

ADDRESSING FIBREGLASS WASTE MANAGEMENT IN THE BOAT-BUILDING INDUSTRY IN THE MALDIVES: A CASE STUDY OF R. ALIFUSHI

IMPLEMENTING SUSTAINABLE LOW AND
NON-CHEMICAL DEVELOPMENT **IN** SIDS
[ISLANDS]



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Abbreviations

FRP	Fibre Reinforced Plastic
GDP	Gross Domestic Product
GEF	Global Environment Fund
ISLANDS	Implementing Sustainable Low and Non-chemical Development in SIDS
IWMC	Island Waste Management Centres
MEK	Methyl Ethyl Ketone
MoTE	Ministry of Tourism and Environment
NGO	Non-Governmental Organization
RWMC	Regional Waste Management Centres
SIDS	Small Island Developing States
UN	United Nations
WAMCO	Waste Management Corporation Limited



1 INTRODUCTION

1.1 Background

Industries are pivotal to economic prosperity of a society, yet developmental activities and industrial growth unavoidably generate hazardous waste.¹

Improper disposal of such waste poses significant risks to both human health and the environment, including soil, air, and water contamination.²

Hazardous waste, defined by its inherent chemical and physical properties, such as toxicity, ignitability, reactivity, and corrosivity, threatens both human well-being and natural resources.³

Effective management of it encompasses a range of activities such as proper collection, transportation, recycling, treatment, disposal, and continuous monitoring of disposal sites.⁴ In many developing countries, inadequate management strategies result in hazardous waste being directly released into the environment, exacerbating existing health and environmental vulnerabilities.⁵

Specifically, in Small Island Developing States (SIDS), there are distinctive challenges in the management of hazardous waste due to the high reliance on

¹ Misra, V., & Pandey, S. (2005). Hazardous waste, impact on health and environment for development of better waste management strategies in future in India. *Environment International*, 31(3), 417–431. <https://doi.org/10.1016/j.envint.2004.08.005>

² Kanagamani, K., Geethamani, P., & Narmatha, M. (2021). Hazardous waste management. In *IntechOpen eBooks*. <https://doi.org/10.5772/intechopen.94080>

³ Kumar, A., Thakur, A. K., Gaurav, G. K., Klemeš, J. J., Sandhwar, V. K., Pant, K. K., & Kumar, R. (2023). A critical review on sustainable hazardous waste management strategies: a step towards a circular economy. *Environmental*

Science and Pollution Research International, 30(48), 105030–105055. <https://doi.org/10.1007/s11356-023-29511-8>

⁴ Kanagamani, K., Geethamani, P., & Narmatha, M. (2021). Hazardous waste management. In *IntechOpen eBooks*.

⁵ Ferronato, N., & Torretta, V. (2019). Waste Mismanagement in Developing Countries: A review of Global issues. *International Journal of Environmental Research and Public Health/International Journal of Environmental Research and Public Health*, 16(6), 1060. <https://doi.org/10.3390/ijerph16061060>



imports from global markets.⁶ SIDS rely on the import of a wide range of products, including mercury-containing thermometers, plastic packaging, second-hand electronics, motor vehicles, and various agricultural and industrial chemicals. Consequently, hazardous and toxic wastes accumulate in significant quantities, often exceeding the technical and infrastructure capacities of SIDS to handle and dispose of them in an environmentally sound manner.⁷ The Republic of Maldives, is among one of the SIDS of the Indian Ocean. An estimated 324,000 tonnes of solid waste is generated in the Maldives annually of which 0.5% to 11% comprises of hazardous chemicals.⁸

The management of such waste in the Maldives is challenging due to lack of land availability, low-lying land, complexity and cost of transporting waste between islands, insufficient regulatory frameworks and lack of financial mechanisms to promote sustainable chemicals management.⁹ Additionally, the lack of economies of scale hinders establishment of national-level recycling and disposal solutions, including hazardous waste and chemicals. Furthermore, the country's susceptibility to climate-related events and ocean



Figure 1: Waste piled in the waste disposal area of HA. Thakandhoo, Maldives

⁶ Implementing Sustainable Low and Non-Chemical Development in SIDS (ISLANDS) – Program Framework Document (PFD) entry – GEF – 7. (2019). In Program Framework Document (PFD) Entry – GEF – 7. GEF. <https://www.thegef.org/projects-operations/projects/10185>

⁷ *ibid*

⁸ Implementing Sustainable Low and Non-Chemical Development in SIDS (ISLANDS) ISLANDS Programme Package | Child Projects. (2019). In www.thegef.org.

⁹ Implementing Sustainable Low and Non-Chemical Development in SIDS (ISLANDS) ISLANDS Programme Package | Child Projects. (2019). In www.thegef.org. https://www.thegef.org/sites/default/files/web-documents/10185_PFD_SIDS_Annex_ChildProjects.pdf



inundation has to be considered among the challenges for waste management in the Maldives.¹⁰

These obstacles have been persisting in the nation for decades, and have only been exacerbated with industrial growth. Industries such as fibreglass boat building has been developing in the country without a proper mechanism to manage waste generated from the industry. Thus, there is an immediate need for identifying ways to address the increasing waste generation in these sectors as the nation's economy continues to grow.

1.2 Objective and Scope of the Study

This case study is undertaken as part of the project "Implementing Sustainable Low and non-chemical Development in SIDS (ISLANDS)". The project is supported by United Nations (UN), with the funding from Global Environment Facility (GEF) and

implemented by the Ministry of Tourism and Environment (MoTE).

The ISLANDS programme's overarching objective is to support SIDS to enter a safe chemical development pathway through strengthening their ability to control the flow of chemicals, products and materials into their territories and to unlock resources for long term management of chemicals and waste, including integrated chemical and waste management in SIDS. This case study is prepared to understand gender dimensions in chemical use and hazardous waste management in the Maldives, highlighting gender-wise roles, vulnerabilities and skills. More specifically, it aims to understand the current situation of waste management in the fibreglass boat building industry in the Maldives, focusing on R. Alifushi. Alifushi is currently recognized as the forerunner of boat building in the country. As such, this study explores waste management practices in the boat building sector in R. Alifushi and its gender-wise impact on human health and the environment.

¹⁰ *ibid*



The specific scope of the study is:

- Assessing practices in the usage of fibreglass in the boat-building industry in Alifushi including import, transport, storage, usage and disposal;
- Identifying issues of concern and key challenges for the sound management of waste in the sector;
- Studying the gender dimensions and gender-wise impact in chemical usage and hazardous waste management in the sector, including gender-wise exposure routes;
- Providing recommendation to address fibreglass waste management in a sustainable manner in Alifushi and also across the nation.



1.3 Study Roadmap

Following this introduction (Section I), this report is structured as follows:

- Study Approach (Section II) presents the methodology utilized in the data collection and analysis for this case study. This includes a profile of the case study area and variables covered in the study,
- Country Overview (Section III) presents an overall situational context of Maldives, including its geographical and socioeconomic profile. This also includes overview of current landscape of waste management in the Maldives, with a focus on chemical and hazardous waste,
- Case Evaluation (Section IV) outlines the key findings from the case study. This includes the good practices identified, as well as issues of concern. It also includes gender dimensions in the sector focusing on roles, and vulnerabilities, current waste management practices as well as challenges and gaps to be addressed to strengthen the waste management in the sector,
- Recommendations (Section V) provides the recommendations for improving the waste management practices and establishing a proper waste management and disposal system for chemicals and hazardous waste in the island, and across nationwide.
- Conclusion (Section VI) presents the summarized overview of the entire report.



2 STUDY APPROACH

2.1 Case Study Area

This case study focuses on the island of Alifushi, situated in North Maalhosmadulu Atoll of the Maldives at an approximate geographic coordinate of 5°58'00.87"N and 72°57'11.90"E.¹¹



Figure 2: R. Alifushi

With a land area of 0.616 km², the island lies on the northern outskirts of the Raa atoll, on a

distinct reef system separate from the other islands in the atoll.¹²

A total population of 1,859 individuals resides in the island, comprising 1,064 male and 795 females. Approximately 19% of the resident population are foreigners. The growth rate of the island from 2014 to 2022 is -0.6, and currently the dependency ratio is at 72.¹³

Over the last few years, the island has seen developments in infrastructure, including education, health facilities and basic amenities such as water and sewerage system to support the local population. Currently, a road construction project is also underway in the island.¹⁴

¹¹ Aleem, A. (2014). ENVIRONMENTAL IMPACT ASSESSMENT: For the construction and setup of an island sewerage system in Alifushi Island, Raa Atoll, Maldives. Water Solutions Pvt. Ltd. <http://saruna.mnu.edu.mv/jspui/bitstream/123456789/4204/1/R.%20Alifushi%20sewerage%20system%20with%20amendments.pdf>

¹² ibid

¹³ Maldives Bureau of Statistics. (2024). Population Dynamics in The Maldives: An

analysis from Census 2022. <https://census.gov.mv/>.

<https://census.gov.mv/2022/census-analysis/>

¹⁴ Shiyaz, I., Sujeeth, A., Samaah, A., Waheed, A., Fathmath, M., Fazeel, S. A., Jinah, A. L., Afzal, A. S., & Hussain, M. S. (2016, November 1). Culture Book R. Alifushi. <http://saruna.mnu.edu.mv/jspui/handle/123456789/1709>



The local economy is primarily based on boat building and fishing, with infrastructure supporting the residents' needs.

2.1.1 Rationale for selection of case study area

R. Alifushi is known as the “Builder’s Island” in the Maldives. Boats built by the skilful boat builders of this island is known for their durability, seaworthiness and exquisite designs.¹⁵ These vessels mark the vital role the island plays in the national economy, having become an integral part of the Maldives transportation system, fishing industry and the continuously growing tourism sector.¹⁶ The boat builders of the island have played a crucial role in preserving Maldivian maritime heritage, while introducing new modern techniques and methods to the sector.¹⁷

This also means that the island has been exposed to issues

created by the fast growth in the sector, without the necessary support services such as a proper waste management system. Discussions with stakeholders at various stages of the project highlighted issues faced by the residents of this island, including an increasing number of health issues and environmental issues. Specific issues emphasized include increase in skin infections, increased number of cancer patients in the island, and frequency of fire incidents in the piled fibreglass waste in the island’s garbage disposal area.^{18,19} Thus, the island was purposefully selected with a single-case study approach as it is determined that an in-depth exploration of the fibreglass waste management in the boat building industry in the Maldives can be attained holistically with the island as the case study sample.

¹⁵ Alifushi. (n.d.). <https://www.offshore.mv/company/alifushi>

¹⁶ *ibid*

¹⁷ *ibid*

¹⁸ R.Alifushi raises concerns over prevalence of cancer. (2023, January 5).

<https://en.sun.mv/>.

<https://en.sun.mv/80127>

¹⁹ Massive fire breaks out in R. Alifushi. (2023, January 7). The Edition. https://edition.mv/presidents_office/26754



2.2 Data Collection

A qualitative case study approach with multiple stages of data collection was used to undertake an in-depth, multi-faceted exploration of the fibreglass boat building industry in R. Alifushi.

Firstly, a closer look at the trends in the Maldives boat-building industry and waste accounts was taken as part of the literature review. This also included the review of relevant laws and regulations to understand the contextual and legislative factors that impact the industry.

Following this, stakeholder consultations were conducted with Island Council and Health Facility of the R. Alifushi. Additionally, key informant interviews were conducted with 4 boat builders of the island. The qualitative data collection process focused on the following:

1. Establishment and development of the boat building sector in the island,
2. Process of building a fibreglass boat from import, transportation, storage, to usage and disposal,
3. Current waste management practices in the industry,
4. Challenges and influencing factors of waste management,
5. Gender dimensional exposure routes and impact, and
6. Recommendations for a sustainable scenario of waste management in the industry.



3 COUNTRY OVERVIEW

3.1 Profile of Maldives

The Republic of Maldives is an archipelago of 1,190 coral islands, located in the Indian Ocean at a latitude between 7° 6' 35" N and 0° 41' 48" S, and a longitude between 72° 33' 19" E and 73° 46' 13" E.²⁰ It stretches approximately 860 km in length and varying in width between 80 and 120 km, with only 1.4% land area, making it one of the most geographically dispersed in the world.²¹ It is also the lowest country in the world, with a maximum natural elevation of 2.4 m and average ground level of 1.5 m above sea level.²²

The country's ocean is home to diverse marine life, including over

1,000 species of fish, various species of coral, and numerous marine mammals.²³ Its coral reef system is the largest in the Indian Ocean, and seventh largest and one of the most diverse in the world, covering more than 8,900 km². These reefs form the backbone of the islands.²⁴

Naturally, the islands are grouped into 26 atolls, however administratively, the islands are divided into 20 atolls.²⁵ In total, there are 182 inhabited islands, 170 resorts and 128 industrial islands.²⁶

²⁰ Maldives. (n.d.).

<https://www.atollsofmaldives.gov.mv/>

²¹ Ministry of Environment. (2017). STATE OF THE ENVIRONMENT 2016. In <https://www.environment.gov.mv/>. <https://www.environment.gov.mv/v2/wp-content/files/publications/20170202-pub-soe-2016.pdf>

²² Moosa, F. S. (n.d.). COUNTRY REPORT: REPUBLIC OF MALDIVES. In <https://www.adrc.asia/> (No. FY2014B). Asian Disaster Reduction Centre (ADRC). https://www.adrc.asia/countryreport/MDV/2014/MDV_CR2014B.pdf

²³ Secretariat of the Convention on Biological Diversity. (n.d.). Main details. <https://www.cbd.int/countries/profile?country=mv>

²⁴ *ibid*

²⁵ Map of Maldives. (n.d.). <https://www.mymaldives.com/>. <https://www.mymaldives.com/maldives/map-of-maldives/>

²⁶ President's Office. (2025). *Gazette: Declaration of Inhabited Islands of the Maldives*. President's Office.



²⁷ ²⁸ ²⁹ Among the inhabited islands, 4 have been denoted as cities.³⁰ A population of 515,132 individuals reside in these islands, including a significant proportion of foreigners; around 26% of the total population.³¹ The Maldivian population comprise of 188,077 females and 194,562 males. While there is a 26% increase of total Maldivian population between 2014 and 2022, an overall decrease has been observed in the annual average growth rate; 3.43% between 1985 and 1990 to 1.56% between 2014 and 2022.³²

The geography and its proximity to the equator contributes to the tropical climate of the country. Warm temperatures, high humidity and distinct monsoon seasons with varying weather

patterns is experienced in this small nation.³³ The dry season (northeast monsoon) experienced from October to May is marked by clear skies and calm conditions. Contrastingly, the wet season (southwest monsoon) experienced from May to October. brings heavy rainfall and strong winds.³⁴

The unique geography of extensive atolls, beautiful coral reefs, and rich marine biodiversity of this island nation contributes greatly to its economy. Both the tourism and fisheries industry; 25.5% of GDP, are heavily dependent on the geographical resources.³⁵ However, these same geographic characteristics also threatens the fragile delicate ecosystem of the nation and

²⁷ Ministry of Tourism and Environment. (2025, March 16). Tourism Facilities. Retrieved from <https://www.tourism.gov.mv/>

²⁸ Managing risks for a safer built environment in the Maldives: Building Regulatory Capacity Assessment – Maldives. (2020, September 7). ReliefWeb. <https://reliefweb.int/report/maldives/managing-risks-safer-built-environment-maldives-building-regulatory-capacity>

²⁹

³¹ Maldives Bureau of Statistics. (2024). Population Dynamics in The Maldives: An analysis from Census 2022. <https://census.gov.mv/>. <https://census.gov.mv/2022/census-analysis/>

³² *ibid*

³³ About Maldives – Invest Maldives. (n.d.). <https://investmaldives.gov.mv/Home/AboutMaldives>

³⁴ *ibid*

³⁵ *ibid*



make it highly susceptible to environmental threats such as climate change and rising sea levels.³⁶

3.2 Economic Sectors

Despite the unique challenges it faces, Maldives has been developing at a rapid speed, showing a steady average growth of the economy with a considerable development of the country's infrastructure and connectivity.³⁷

Tourism is the single largest contributing sector to the economy, contributing 21.4% of the Nominal GDP share in 2021.³⁸ In addition to tourism, the Maldives

has a growing fisheries sector, which is another vital component of its economy. Both these industries are the major sources of foreign exchange earnings and government revenue.³⁹ While fisheries sector had only a share of 4.1% of the Nominal GDP for the year of 2021, the government is currently putting extra efforts and initiatives to further grow the sector and increase Maldivian participation.^{40, 41}

The nation also has an industrial or manufacturing sector that is responsible for 1.9% share of the GDP in 2021.⁴² The traditional manufacturing industries includes boat-building and handicrafts, along with the fish-processing

³⁶ Ibid

³⁷ The World Bank In Maldives – Overview. (2023, October 4). <https://www.worldbank.org/>. <https://www.worldbank.org/en/country/maldives/overview>

³⁸ Maldives Bureau of Statistics. (2022). ANNUAL GROSS DOMESTIC PRODUCT Maldives. In <https://statisticsmaldives.gov.mv/>. <https://statisticsmaldives.gov.mv/nbs/wp-content/uploads/2022/10/Annual-GDP-production-2022.pdf>

³⁹ Economic profile. (n.d.). <https://www.maldiveshighcommission.uk/index.php/business/economic->

[profile#:~:text=The%20Maldivian%20economy%20is%20heavily,much%20larger%20proportion%20of%20GDP.](#)

⁴⁰ Maldives Bureau of Statistics. (2022). ANNUAL GROSS DOMESTIC PRODUCT Maldives.

⁴¹ The World Bank In Maldives – Overview. (2023, October 4).

⁴² The economic context of the Maldives – International Trade Portal. (n.d.). <https://www.lloydsbanktrade.com/en/market-potential/maldives/economical-context>



industry. Boat-building industry in itself plays an integral part of the economy, underpinning key sectors such as fishery and tourism.⁴³ The industry's blend of traditional craftsmanship and modern innovation continues to drive economic growth and provide significant employment opportunities, contributing to the overall economic resilience of the country.⁴⁴

3.3 Waste Management Strategy

Sustainable waste management is a complex issue in the Maldives, exacerbated by its unique geographic and economic conditions. The dispersed nature of the islands, coupled with the high volume of waste generated by residents and tourists, poses

significant challenges to effective waste management.⁴⁵

3.3.1 Waste Generation and Composition

According to reports published between 2007 to 2017, daily waste generation rates of the country ranges from 0.71 to 2.97 kg per person for Greater Male' region and between 0.7 to 1.3 kg per person in the atolls. Furthermore, between 2004 to 2014, a 155% increase in municipal waste generation was reported for Greater Male' region while a 57.4% increase in waste generation was observed in the atolls for the same time frame.⁴⁶

Generally, waste in the Maldives is predominantly composed of organic material, plastics, paper, metals and glass; around 80%.⁴⁷ A

⁴³ *ibid*

⁴⁴ *ibid*

⁴⁵ Consortium: ENVIROPLAN S.A. (Greece), CONCEPT International (Tunisia), & Riyan Private Limited. (2023). DRAFT: Maldives Waste Management Policy and Formulation of a National Waste Management Strategy. In <https://www.environment.gov.mv/>. <https://www.environment.gov.mv/v2/download/2487/>

⁴⁶ Moosa, L. (2021). Maldives National Waste Accounts 2018 & 2019: Final Report. In [unescap.org. https://www.unescap.org/sites/default/d8files/2021-04/Maldives_National_Waste_Account_Report_2018-19.pdf](https://www.unescap.org/sites/default/d8files/2021-04/Maldives_National_Waste_Account_Report_2018-19.pdf)

⁴⁷ *ibid*



significant portion of the waste is plastic, accounting to around 12% of the total waste produced in the country.⁴⁸

In terms of industrial waste, it is defined as waste produced from activities related to the production of goods and products, including electric power generation and the manufacturing of materials like pulp and paper, iron and steel, glass, and concrete.⁴⁹

As for the Maldives, industrial waste includes fibreglass waste generated in boat construction, fish waste and metal scrape from fish processing industry and waste oil generated in airports

and powerhouse.⁵⁰ Additionally expired medicines and chemicals, some types of e-waste, batteries and empty containers of chemicals is also considered as industrial waste.⁵¹ It should be noted that sector specific data on the quantities of waste generated from most of the economic or industrial activities is currently not recorded in the country.⁵² For instance, the quantity of fibreglass waste accumulated in boat-building industry and fish waste accumulated from fish processing industry is not recorded. As for waste oil, it was recorded that 2.621 tonnes of waste oil were generated in 2021, while metal scraps from fish waste amounted to 3% of total waste in the sector.⁵³

⁴⁸ The Maldives | UNEP Law and Environment Assistance platform. (n.d.). [https://leap.unep.org/en/countries/mv/case-studies/maldives#:~:text=Currently%2C%20the%20total%20plastic%20footprint,Ocean%20Plastics%20Alliance%2C%202021\).](https://leap.unep.org/en/countries/mv/case-studies/maldives#:~:text=Currently%2C%20the%20total%20plastic%20footprint,Ocean%20Plastics%20Alliance%2C%202021).)

⁴⁹ Hazardous Waste Experts. (2024, February 16). What is Considered Industrial Waste, and How to Manage it? <https://www.hazardouswasteexperts.com/industrial-waste-management/>

⁵⁰ Consortium: ENVIROPLAN S.A. (Greece), CONCEPT International (Tunisia), & Riyan Private Limited. (2023). DRAFT: Maldives Waste Management Policy and Formulation of a National Waste

Management Strategy. In <https://www.environment.gov.mv/>. <https://www.environment.gov.mv/v2/download/2487/>

⁵¹ *ibid*

⁵² Moosa, L. (2021). Maldives National Waste Accounts 2018 & 2019: Final Report. In unesco.org.

⁵³ Consortium: ENVIROPLAN S.A. (Greece), CONCEPT International (Tunisia), & Riyan Private Limited. (2023). DRAFT: Maldives Waste Management Policy and Formulation of a National Waste Management Strategy.



The construction industry further generates C&D waste of around 300 tonnes and 200 tonnes daily in Male' and Hulhumale' respectively, though this is considered an under estimation for the whole country.^{54, 55}

⁵⁴ Hazardous Waste Experts. (2024, February 16). What is Considered Industrial Waste, and How to Manage it? <https://www.hazardouswasteexperts.com/industrial-waste-management/>

⁵⁵ Moosa, L. (2021). Maldives National Waste Accounts 2018 & 2019: Final Report. In unescap.org.



3.3.2 Waste Management in Greater Male' Region

Waste Management Corporation Limited (WAMCO) currently oversees waste management in Greater Male' region; including collection, transport, storage and disposal.⁵⁶ Thilafushi island is the main waste management facility in the country.



Figure 3: Waste piled in Thilafushi

Waste from Greater Male' and other islands in the region including tourist resorts are transported there. The amount of

daily waste transferred to Thilafushi is over 500 to 700 tonnes.⁵⁷ Furthermore, industrial waste entering the site yearly is reported to be 2,200 tonnes.⁵⁸

Despite the island being designated as the waste disposal location, with WAMCO responsible for the task, bulky waste such as furniture, refrigerators, washing machines and similar items are still discarded along road sides, open areas and unused land plots in the Greater Male' area.⁵⁹

In Thilafushi, up until as recently as 2021,⁶⁰ the main method of waste management was open burning of mixed waste. Resultingly, it has caused severe air pollution and release of heavy metals. Currently, work is underway to establish a waste to energy facility

⁵⁶ WAMCO - Waste Management Corporation Limited. (n.d.). <https://wamco.com.mv/our-company/1>

⁵⁷ Thilafushi waste-to-energy project to begin in 2023. (n.d.). PSMnews.mv. <https://psmnews.mv/en/103516>

⁵⁸ Consortium: ENVIROPLAN S.A. (Greece), CONCEPT International (Tunisia), & Riyan Private Limited. (2023). DRAFT: Maldives Waste Management Policy and Formulation of a National Waste Management Strategy.

⁵⁹ Moosa, L. (2021). Maldives National Waste Accounts 2018 & 2019: Final Report. In unescap.org.

⁶⁰ Ministry of Environment. (2021, August 19). Stopping the open burning of K. Thilafushi: (IUL)438-WMPC/438/2021/224. www.environment.gov.mv. <https://www.environment.gov.mv/v2/en/download/12458>



on the island, as an initiative to make waste management more sustainable in the country.⁶¹

3.3.3 Waste Management at Island Level

3.3.3.1 Waste Collection at Island Level

WAMCO is also responsible for managing waste in the rest of the cities, while Island Councils manage waste on their respective islands. In some islands, Island Councils have agreements with private contractors for waste collection while in other islands, waste collection is carried out by the council staff.

In most islands, the waste is transported to the Island Waste Management Centres (IWMCs), where it is segregated, sorted and disposed of.⁶² IWMCs are generally equipped with equipment such as plastic shredder, glass crushers, compactors for metals and

plastics, wood chippers, weighing scales, etc.⁶³ However, in a lot of the IWMCs, there is a lack of spare parts for the equipment or lack of technical expertise needed to operate or maintain the machines.⁶⁴

In the inhabited islands where IWMCs has not yet been established, the waste is transported to a general garbage disposal area allocated by the Council for dumping.⁶⁵ While most islands have the designated waste disposal area away from the residential areas, there are few islands where due to lack of space, the disposal area is located near to residential houses.

3.3.3.2 Waste Disposal

Majority of the islands dispose their waste by open air burning, or is stockpiled on site.⁶⁶ Open air burning leads to air pollution and disturbs the residents living in areas nearby to the centre.

⁶¹ Consortium: ENVIROPLAN S.A. (Greece), CONCEPT International (Tunisia), & Riyan Private Limited. (2023). DRAFT: Maldives Waste Management Policy and Formulation of a National Waste Management Strategy.

⁶² *ibid*

⁶³ *ibid*

⁶⁴ *ibid*

⁶⁵ *ibid*

⁶⁶ *ibid*



Stockpiling leads to decrease in size availability in the IWMCs, ultimately leading to overspilling of waste to other nearby areas of the island causing environmental hazards.⁶⁷

Moreover, recovery of reusable and recyclable waste is undertaken by few NGOs and private businesses or individuals.⁶⁸ Some of the waste, as well as useful recyclable materials, which cannot be managed at island level is periodically transferred to Regional Waste Management Facilities (RWMFs). In islands with proper equipment, combustible waste is also shredded and baled until incineration is possible. Waste such as metal, glass and plastic, is separated and stockpiled.⁶⁹

In order to minimize the volume of waste and find sustainable solutions for its management with minimal environmental impact, the government is currently exploring waste-to-energy projects across the country to

convert waste into electricity.⁷⁰

There has also been plans to establish a hazardous waste management centre in Thilafushi and Addu.

3.3.4 Involvement of women in Waste Management

Both in the Greater Male' region and in other islands, waste is mostly handled by women at a household level. In addition to that, women are also involved in waste collection at an institutional level, both at WAMCO and in some Island Councils. Contrastingly, men are more involved in waste handling and disposal process, both in Thilafushi and in the IWMCs.

⁶⁷ *ibid*

⁶⁸ Moosa, L. (2021). Maldives National Waste Accounts 2018 & 2019: Final Report. In unescap.org.

⁶⁹ *ibid*

⁷⁰ Thilafushi waste-to-energy project to begin in 2023. (n.d.). PSMnews.mv. <https://psmnews.mv/en/103516>



3.3.5 Chemical and Hazardous Waste Disposal

As per the Waste Management Act (Law No 24/2022), waste produced by the following are deemed as hazardous waste; explosives, flammable liquids, easily flammable solid substances, combustible substances, substances that are flammable when mixed with water or result in the formation of flammable gas, oxidizers, organic peroxide, toxic substances, infectious substances, corrosives, and ecotoxic substances.⁷¹ Under the Act, it is illegal to import, sell, use and distribute any hazardous waste or relevant waste substance in the Maldives. Additionally, hazardous waste shall not be recycled, reused, or processed for any other such purpose in the country.⁷²

⁷¹ Government of Maldives. (2023, January 16). Waste Management Act (no. 24/2022). Utility Regulatory Authority. <https://ura.gov.mv/downloads/waste-management-act-no-242022/>

⁷² *ibid*

⁷³ Government of Maldives. (n.d.-a). Maldives – Environmental Protection And Preservation Act Of Maldives (Act No: 4/93). http://www.ilo.org/dyn/natlex/natlex4.detail?p_lang=en&p_isn=85778&p_classification=01

Similar provisions are included in the Environment Protection and Preservation Act (Law No: 4/93). As per this Act, any type of waste that may be harmful to the environment, hazardous/toxic or nuclear waste shall not be disposed within the territory of Maldives.⁷³ In the situation that the disposal of chemicals becomes necessary, specific guidelines needs to be followed to ensure the prevention of any harm to the general population.⁷⁴

Fire and Rescue Services of the Maldives National Defence Force (MNDF) currently takes responsibility for disposal of hazardous chemicals in the country. Expired chemicals or hazardous waste are collected and transported to Thilafushi by MNDF.⁷⁵ MNDF also acts as first

⁷⁴ *ibid*

⁷⁵ Ministry of Climate Change, Environment and Energy. (2022). Baseline Assessment on National Use of Chemicals and Associated Risks 2022. In UNDP (ISBN 978-99915-78-14-9). <https://www.undp.org/maldives/publications/baseline-assessment-national-use-chemicals-and-associated-risks-2022>



responders during emergency situations that involving mishandling, illegal transactions and accidents related to hazardous chemicals. This includes accidents of oil spills and hazardous chemicals. However, due to the existing logistical challenges, there are delays in providing these services when requested by agencies and private parties.⁷⁶ Furthermore, chemicals used in households are often discarded mixed with municipal waste. Upon open burning of such waste, which is still practices in many islands, results in the release of harmful toxins into the atmosphere.⁷⁷

The government of Maldives currently are working on establishing regional hazardous waste management centres / storage facilities in Thilafushi and Addu City. As per the National Waste Management Policy and Strategy (NWMPS) 2023 – 2027, regulations would be set forth which mandates waste generators and the collection/treatment providers to submit yearly reports. And each

batch of transferred hazardous waste must be followed throughout its life cycle by a notification for waste shipment (a "Transfer Note" or "Manifest").⁷⁸

⁷⁶ *ibid*

⁷⁷ *ibid*

⁷⁸ *ibid*



4 CASE EVALUATION

4.1 The beginning and the present of the industry

The start of boat-building industry as a main occupational sector in R. Alifushi can be traced back to 1982. At the time, the boats were constructed in the Maldivian traditional way, using timber from palm trees as the main material and minimal handmade tools.⁷⁹ A boatyard, generally called as the Alifushi Boatyard, was established around this time, as an initiative under Kuwait Fund for building fishing boats. The boatyard quickly expanded to include a boat building training centre along with a vocational training centre to train new experts for the industry.⁸⁰

As such, the industry went on to become popular around 1995–1997

and continued to grow and expand.⁸¹ In around the early 2000s, a major shift occurred in the sector whereby the main material used to build boats changed from timber to fibreglass as the global demands and practices changed. With this, modernized techniques and automated tools and software applications such as usage of AUTOCAD were introduced to the industry.⁸²

Initially, when the sector started in the country, the master boat builders had no need for diagrams or sophisticated instruments. The design of the boat would only be known to the head carpenter, as a preliminary design just in their heads.⁸³ The design would then be brought to life with the help of a few carpenters. However, in the

⁷⁹ Shiyaz, I., Sujeeth, A., Samaah, A., Waheed, A., Fathmath, M., Fazeel, S. A., Jinah, A. L., Afzal, A. S., & Hussain, M. S. (2016, November 1). Culture Book R. Alifushi. <http://saruna.mnu.edu.mv/jspui/handle/123456789/1709>

⁸⁰ Didi, H. (1985, December 10). ދިވެހި ބަހުގެ ބަހު. <http://saruna.mnu.edu.mv/jspui/handle/123456789/5911>

⁸¹ Shiyaz, I., Sujeeth, A., Samaah, A., Waheed, A., Fathmath, M., Fazeel, S. A.,

Jinah, A. L., Afzal, A. S., & Hussain, M. S. (2016, November 1). Culture Book R. Alifushi.

⁸² *ibid*

⁸³ Mohamed, N. (n.d.). Maldivian Seafaring in the Pre-Portuguese Period. In <http://qaumiyyath.gov.mv/>. National Centre for Linguistic and Historical Research. <http://qaumiyyath.gov.mv/docs/whitepapers/history/seafaring.pdf>



current practices, the design of the boat is generated using AUTOCAD software, and boat-building is only started upon approval of the design by the client.⁸⁴

Presently, Alifushi boatyard has the capacity to accommodate more than 50 boats of varying sizes, as compared to the initial capacity of only 12 fishing vessels.⁸⁵ Additionally, a variety of services ranging from designing and fabricating crafts with fibreglass and wood to routine annual maintenance and major restoration and retrofitting services are provided by various companies in the boatyards in Alifushi. This includes carpentry, painting, rigging, mechanical and electrical services, machine fabrication and modern painting.

With the modernization of the sector, the skills and expertise of the experienced boat builders are being passed down from one generation to another, through continuous boat-building



Figure 4: Alifushi boatyard

specialized training programs conducted in the island.⁸⁶

Currently, boat-building is the main economic activity in the island. As per the Island Council, around 12% of the island's resident population, all of whom males, are involved in the industry. As per the Council, it is assumed that almost every household on the island benefits economically from the sector. However, it is important to note that, as with most economic sectors of the country, the number of foreign workers in the industry has increased over the years,

⁸⁴ Shiyaz, I., Sujeeth, A., Samaah, A., Waheed, A., Fathmath, M., Fazeel, S. A., Jinah, A. L., Afzal, A. S., & Hussain, M. S. (2016, November 1). Culture Book R. Alifushi.

⁸⁵ *ibid*

⁸⁶ *ibid*



which has ultimately resulted in a decrease in income for the local population.

4.2 Process of Building a Fibreglass Boat

The process of building a boat starts with the drawing of the design as per the client's request. Following this, a plug is made which is an exact hand-crafted replica of the final hull.⁸⁷ The plug is generally made from wood and its only purpose is to cast the mould, after which it is discarded.⁸⁸ The mould which is made of fibre reinforced plastic (FRP), is a reverse or mirror image of the finished hull. This allows the FRP materials to be laid on the inside.⁸⁹ Thus, both plug and mould are a reproduction of the hull or deck, faithful in size, shape and every detail.⁹⁰ Following this, various chemicals are used for the completion of the boat.

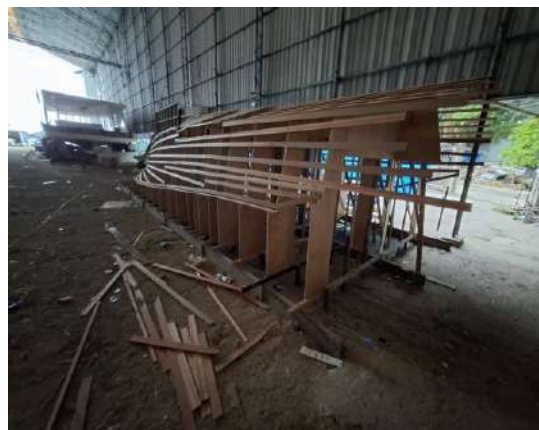


Figure 5: Plug made by wood



Figure 6: Mould made by FRP

4.2.1 Chemical Usage

The following list includes the main substances used in various quantities for the completion of the boat. These substances are identified as hazardous chemicals

⁸⁷ FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS. (1991). Fishing boat construction: 2 Building a fibreglass fishing boat: FAO FISHERIES TECHNICAL PAPER 321. In <https://openknowledge.fao.org/>.
<https://openknowledge.fao.org/server/a>

[pi/core/bitstreams/d1239663-4ed7-4179-9a8d-1ab28ad61c9a/content](https://openknowledge.fao.org/server/a/pi/core/bitstreams/d1239663-4ed7-4179-9a8d-1ab28ad61c9a/content)

⁸⁸ ibid

⁸⁹ ibid

⁹⁰ ibid



which can have various harmful impacts on both the health of workers and the environment, if proper safety measures are not taken.⁹¹

1. Solvents like turpentine, acetone, methyl isobutyl ketone, methyl ethyl ketone (MEK), ethanol, and methylated spirits,
2. Epoxy resins, polyester resins and vinyl ester resins,
3. Hardeners, catalysts, initiators, promoters and accelerators,
4. Paints,
5. Adhesives and fillers,
6. Thinners,
7. Varnish,
8. Primers,

9. Corrosive cleaning and surface preparation substances (such as acids, pickle paste, mould release agents)

4.2.2 Import and Transportation

The life cycle of fibreglass in the Maldives, from import to usage and disposal, is difficult to trace as it is not carried out in a systemic manner. As per the boat builders, even though there are no wholesalers or retailers on the island, there are no difficulties or restrictions in obtaining fibreglass. Individual businesses in Alifushi purchase and transport fibreglass and chemicals from distributors and/or importers in Male' and transport them to the island via supply boats. No specific safety measures are taken by the boatyard owners or supply boats while transporting these to and within the island.

⁹¹ Environmental Protection Authority Te Mana Rauhi Talao. (2014). Using hazardous substances in fibreglass boat building. In www.evatechsolutions.co.nz.

https://www.evatechsolutions.co.nz/files/us-substances-fibreglass-boat-building-guidance_2_.pdf



4.2.3 Storage

There are few storage facilities in the island for chemicals and fibreglass. However, these are temporary constructed spaces that are generally not meant for long-term storage.



Figure 7: Temporary chemical storage facilities

It was also observed that chemicals are generally kept in the boatyards. In almost all boatyards visited, there were large barrels of containers in a haphazard manner around the

working vicinity. No labels were found on these barrels. Few containers of chemicals were also kept out in the open, next to a plug or mould being worked on. Chemical containers were also observed to be covered by tarp.



Figure 8: Chemical Stored in Boatyards



4.2.4 Training and Occupational

Health and Safety



Figure 9: Chemicals stored under tarp in boatyard

The Rural Youth Vocational Training Centre (RYVTC) was established in Alifushi around the 1980s as a specialized centre for conducting boat-building training courses. This Centre was later renamed as Regional Youth Vocational Training Centre (RYVTC).⁹² Following the restructuring of the Technical and Vocational Training (TVET) system in the Maldives, the training centre

subsequently became a campus of Maldives Polytechnic.⁹³

Currently, Maldives Polytechnic provides three accredited courses in boat-building: Advanced Certificate in Wooden & Fibre Glass Boat Building (MNQF level 4), Certificate III in Fibre Glass Boat Building (MNQF Level 3) and Certificate III in Wooden and Fibre Glass Boat Building (MNQF Level 3).⁹⁴ In addition to the courses offered by Maldives Polytechnic, the Maritime Training Institute also provides Boat Building Courses in Alifushi.

According to the boat builders, the training courses include a module on occupational safety in boat building. It was also noted that any newly hired staff, both local and foreign, receive training on proper handling of fibreglass and chemicals during the boat building process as part of their orientation upon being hired in the boatyards.

⁹² Ministry of Education. (2019). Maldives Education Sector Analysis: February 2019. In <https://support.moe.gov.mv/>. https://support.moe.gov.mv/wp-content/uploads/2020/05/EDUCATION-SECTOR-ANALYSIS_ESA.pdf

⁹³ *ibid*

⁹⁴ Maldives Polytechnic. (n.d.). <http://www.polytechnic.edu.mv/Home/Programs>



However, according to the island stakeholders, proper occupational health and safety protocols aren't followed by the workers. It was also highlighted that while masks and gloves are available in the island, not all workers utilize them, particularly foreign workers. The stakeholders further emphasized that this issue is partly due to a lack of supervision by the boatyard owners.

In terms of occupational safety guidelines in the working environments, the island stakeholders also highlighted the absence of fire extinguishers and water pumps necessary in boat yards in case of fire accidents or emergencies.



Figure 10: Absence of proper occupational and health features in boatyards

4.3 Waste Management Practices

As discussed earlier, the industry's growth has been exacerbated over the last few decades by modernized techniques and trends, to be in par with global standards and demands. However, the secondary services required to support the growth in the industry, such as proper waste disposal, specifically the disposal of chemicals and hazardous waste has not developed to the required degree. As such, while the boat-building industry in the Maldives has grown and moved from timber to mostly fibreglass, there hasn't been a proper waste management system established



for the chemicals and waste accumulated from the sector.

According to the Alifushi boat builders, over 30 tonnes of waste is generated annually from the boat building industry in the island. Although the composition of this waste is currently unknown, waste generated from the boatyards include fiberglass waste, empty chemical containers, discarded moulds, plastic bottles and metal waste. Commonly followed method of managing this waste currently is by open dumping; mostly in the IWMC.



Figure 11: Waste dumping in Alifushi IWMC and nearby areas

However, due to overaccumulation of non-disposable waste, the areas adjacent to the IWMC and areas close to the boatyards are also currently used as waste dumping areas. This includes empty chemical containers, fibreglass waste, discarded moulds, plastic bottles and metal waste. Unlabelled containers of chemicals were also found left in open air in and around the boatyards. Waste was also observed to be dumped near the coastline, areas known for eroding, which would ultimately result in the waste ending up in the ocean.

While both the government stakeholders and the boat builders agreed that this is not a viable and sustainable solution, there are various challenges and factors influencing the current practices.



*Figure 12: Waste dumping near the
ocean coastline*



*Figure 13: Waste discarded near the
boatyard areas*



4.3.1 Challenges and Gaps

1. Absence of a national regulatory body

As of now, there is no national regulatory authority responsible for the monitoring of the boat building industry. Thus, even though there are regulations including provisions for the management of hazardous waste and chemicals, there are challenges in monitoring the implementation these provisions in the fibreglass boat-building industry; mostly owing to the lack of a proper regulatory body. Furthermore, the lack of awareness among workers on the impact of improper usage and disposal of fibreglass waste makes it difficult for the island level stakeholders to implement rules and protocols at an island level.

Lack of governmental support
Lack of support from the government institutions, especially at a national level was another challenge emphasized during the consultations.

As per the consultations with boat builders, they are informed and aware of the prohibition of burning, burial, or ocean disposal of the sector hazardous waste. However, it is also not possible to transfer this waste to the RWMCs such as Thilafushi or R. Vadhoos, as the centres are not equipped to manage and dispose hazardous waste. Due to the lack of proper mechanism to dispose the sector waste, the boat builders raised concerns of not being supported by the national stakeholders in addressing the issue.

2. Lack of resources for waste management

With the absence of a proper waste management system in the island, waste has become accumulated in various areas of the island, including the IWMC, boat yards and nearby areas. Both the Island Council and boat builders have offered to pay for the transfer of the waste to a RWMC. However, as the RWMCs also currently lack the capacity and mechanisms required for managing and disposing of hazardous waste.



4.4 Exposure Routes and Impact

The following are the exposure routes and impacts of the current waste management practices in the sector identified through the data collection process of the case study. While only men are directly involved in the building of the boats, the issues identified is assumed to impact both genders in the community, especially to those living in close proximity to the boatyard.

4.4.1 Exposure via usage

The following (Table 1) are the health impacts known to be caused due to prolonged exposure to chemicals that are used in the fibreglass boat building industry.⁹⁵

Table 1 Health impacts of commonly used chemicals in fibreglass boat-building

Chemicals	Health Impact
Epoxy Resins and Hardeners	Causes a range of skin condition

	Sensitisations that result in breathing difficulties
Polyester Resins	Release large amounts of styrene that is toxic to human's internal organs and irritates the skin and eye. Styrene is suspected of causing cancer.
Solvents (Acetone, MEK, toluene)	Cause personality changes, sleep disorders, memory loss, damage to internal organs such as the kidney, liver, and brain, fertility problems and harm an unborn child. Cause hearing loss by damaging nerves in the ear. Can cause loss of sexual function and mood swings.
Peroxides	Corrosive in nature

⁹⁵ Environmental Protection Authority Te Mana Rauhi Talao. (2014). Using hazardous substances in fibreglass boat building. In www.evatechsolutions.co.nz.

https://www.evatechsolutions.co.nz/files/us-substances-fibreglass-boat-building-guidance_2_.pdf



	Can severely burn the eyes, nose, throat, and airways. Can cause permanent damage to eyes.
Fillers, Adhesives and Paints	Many contains isocyanates. Isocyanates exposure cause asthma. Antifouling paints can cause cancer, damage internal organs such as the liver, and kidneys, damage central nervous system and harm an unborn child.
Cleaners	Acids and bases used for cleaning and preparing surfaces are corrosive. Corrosive substances can cause chemical burns to the skin and permanently damage the eyes. Vapour from corrosive

	substances can burn the mouth, nose and respiratory tract.
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Even though the general population of the island, including men, women and children are at risk of being exposed to these chemicals, the boat builders themselves are at a higher risk of being exposed and impacted. In an effort to identify possible gender differences in health issues possibly caused due to exposure to these chemicals, data on the number of respiratory and skin infections were collected from Alifushi health centre.

The following table (Table 2⁹⁶) presents records of respiratory infections in men and women between 2020–2024 as compared to 2015–2019, obtained from Alifushi health centre. As per the table, the number of respiratory infection cases recorded between 2015–2019 is almost the same for both men and women (1274 cases of men, 1282 cases of women). However, between 2020–2024, there is a significant gender

⁹⁶ Data is provided as received from the source.



difference, with more men experiencing respiratory infections. However, this data is not sufficient to establish a correlation between the two, and further research needs to be conducted on the issue.

Table 2 Number of respiratory infections in R. Alifushi (males verses females)

Gender	Number of respiratory infection cases in	
	2015–2019	2020–2024
Male	1274	2079
Female	1282	871

Source: Alifushi Health Centre, 2024

The Table 3 below presents the number of skin infection cases recorded in Alifushi health centre by gender and age groups for the periods from 2015–2019 and 2020–2024. According to the table, women under 45 years reported a higher number of cases than men, whereas men between the ages of 45–65 years reported higher number of cases than women. This data again, is not sufficient to conclude any causation between exposure to chemicals and skin infections. However, health officers of the island highlighted that increasing number of skin

infections are being reported, particularly among foreign workers of the island.

Table 3 Number of skin infections in R. Alifushi (males verses females)

Gender	Number of skin infection cases			
	2015–2019		2020–2024	
	Under 45 years	45–65 years	Under 45 years	45–65 years
Male	24	41	7	15
Female	29	4	27	4

Source: Alifushi Health Centre, 2024

4.4.2 Exposure via burning

The burning of hazardous waste is legally not allowed in the country. However, due to the increasing accumulation of waste, the practice of burning it in containers away from residential areas is still practiced across the country. In addition to purposeful burning, frequent accidental fires occur in Alifushi IWMC, where fibreglass waste is stockpiled. The latest reported fire occurred in January 2023. During these fires, council staff and community volunteers work in the smoke to extinguish the flames. Due to the absence of necessary fire safety tools such as



fire extinguishers and water pumps, the process takes longer than it would otherwise. The council reported that during the last incident, the staff worked continuously for 24 hours in shifts for 3 days to completely extinguish the fire. As a result, the general population was continuously exposed to harmful gases in the atmosphere during this period.

These issues raise concerns of air contamination, as burnt waste often includes a mixture of general and chemical waste, leading to the release of harmful substances into the atmosphere. This results in severe consequences for both the environment and human health. Inhaling the pollutants released into the toxic air can cause respiratory disorders, cardiovascular diseases, neurological disorders, and even cancer with prolonged exposure.⁹⁷ As such, exposure due to burning can lead to impacting both

genders as the harmful pollutants in air can be inhaled by any individual residing in the surrounding area.

Furthermore, stakeholder consultations conducted in Alifushi raised concerns over the increase in the number of cancer patients in the island. As per statistics from Alifushi Health Centre, there are 4 male and 9 female patients currently being followed up by the centre for cancer. Based on the Asandha (Government's universal health insurance scheme) Cancer Statistics of up to June 2022, the number of unique patient counts based on where the patient received healthcare service peaked in R. Alifushi around 2019, and number of unique patients by registered island peaked in 2021 (See Table 4 below).⁹⁸

Table 4 Number of unique cancer patient counts - R. Alifushi (2012 – 2022)

	Number of unique	Number of unique
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⁹⁷ Hazardous waste Air emissions: Why proper disposal matters. (n.d.). <https://blog.idrenvironmental.com/hazardous-waste-air-emissions-why-proper-disposal-matters>

⁹⁸ Asandha Cancer Statistics June 2022. (n.d.). <https://zinmaadhaaru.com/wp-content/uploads/2023/01/Asandha-Cancer-Statistics-June-2022.pdf>



	patient counts based on where the patient received healthcare service	patients by their registered islands
2012	1	40
2013	4	22
2014	6	50
2015	5	80
2016	2	118
2017	2	106
2018	7	120
2019	59	171
2020	43	153
2021	9	180
2022	12	40
TOTAL	141	789

Source: Alifushi Health Centre, June 2022

According to stakeholders, including the Island Council and health facility officers, these emerging health issues may result from the improper management of chemicals and hazardous waste in the island's boat-building industry. However, they emphasize the need for thorough research to identify the exact causative factors. Therefore, further research is necessary to determine any relationship between exposure to chemicals used in boat building

and the increase in related health issues in Alifushi.

As per the boat builders, the emerging health issues are not caused by any activities within the sector. It was highlighted that no cancer cases have been reported among the boat builders themselves, and in general, most boat builders are in good health. Thus, according to the boat builders, correlating the health issues with the sector without proper study can damage their reputation and support the halting of the industry's work.

In terms of impacts to the natural environment, the chemicals released through burning can pollute soil and water bodies, damage ecosystems, and contribute to smog formation upon re-deposition in the environment.⁹⁹ As per the island council, they have not observed any contamination of the islands' ground water. However, it was noted that the neighbouring households from the boatyards are not able to collect rainwater

⁹⁹ Hazardous waste Air emissions: Why proper disposal matters. (n.d.).



due to contamination. It was not specifically stated whether this contamination is due to residual dust on the rooftops or due to air contamination. Similar to the health impact, analytical study is needed to confirm the correlation between the contamination and the sector issues.

Another environmental issue exacerbated by the improper waste management or lack of thereof is the increase in vector-borne diseases in the island. The discarding of empty containers to various areas of the island becomes breeding grounds for mosquitoes, especially during the rainy season.



Figure 14: Rain water collected in discarded containers which becomes breeding grounds for mosquitoes





5 RECOMMENDATIONS

Based on the findings of the case study, the following recommendations are put forth to improve the chemical and hazardous waste management in the boat-building sector. While these recommendations are formulated specific to Alifushi island, they cover the boat-building sector as a whole in the nation and can be duplicated in other islands involved in boat-building.

1. There is a need to identify a national level regulatory body to oversee and monitor the workings of the fibreglass boat-building industry in the country. The regulatory body will be responsible for ensuring that proper guidelines are followed for the import, transport, storage, usage and subsequent management of chemical and hazardous waste accumulated in the sector, as per the current legislations. Additionally, they will also be responsible to ensure implementation of occupational health and

safety measures in the sector, in an effort to minimize its impact on human health and environment.

2. There is a strong need to strengthen the concepts of reusing and recycling in the country, including for fiberglass waste. International best practices for the management of fiberglass waste are recycling. This includes breaking the waste fibre down into pieces and reusing it for the making of construction bricks. Introduction of such techniques can help establish a sustainable waste management system for hazardous waste in the country. It is also important to ensure that the system is established in a way that it would not impact residential populations, i.e., through dust and other fumes that maybe released from the machines during these processes.



- 3.** Fast-tracking the establishment of the proposed hazardous waste management centres in Thilafushi and Addu is crucial to minimize their impact on human health and the environment. The hazardous waste management centres should have the required connections for the transportation of hazardous waste from different parts of the country.
- 4.** Proper coordination among national and local level stakeholders needs to be established to provide the necessary support and guidance to ensure a sustainable waste management system.
- 5.** There is a need to undertake research to understand the causative factors for the emerging health issues on the island and identify any correlation with the fibreglass boat building industry. This will help facilitate the necessary measures to address the challenges of the sector if needed and establish a sustainable waste and chemical management system with minimal impact to individuals' health and the environment across the nation.



6 CONCLUSION

For a nation to advance, various industries need to be established and developed in par with global standards. In Maldives, while tourism is the main economic sector, a lot of other subsequent sectors such as boat-building, and traditional handicraft making is directly linked to the tourism sector. Aside from that, sectors such as agriculture, fisheries and boat-building are the primary livelihoods for majority of the island communities. Thus, finding ways to sustain the sector in a human and environmentally friendly mechanism is necessary.

The boat-building industry has thus far grown with minimal regulation and oversight. As a result, while the technical capacity and skills of boat builders have improved and increased, other challenges such as management of the space needed for the sector and proper waste management techniques has been lacking.

R. Alifushi is an island renowned for its boat-building craftsmanship. At the moment, the boat builders are skilled to be

in par with international standards. However, the perception of the sector is clouded due to the environmental and social issues arising due to the lack of mechanism for managing the chemicals and hazardous waste generated.

The current mechanism for waste management in Alifushi is dumping in the IMWC. However, with the space constraints, the IMWC has become over piled with waste resulting in the accumulation of waste in various areas around the IMWC and the boatyards. Additionally, improper techniques such as burning of the hazardous waste is also practiced in an effort to reduce the volume of accumulated waste in the areas. However, such practices lead to environmental issues such as air and water pollution from the chemicals seeping into the ground. It also becomes an eye sore for the residents of the island and any visitors. It is important to note that, while not a major tourist destination compared to some other islands in the Maldives, Alifushi has the potential. However, to tap into this potential, long-



term solutions are needed for waste management in the island.

Additionally, health issues such as cancer, skin infections and respiratory difficulties has become a recurring and increasing concern among the public in Alifushi. Whilst these issues cannot be directly linked to the boat-building sector without a proper study, literature has shown the increased exposure to hazardous waste and chemical can result in similar health issues.

Thus, the need for a sustainable waste management system in the island is a necessity. Especially, with the predominant male population working in the sector, the impact on male by the hazardous waste and chemicals need to be understood. In this regard measures need to be established accordingly to minimize the impact on workers, the general population and the environment.

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