alternatives.

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Our vision: A resilient Pacific environment sustaining our livelihoods and natural heritage in harmony with our cultures.

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# PacWastePlus Programme

The Pacific – European Union (EU) Waste Management Programme, PacWastePlus, is a 72-month programme funded by the EU and implemented by the Secretariat of the Pacific Regional Environment Programme (SPREP) to improve regional management of waste and pollution sustainably and cost-effectively.

**About PacWastePlus**

The impact of waste and pollution is taking its toll on the health of communities, degrading natural ecosystems, threatening food security, impeding resilience to climate change, and adversely impacting social and economic development of countries in the region. The PacWastePlus programme will generate improved economic, social, health, and environmental benefits by enhancing existing activities and building capacity and sustainability into waste management practices for all participating countries.

Countries participating in the PacWastePlus programme are: *Cook Islands, Democratic Republic of Timor-Leste, Federated States of Micronesia, Fiji, Kiribati, Nauru, Niue, Palau, Papua New Guinea, Republic of Marshall Islands, Samoa, Solomon Islands, Tonga, Tuvalu, Vanuatu*.

**KEY OBJECTIVES**

**Outcomes & Key Result Areas**

The overall objective of PacWastePlus is "to generate improved economic, social, health and environmental benefits arising from stronger regional economic integration and the sustainable management of natural resources and the environment".

The specific objective is "to ensure the safe and sustainable management of waste with due regard for the conservation of biodiversity, health and wellbeing of Pacific Island communities and climate change mitigation and adaptation requirements".

**Key Result Areas**

- Improved data collection, information sharing, and education awareness
- Policy & Regulation - Policies and regulatory frameworks developed and implemented.
- Best Practices - Enhanced private sector engagement and infrastructure development implemented
- Human Capacity - Enhanced human capacity

**Learn more about the PacWastePlus programme by visiting**

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# About this Research Publication Series

Single-use disposable diapers have been identified as a waste issue in Pacific countries, both in landfills and as a commonly littered item. Three Pacific countries (Kiribati, Vanuatu and Tuvalu) have implemented import controls to assist with the management of single-use disposable diapers, the only known measures of their kind in the world. However, the need to contain and manage baby excreta to reduce public health risks is well understood, as is the need for economic growth and equality and inclusion in today's Pacific societies, ensuing women are encouraged into the workforce and to contribute to community activities.

The Pacific therefore faces a challenge: attempting to reduce environmental risks from the disposal of single-use disposable diapers, while balancing the social and economic benefits that single-use disposable diapers bring. Currently there is a lack of reliable information on suitable alternatives for single-use disposable diapers to enable informed decisions in the Pacific Island context.

This research, commissioned by the Secretariat of the Pacific Regional Environment Programme (SPREP) through the European Union's funded PacWastePlus Programme, therefore aims to fill this gap by providing information to:

- Guide informed decision making for governments when developing policy controls to reduce environmental effects from single-use disposable diapers, while balancing social and economic factors
- Inform communities and the private sector on viable alternatives to current single-use disposable diaper use and disposal practices for the Pacific.

**Assessment of Alternatives to Single-use Disposable Diapers Publication Series**

**Volume 1:**
**Executive Summary**

Summary of the research background and key findings

**Volume 2:**
**Literature Review**

Research report that provides details on the background of single-use disposable diapers and alternative infant hygiene garments and review of global policies addressing single-use disposable diapers management

**Volume 3:**
**Field Work and Results**

Details of the research methodology and findings for each research component

**Volume 4:**
**Guidance for Decision Markers**

Guidance for informed decision making for governments when developing policy controls to reduce environmental effects from single-use disposable diapers, while balancing social and economic factors

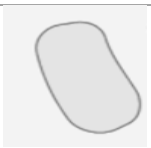
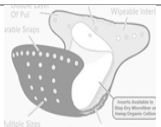
**Volume 5:**
**Guidance for Communities and Private Sector**

Informs communities and the private sector on viable alternatives to current single-use disposable diaper use and disposal practices

# Glossary

| Item | Description |
|---|---|
| **Engineers Without Borders** | For-purpose organisation creating social value through engineering. Completed social and technical components of this research. |
| **Escherichia coli (E. coli)** | Bacteria found in the environment, foods, and human excreta. E. coli can make humans sick with diarrhoea and other illnesses. |
| **Excreta** | Waste matter (such as urine and faeces) eliminated from the body |
| **Infant hygiene garments** | Covering used to contain baby excreta including single-use disposable diapers and reusable nappies |
| **Pit latrine or ventilated pit (bush toilet / long drop** | Type of toilet that collects human excreta in a hole in the ground |
| **Reusable nappy** | A cloth garment, traditionally square and made from towelling, but more recently including modern cloth nappies. They are reusable and require laundering. The local vernacular differs in describing these types of products. For example, in Vanuatu and Samoa, the word 'napkin' is used for this type of nappy, and in Tonga 'napikeni' is used. Components of reusable nappies are provided in the following illustration. |
| **Rural** | Small villages with a low population, outside cities or towns |
| **Secretariat of the Pacific Regional Environment Programme (SPREP** | Inter-governmental organisation established by the Governments and Administrations of the Pacific charged with protecting and managing the environment. Commissioned this research. |
| **Single-use biodegradable, eco/**environmentally friendly**, compostable diaper (eco-friendly / compostable single-use diaper** | A single-use garment that has waterproof qualities similar to those in single-use disposable diapers, but that claim biodegradability, environmentally friendliness, or compostability. These diapers are commonly made from cellulose, chlorine-free wood pulp, super absorbent polymer (SAP), cotton, bamboo, and other plant-based fibres. Most versions use non-compostable (petrochemical-based) plastics for fasteners. |
| **Single-use disposable diaper** | A single use, throw away garment that is waterproof, and fitted. Single-use disposable diapers are available to be used from birth until babies are potty trained. Single-use disposable diapers are manufactured with a range of petrochemical-based plastics, and a complex combination of polymer types. |
| **Super Absorbent Polymer (SAP) (also known as slush powder)** | A water-absorbing polymer that can absorb and retain extremely substantial amounts of a liquid. Primarily used as an absorbent solution for diapers. Main ingredients are acrylic acid, and sodium hydroxide. |
| **Urban** | Densely populated area, usually a city or town, usually provided with government services such as water and wastewater |
| **Wastewater soak-away area** | Typically, a pit, filled with natural liner/filtration such as gravel or aggregates, into which wastewater is piped so it can drain slowly out into the surrounding soil |

## Components of Reusable Nappies'

| Components | Illustration | Description |
|---|---|---|
| **Prefolds** |  | Flat square of fabric with thicker middle panel sewn in, eliminating some folding |
| **Fitteds** |  | Fabric diapers that have sewn-in elastic and often fasteners such as snaps or velcro |
| **Covers** |  | Water resistant material that is used over an absorbent piece such as prefold, fitted, or insert. |
| **Inserts and Boosters** |  | Absorbent layer you add to your nappy to absorb fluids |
| **Pockets** |  | Diapers with a waterproof cover already sewn to the outside, a fabric inside layer, and an opening for stuffing inserts. |
| **All-in-One** |  | Diapers sewn all together with inserts, waterproof cover, and fasteners all in one piece. |
| **All-in-Two** |  | Waterproof outer covers that feature either lay-in or snap-in inserts. |
| **Liner** |  | Thin top layer helps catch solids and reduce soiling. Usually designed to draw moisture. Can be disposable or reusable. |
| **Modern Cloth Reusable Nappy (Modern Cloth Nappy)** |  | Fitted premade reusable nappy design similar to single-use disposable diapers but able to be washed and reused |

# Introduction

The transition to a more convenient lifestyle over the last seventy years has seen a dramatic increase in single-use plastic items onto global markets (UNEP, 2018). Included in the range of items are single-use disposable diapers. Although convenient in their use, the post-use disposal of these items is increasing solid waste that is difficult to manage and has significant impacts on our environment (UNEP, 2021).

Single-use disposable diapers have been identified as a waste issue in Pacific countries, both in landfills and as a commonly littered item. Three Pacific countries (Kiribati, Vanuatu, and Tuvalu) have implemented import controls to assist with the management of single-use disposable diapers, the only known measures of their kind in the world.

However, the need to contain and manage baby excreta to reduce public health risks is well understood, as is the need for economic growth and equality and inclusion in today's Pacific societies, ensuing women are encouraged into the workforce and to contribute to community activities.

**The Pacific faces a challenge:**

attempting to reduce environmental risks from the disposal of single-use disposable diapers

while balancing the social and economic benefits that single-use disposable diapers bring

Currently there is a lack of reliable information on suitable alternatives for single-use disposable diapers to enable informed decisions in the Pacific Island context.

This research, commissioned by the Secretariat of the Pacific Regional Environment Programme (SPREP) through the European Union's funded PacWastePlus Programme, aimed to fill this gap.

This research sought to:

- Explore current **practises** on the use and disposal of single-use disposable diapers, reusable nappies, and eco-friendly / compostable diapers in the Pacific
- Explore current **perceptions** on the use and disposal of single-use disposable diapers, reusable nappies, and eco-friendly / compostable diapers in the Pacific
- Explore the **physical performance** of reusable nappies and eco-friendly / compostable diapers in the Pacific
- Identify and understand **barriers and opportunities** for reducing environmental impacts associated with single-use disposable diaper disposal in Pacific communities, balancing social and economic factors

# Literature Review

A desktop literature review was conducted to review the evolution over time of infant hygiene garments and understand the development and use of single-use disposable diapers and alternative infant hygiene garments. The review also analysed global policies addressing single-use disposable diapers management and identified products available for technical analysis.

## Before Single-use Disposal Diapers

### *Traditional Practices for Infant Hygiene*

Prior to the development of cloth fabrics, infant hygiene in warmer climates leaving babies open and using timing, intuition, and babies signals and cues to understand when the baby has to go (Katharina, 2016). In modern society this method is called Natural Infant Hygiene, or 'elimination communication' (Bauer, 2006; Dombrowski, 2019). In colder climates, infant hygiene involved wrapping and swaddling babies in furs or natural fibres.

In the Pacific, a form of elimination communication was traditionally used for infant hygiene, along with wrapping in bark cloth or tapa (bark from mulberry and fig trees softened through a process of soaking and beating).

### *Natural Fibres and Super Absorbent Materials*

Plant fibres and other biological based components provide potential biodegradable material able to be used for diapers manufacture. Fibres found in the Pacific currently being used for infant hygiene products around the world include:

- **Banana fibre** – used in absorbent hygiene products and nappies in India and Rwanda; derived from banana tree stems which can be sourced from local plantation waste; produced by stripping the banana tree cores and cooking with a paper and water mix before setting them in the sun (CGTN Africa, 2015; Sheriff, 2020).
- **Combination banana fibre with bamboo, hemp, or cotton** – considered to have comparable absorption and antimicrobial properties to regular single-use disposable diapers; produced by cutting banana fibres, heating with water and sodium hydroxide, wrapped in muslin cloth, and then heat sealed in softened canvas cloth (Hireni and Krishna, 2019, Petchimuthu *et al.,* 2019; Sowmiya and Sentthilkumar, 2019; Sparkle, 2021).
- **Coconut fibre** – used in biomedical applications such as towels and nappies; coconut fibre is highly absorptive and can reinforce polylactide fibre to improve water absorption (Gbenebor *et al.,* 2018; Kahar et al., 2019)
- **Starch** (sourced from sorghum wholegrain waste) and **chitosan** (sourced from shellfish waste) – natural polysaccharides biopolymers with high water uptake capacity; could replace petrochemical-based nappy super absorbent polymers (Narayanan and Dhamodharan, 2015; Teli and Mallick, 2018; Zhao *et al.,* 2021; Dutkiewicz, 2002).

Further research is needed prior to these resources being used to produce infant hygiene products in the Pacific.

### *Reusable Nappies*

Since the industrial revolution, cotton cloth fabric was combined with the invention of the safety pin to create a folded and fastened garment to catch baby excreta (Dyer, 2005). These square cloths (also called flats in this study) provided absorption and contained 'most' excreta in a product that could be washed and reused repeatedly.

Cotton towels continue to be a common material used for reusable nappies, but nappies are now found to be made from a large array of fabrics, commonly including microfiber, bamboo, charcoal bamboo, and hemp.

A summary of properties and characteristics of different fabrics used for reusable nappies is found in Table 1.

*Table 1 Characteristics of Fabrics Currently used in Reusable Nappies*

| Fabric | Details |
|---|---|
| **Cotton** | Natural fibre / plant origin.<br>Global cotton production is a large user of water and pesticides. |
| **Organic cotton** | Natural fibre / plant origin. Production requires large amount of water, but reduced pesticides and chemicals compared to non-organic cotton. |
| **Microfiber** | Synthetic fibre – Usually a blend of Polyester and Polyamid. Made with chemicals and petroleum |
| **Bamboo** | Semi-synthetic fibre;<br>Bamboo stalks processed (requires chemicals).<br>Usually combined with cotton.<br>Anti bacterial fabric. |
| **Charcoal Bamboo** | Charcoal bamboo is usually a bamboo core between layers of black fleece. The dark colour prevents visible staining. |
| **Hemp** | Natural fibre. More hygroscopic (water-holding) than cotton, and usually grown in a low-impact manner.<br>Anti bacterial fabric.<br>Usually combined with cotton. |



## Single-use Disposable Diapers

### *History*

Single-use disposable diapers were developed in 1956 by the company Procter & Gamble during the post-war industrial revolution. Initial versions were rated highly by consumers but were expensive – 4-5 times the price of the common reusable nappies at the time. Uptake was slow.

In 1964, Procter & Gamble developed a new manufacturing process to improve production and significantly decreased manufacturing costs (Baby & Adult Hygiene Products, 2017). The transition from reusable nappies to single-use disposable diapers slowly increased, before expanding rapidly in the 1970s due to economic pressures and feminism, calling women to the workforce.

Women were pressured to rethink the way they managed household chores to free up time for work (and/or other activities). Disposable Diapers were seen to simplify and reduce the burden of washing reusable cloth nappies (Smith-Howard, 2021). The use of disposable diapers grew in earnest by the 1980s; 8% of American families were using disposable diapers in 1969, growing to more than 65% of families in the 1980s. Disposable diapers became 'the norm'.

### *Popularity*

Single-use disposable diapers are now popular worldwide due to their low upfront cost and convenience, enabling parents to share task of changing babies with family members and caregivers. Research from both developed and developing countries has found approximately 80% of families predominately use single-use disposable diapers (Shanon et al. 1990; Jesca and Junior, 2015 O'Brien et al., 2009; Bender and She, 2017).

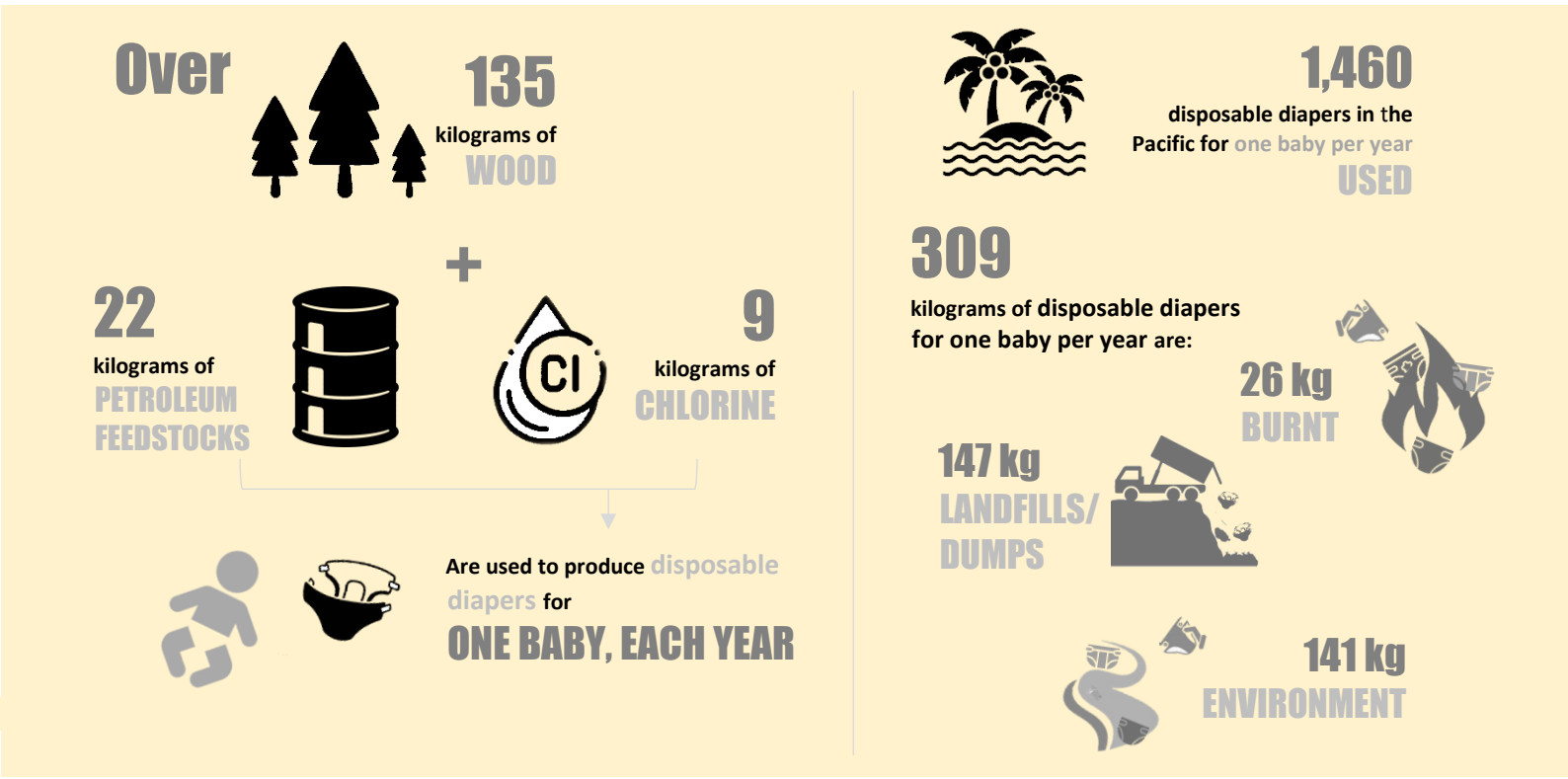
### *Manufacture*

The transition to single-use disposable diapers signified a movement of labour, away from parents who no longer needed to wash reusable cloth nappies, to a complex system of fibre providers, pulp and paper engineers, manufacturers, logistics companies and waste managers (Smith-Howard, 2021) to design, manufacture and manage single-use disposable diapers.

Single-use disposable diapers consume significant resources in their manufacture, including an estimated 135 kilograms of wood, 22 kilograms of petroleum feedstock, and 9 kilograms of chlorine to manufacture diapers for one baby for one year (illustrated **Error! Reference source not found.**) ( Adapted from GroVia, 2020; based on Lehrburger et al., 1991).

A standard single-use disposable diaper consists of a top sheet (non-woven polypropylene lining), absorbent core (also known as 'fluff' using synthetic materials, cellulose, or other fibres) and waterproof back sheet (low-density polyethylene). These layers promote dryness at the baby's skin (Dey *et al.,* 2016, Counts *et al.*, 2017).

The absorbent core also contains sodium polyacrylate SAP that can absorb over 30 times its weight in liquid. Through plastic components, single-use disposable diapers contain harmful chemicals, including volatile organic compounds and phthalates (Bienkowski 2019).




*Disposal*

Single-use disposable diapers are reported to take nearly 500 years to decompose (Khoo et al., 2019) and globally are the third largest single consumer item in landfills, accounting for approximately 4% of solid waste (Ajmeri and Ajmeri, 2016). In the Pacific, diapers and other hygiene products were found to comprise an average of 8% of total waste to landfills (Regional Suite of Audits 2019-21 (World Bank, UN Environment, PRIF, PacWastePlus, POLP)).

Single-use disposable diaper disposal in landfills can cause three main environmental effects: methane emissions through creation of anaerobic conditions and excreta decomposition (KESAB, 2015); leachate seepage into groundwater; and generation of odour (Smith *et al.,* 2001). Despite these issues, landfilling currently remains the best disposal method to manage single-use disposable diapers.

Other management practices include disposal in pits, burning, and discarding as litter, generating pollution and contamination (Wambui *et al.,* 2015).

*Recycling*

Recycling of single-use disposable diapers is a potential post-use management option. However, the processing is complex and requires large scale and expensive infrastructure (Khanyile *et al.,* 2020; Recycling International 2007; Torrijos *et al.* 2014; Vick 2015). Two European plants have closed due to the constraints of economic feasibility, social acceptance, and collection logistics (Recycling International, 2007; Vick, 2015). Recycling of single-use disposable diapers is not currently suitable for use in the Pacific.

## *Benefits of Single-use Disposable Diapers*

### Public Health

The need to contain and manage human excreta to reduce public health risks is understood, particularly in developing countries (Gil et al., 2004). Research has shown poor sanitation and unhygienic disposal of baby excreta can be linked to a higher occurrence of diarrhoea and other bacteria-related diseases (O'Connell, 2015; Gil et al., 2004; WSP WBG; 2015).

Since the 1980s, diarrhoeal disease globally has reduced significantly due to the implementation of a range of hygiene practices, including use of single-use disposable diapers (Gil *et al.,* 2004).

### Women Entering the Workforce

The transition from reusable nappies to single-use disposable diapers globally was encouraged through economic pressures and feminism, calling women to the workforce. Disposable diapers are convenient, safe, and time saving, resulting in a shift in cultural normal with woman no longer being expected to remain at home caring for children (Smith-Howard, 2020).

In the Pacific, the introduction of disposable diapers, along with other modern conveniences, contributed to a change in the dynamics of family life; a reduction in labour at home provided woman an increased freedom of movement and an opportunity to enter the workforce, resulting in social and economic benefits (USAid 2021; UNEP 2021).

A rise in the population working women creates an opportunity for countries to increase the size of their workforce and achieve additional economic growth (USAid 2021).

***Single-use disposable diapers have increased in use, predominantly due to their ability to relieve parents of the labour required to use traditional cloth nappies. However, they create environmental issues in their design and disposal to controlled landfills or elsewhere in the environment. Current recycling infrastructure is not appropriate for Pacific countries.***



## Alternative Infant Hygiene Management Options

Modern reusable nappies and eco-friendly / compostable diapers are infant hygiene garments available and included in this study as alternatives to single-use disposable diapers and reusable nappies. A brief background of these garments is provided below.

### *Modern Cloth Reusable Nappies*

Square cotton cloth reusable nappies have recently seen a modern take, with the development of 'modern reusable nappies', that are fitted premade designs consisting of waterproof outers, absorbent inserts, liner layers, and snap fastenings (Villines, 2019). They were designed to limit leaks, improve absorption, and minimise diaper rash (Khoo et al., 2019; Mihm and Ciaramidaro, n.d.). These reusable nappies are called all-in-ones and all-in-twos for this study. Globally, the uptake of modern reusable nappies is gaining momentum with parents seeking to make environmentally friendly choices while balancing ease and practicality.

### *Single-use Biodegradable Diaper*

A more recent option for infant hygiene is disposal diaper brands that claim biodegradability, eco/environmental-friendliness, or compostability (summarised in this study as "eco-friendly / compostable diapers"). These diapers are single-use garments that have waterproof qualities similar to single-use disposable diapers, but are manufactured using natural properties such as cellulose, chlorine-free wood pulp, cotton, bamboo and other plant-based fibres (Jenisgem 2012 in Khoo et al., 2019), therefore reducing petrochemical material consumption during production. However, in addition to the natural properties, many eco-friendly / compostable diapers are still manufactured using petrochemical-based sodium polyacrylate SAP, and non-compostable plastics for fasteners (Comfy Koalas, 2020; Eco by Naty, 2020; TOM, 2021).


**At the time of publishing this report, there are no known eco-friendly diapers on the market able to claim 100% biodegradability, and certified, for instance, under a standard such as the Australian Organics Recycling Association and the Australasian Bioplastics Association (AORA, 2020). Eco-friendly / compostable single-use diapers do not degrade / compost naturally in the environment; they need specialist infrastructure such as controlled high temperatures and microbial composting facilities**

Eco-friendly / compostable single-use diapers do not degrade / compost automatically in the environment. Certain varieties, using specific industrial composting facilities with controlled high temperatures and microbial activity (Atkin, 2019; Sustainability Victoria, 2021), may be able to biodegrade or be composted. However, as with recycling single-use disposable diapers (Section 0), processing is complex and requires large scale and expensive infrastructure. Despite efforts to use a larger percentage of biodegradable materials in their design, these diapers are predominantly disposed of with other mixed solid waste in landfills (Atkin, 2019; Stewart, 2020). Several brands in fact state that landfill is the appropriate disposal method (Comfy Koalas, 2020, Ecoriginals, 2021, TOM, 2021). Global estimates suggest that eco-friendly / compostable diapers comprise 3.5% of the global diaper market (Bedford, 2021), suggesting there is limited presence of these products globally. Of those products available there is low confidence in their ability to deliver the same quality and function of petrochemical based diapers (Buzatu, 2020) which is a major barrier for parents.

## Current Policy Controls for Single-use Disposable Diapers

Three Pacific countries have taken strong steps to address single-use disposable diapers, appearing to be global firsts for implementation of policy to regulate single-use disposable diapers.

A summary of initiatives and policies regulating single-use disposable diapers, globally and in the Pacific, is provided below.

### *Current Global Policy*

Many countries around the world are adopting import restrictions, initiatives and policies for the management or single-use plastic bags and other single-use items (WTO, 2021), currently single-use disposable diapers are not a targeted item. The European Union, led by France, has recently completed consultation to examine banning some of the chemicals found in single-use disposable diapers, but not the diapers themselves (ECHA, 2021).

### *Global Policy to Tackle Plastic Pollution and Promote Disposable Diaper Alternatives*

In response to the global climate change crisis, aggravated by the depletion of natural resources and the low capacity to manage solid waste, especially single-use plastic, the United Nations Environment Assembly in March 2019, announced Resolution 9, addressing disposable plastic pollution, encouraging member states to promote research for improvement of more sustainable alternatives to single-use plastic products, considering the complete life cycle analysis of these new alternatives (UNEP, 2019 apud Notten et al., 2021).

### *Current Policy in the Pacific*

In their 2020 report, ***Plastic Pollution Prevention in Pacific Island Countries: Gap analysis of current legislation, policies and plans,*** the Environmental Investigation Agency suggests that national plans and policies in the Pacific should consist of national reduction targets for problematic and single-use plastics. Single-use disposable diapers are mentioned in this report as a single-use plastic item worthy of attention.

Pacific countries appear to be at the front regarding implementation of policy to regulate single-use disposable diapers, with three countries recently taken strong steps to address this waste stream - Kiribati, Tuvalu, and Vanuatu.



*Table 2: Kiribati, Tuvalu, and Vanuatu country initiatives to regulate single use disposable diapers*

| Country | Initiatives |
|---|---|
| **Kiribati** | Introduced legislation to prohibit the importation of 'non-biodegradable nappies' in their recent amendments to the *Customs Act* Schedule 3 (Section 64) – Prohibited items No,17. (Gov RoK 2019). Although the legislation is in force, implementation has been found to be difficult to enforce due to the lack of clarity in definition of "non-biodegradable" and lack of equipment to assess and enforce biodegradability claims by suppliers.<br>Additionally, there are no separate collections for diapers currently in Kiribati, and no industrial composting facilities to process the materials. The intention to shift to 'biodegradable' is admirable, yet in practice, there is no net benefit provided to the country through this policy.<br>This policy has the potential to result in negative effects, with the (supposedly) compostable diapers being processed at an organics facility, potentially contaminating the compost, and creating health risks. |
| **Tuvalu** | A levy of AUD0.05c (USD0.03c) has been added to each single-use disposable diaper imported under the *Waste Management (Levy Deposit) Regulation 2019*. This levy is in operation and the government is utilising the income to undertake in-country product testing with an eco-friendly / compostable single-use diaper supplier. The government intends to ulitise the income from the waste levy to subsidise the import of certified Compostable Diapers. |
| **Vanuatu** | the first country to introduce their "intent" to ban single-use disposable diapers from import, under Phase II of their *Waste Management Regulations 2018*, announced in December 2019. Implementation of this ban has been delayed due to a change in government, and to allow more time to consider and consult further on the implications of the ban due to community dissatisfaction (Regenvanu, 2021). |

The Kiribati, Tuvalu, and Vanuatu policies, as shown in Table 2 above, are the first of their kind, and each country is now challenged with implementation issues: Vanuatu currently reviewing their suggested ban, Kiribati encountering barriers for legislative enforcement and effective management of 'non-biodegradable' alternatives, and, to date, the benefits of the Tuvalu levy not yet evident. Additionally, nine countries in the Pacific have mention of diapers or nappies in their waste strategies, however, most refer only to the portion of the waste stream diapers represent.

No policy was identified that encouraged reusable nappies through incentives or other means such as national education campaigns.

**Do Not:** **Dispose single-use disposable diapers in Waterways, Oceans, or the Environment**

Single-use disposable diapers may take **500 years to break down** in the environment. They can release chemicals and bacteria and may entangle land and marine animals. When single-use disposable diapers eventually start to decompose, they break into smaller particles called "**microplastics**", which can be eaten by fish and end up in food eaten by us.

**Do Not:** **Burn single-use disposable diapers**

Burning of single-use disposable diapers will **emit dioxins and toxic fumes**. These fumes may affect our health and may spread into the surrounding environment (*into food and water sources*). Bury used diapers in controlled, covered pits.

**Do Not:** **Dispose single-use disposable diapers in areas near water supply and gardens**

Single-use disposable diapers in the environment may release chemicals such as dioxins, heavy metals, and bacteria from the baby excreta into the soil and water. These chemicals may end up in gardens and can **spread pollution and disease**.

**Do Not:** **Dispose reusable nappies wastewater near groundwater, water supplies and gardens**

Untreated wastewater, including from washing reusable nappies, has the potential **spread disease and contaminate soil and drinking water** sources. Most outbreaks of waterborne illnesses can be traced to wells or water supplies. contaminated by sewage.

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