National Maritime Foundation

THE ONGOING TRANSFORMATION OF SUSTAINABLE SHIP RECYCLING IN INDIA

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Contents

Acronyms and Abbreviations

AERB	Atomic Energy Regulatory Board
AFFF	Aqueous Film Forming Foam
ASSRGWA	Alang Sosiya Ship Recycling & General Workers' Association
ASSRY	Alang Sosiya Ship Recycling Yard
BIS	Bureau of Indian Standards
BSBA	Bangladesh Ship Breakers Association
BSRB	Bangladesh Ship Reprocessing Board
CAPEX	Capital Expenditures
CHWIF	Common Hazardous Waste Incineration Facility
CHW-TSDF	Common Hazardous Waste Treatment Storage Disposal Facility
CO_2	Carbon dioxide
CRZ	Coastal Regulation Zone
CSR	Corporate Social Responsibility
DISH	Directorate of Industrial Safety and Health
EEC	Elegant Exit Company
EIA	Environmental Impact Assessment
EOL	End-of-Life
EPS	Expanded Polystyrene
ESG	Environmental, Social, and Governance
ETP	Effluent Treatment Plant
EU SRR	EU Ship Recycling Regulation

FOC	Flag of Convenience
GDP	Gross domestic product
GGEPIL	Green Gene Enviro Protection and Infrastructure Private Limited
GMB	Gujarat Maritime Board
GPCB	Gujarat Pollution Control Board
GSR	Green Ship Recycling Services
GST	Goods and Services Tax
GT	Gross tonnage
HBCDD	Hexabromocyclododecane
HCFC	Hydrochlorofluorocarbons
HKC	Hong Kong Convention
HSE	Health, Safety, and Environment
IHM	Inventory of Hazardous Materials
ILO	International Labour Organisation
IMO	International Maritime Organization
ISRA	International Ship Recycling Association
IZAYDAS	Izmit Waste and Residue Treatment, Incineration and Recycling Co. Inc.
KLPD	Kilo Litres Per Day
LDT	Light Displacement Tonnage
LGT	Liquefied Gas Tanks
MD	Material Declaration
MEPC	Marine Environment Protection Committee
MIV 2030	Maritime India Vision 2030
MMT	Million Metric Tons
MMTPA	Million Metric Tons Per Annum

MoEF&CC	Ministry of Environment, Forest and Climate Change
MoPSW	Ministry of Ports, Shipping, and Waterways
MPRSA	Marine Protection, Research, and Sanctuaries Act
MRCC	Maritime Rescue Co-ordination Centre
Mt	Million Tons
NGT	National Green Tribunal
NMF	National Maritime Foundation
NOx	Oxides of Nitrogen
OECD	Organisation for Economic Cooperation and Development
OPEX	Operating Expenses
PESO	Petroleum and Explosives Safety Organisation
PESTLE	Political, Economic, Social, Technological, Legal, and Environmental
PFOS	Perfluorooctane Sulfonic Acid
PM	Particulate Matter
QCO	Quality Control Order
RRC	Ready for Recycling Certificate
SBWTUF	Ship Breaking Workers' Trade Union Forum
SDOC	Suppliers Declaration of Conformity
SLF	Secured Landfill Facility
SoC	Statements of Compliance
SO_2	Sulphur dioxide
SPCB	State Pollution Control Board
SRIA	Ship Recycling Industries Association
SSI	Sustainable Shipping Initiative
SWOT	Strengths, Weaknesses, Opportunities, and Threats

TBT	Tributyltin
TMT	Thermo Mechanically Treated steel
TSDF	Treatment Storage Disposal Facility
VSCP	Visual and Sampling Check Plan

Abstract

The ship recycling industry — an environmentally friendly and economically viable method for End-of-Life (EOL) vessels — underwent a historical shift from Europe and the United States to regions with more lenient regulations post-1970s, driven by stringent social and environmental laws in the Global North. This relocation of the ship recycling industry prompted a crucial examination of safety standards in ship recycling yards, emphasising the necessity for sustainable practices in managing EOL marine structures, given potential environmental and health hazards. The focal point of this study is the Alang Sosiya Ship Recycling Yard (ASSRY) in India, a critical hub in the industry's evolution. Situated in the Gulf of Khambhat, Alang-Sosiya encompasses 153 ship-breaking yards along a 12-kilometre beachfront, further expanding to 4.5 kilometres. This report is part of the National Maritime Foundation's (NMF) ongoing project, "Sustainable Ship Recycling Industry in India", funded generously under the aegis of the Corporate Social Responsibility Grant from the Goa Shipyard Limited for the financial year 2023-24. With an unwavering commitment to advancing sustainability in the maritime sector, the report meticulously scrutinises enhanced recycling, reusing, and disposal techniques, and provides a detailed exploration of the current scenario at Alang-Sosiya, informed by the NMF team's field visit to ASSRY. The report offers a descriptive analysis, incorporating SWOT and PESTLE analyses of ASSRY. The authors draw insights from stakeholder interactions and on-site visits, proposing a strategic framework of short-, medium-, and long-term measures for the Indian ship recycling industry, and their analyses offer indispensable insights and recommendations for governmental and regulatory bodies, crucial for implementing necessary measures. The holistic approach adopted in this report will contribute significantly to the project's overarching goal of positioning India as a global leader in ship recycling, characterised by elevated sustainability criteria thereby promoting the long-term sustainability and positive advancement of India's ship recycling industry.

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1 Navigating the Seas of Ship Disposal

In the intricate weave of global trade, the shipping industry stands out as a pivotal force, facilitating the movement of goods across the seas that form the arteries of our interconnected world.[1] However, with ships typically enjoying a lifespan of 25-30 years, the question of their disposal becomes a critical juncture where economic considerations intersect with environmental responsibility.[2] After completing their operational life, a significant number of vessels find their way to ship-breaking yards, where they are transformed into reservoirs of steel, iron, and other valuable resources. This challenge becomes particularly pronounced in a globalised world, where the world trade fleet plays a crucial role in mitigating transport costs.[3]

Shipping markets exhibit cyclicality, extending over decades. The growth in trade and subsequent shipbuilding bubble often leads to an inflation in the size of the world fleet. However, the demand for shipping services does not necessarily rise at an equal pace, creating a persistent imbalance. This discrepancy arises from the medium- to long-term nature of capacity expansion, which involves the addition of new ships to the world fleet and requires years of funding that companies may find challenging to reverse. Consequently, a drop in charter rates occurs, making it difficult and time-consuming for companies to meet the breakeven cost per vessel, which consists of both Operating Expenses (OPEX) and Capital Expenditures (CAPEX).[4]

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1 R. Scott Frey, "Breaking Ships in the World-System: An Analysis of Two Ship Breaking Capitals, Alang India and Chittagong, Bangladesh", Tennessee Research and Creative Exchange (TRACE), University of Tennessee, Knoxville, May 2013 https://trace.tennessee.edu/cgi/viewcontent.cgi?article=1001&context=utk_cssjpapers

2 Md. Golam Mohiuddin et, "Analysis of Present Global Ship Recycling Status and Challenges for Bangladesh", *Global Scientific Journals* Volume 11, Issue 4, April 2023

3 *Ibid*

4 Srinjoy Dasgupta, "Indian shipping industry – an ocean of opportunities", National Maritime

OPEX encompasses the day-to-day operational costs of running a vessel, including crew wages, maintenance, fuel, and insurance. On the other hand, CAPEX includes the capital expenditures associated with acquiring and maintaining the ship, such as the initial purchase cost and major upgrades.[5] The challenge intensifies when the drop in charter rates renders it economically unsustainable for companies to cover these expenses, ultimately leading to the scrapping of vessels. Sustainable ship recycling emerges as a strategic manoeuvre to address this complex scenario, helping to balance the demand-supply gap and cope with the challenges posed by economic fluctuations in the shipping industry. This cyclic pattern draws parallels with historical periods, such as the shipbuilding busts seen in the 1970s and 2009, where the imbalance in fleet size and demand necessitated systematic vessel disposal.[6]

If recent scrapping patterns persist, by the end of 2030 approximately 43% of the existing global container fleet will be scrapped, and the demand for dismantling will exceed over 1,500 ships annually.[7] The disposal of End-of-Life (EOL) vessels can be accomplished through two major methods—land-based and ocean-based, each presenting its own set of environmental considerations and challenges.[8] As the demand for sustainable practices grows, finding innovative and eco-friendly solutions for ship recycling becomes imperative, ensuring the industry's longevity while minimising its environmental impact.

Day celebration Conference, Indian Maritime University (IMU), 5 April 2018 https://www.iimidr.ac.in/wp-content/uploads/Indian-shipping.pdf

5 Julian Ulrich Hausweiler, "Paths forward for Sustainable Maritime Transport A techno-economic optimization framework for next generation vessels", KTH Royal Institute of Technology, 14 August 2023 https://kth.diva-portal.org/smash/get/diva2:1797555/FULLTEXT01.pdf

6 Srinjoy Dasgupta, "Indian shipping industry – an ocean of opportunities", 2018

7 "Breaking Out: Anchoring Circular Innovation for Ship Recycling", NGO Shipbreaking Platform, 20 September 2022 https://shipbreakingplatform.org/wp-content/uploads/2022/10/Breaking-Out-Magazine.pdf

8 Soumyajit Dasgupta, "10 Types of Ship Disposal Techniques", Marine Insight, 02 April 2019 https://www.marineinsight.com/guidelines/10-types-of-ship-disposal-techniques/

1.1 Common Disposal Technique

The Shipping Industry has various ways to handle EOL vessels. Some of the common methods are:

1.1.1 Sea-Based Disposal

The shipping industry employs diverse methods to manage end-of-life vessels, and one prevalent approach is scuttling — intentional sinking of retired vessels has dual benefits, creating artificial reefs and wreck diving sites. To implement this, disposable ships are submerged in deep offshore waters after meticulous removal of hazardous elements and electrical devices. These artificial reefs not only offer secure habitats for marine species but also promote feeding, shelter, and spawning. Wreck diving sites, another outcome of intentional disposal, serve as training grounds or generate commercial revenue through recreational diving activities.[9]

In sea-based disposal, strict adherence to environmental regulations would be needed such as Australia's Environment Protection (Sea Dumping) Act 1981. This legislation mandates a sea dumping permit for various vessel disposal activities, including intentional sinking and using ship hulks for military exercises. The meticulous permitting process ensures proper preparation and suitable site selection, minimising adverse impacts on the marine environment. Ideal disposal sites should be at least 2,000 metres deep, 50 nautical miles from the coast, and 20 nautical miles from sensitive zones. Material preparation involves clearing pollutants, and the process extends beyond the Sea Dumping Act to other Commonwealth legislation. The sea dumping permit application incurs a fee of $12,700, ensuring compliance with environmental regulations.[10]

However, while sea-based disposal techniques like scuttling have their advantages, it's essential to consider the importance of land-based vessel disposal methods.

9 *Ibid*

10 Disposal of vessels at sea, Department of Climate Change, Energy, the Environment and Water, Government of Australia, accessed on 20 December 2023. https://www.dcceew.gov.au/environment/marine/sea-dumping/disposal-vessels#daff-page-main

Unlike sea-based approaches, land-based techniques often offer more controlled and environmentally friendly processes.

1.1.2 Land-Based Disposal

Land-based approaches, in contrast to those at sea, commonly deliver processes that are both controlled and environmentally friendly.[11] Recycling and dismantling vessels on land presents opportunities for recovering valuable materials, reducing environmental impact, and adhering to rigorous safety and pollution control standards. This stands in stark contrast to the potential environmental risks linked to sinking ships at sea, emphasising the importance of advocating and exploring sustainable land-based vessel disposal practices.[12]

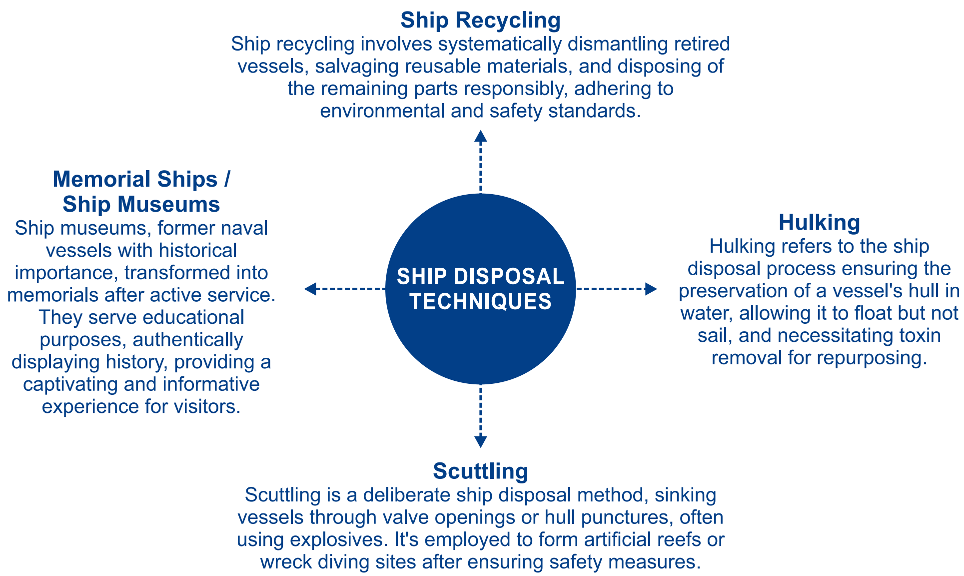

Figure 1. Common Ship Disposal Techniques
Source: Collected by the authors

Addressing the issue of EOL vessels demands responsible disposal methods, where deliberate ocean disposal should be the last resort. Tackling the challenge of EOL

11 Disposal of Vessels at Sea, United States Environmental Protection Agency, accessed on 24 November 2023 https://www.epa.gov/ocean-dumping/disposal-vessels-sea

12 Soumyajit Dasgupta, "10 Types of Ship Disposal Techniques", 2019

vessels necessitates the implementation of conscientious disposal methods, where the deliberate disposal of vessels into the ocean should be considered a last resort. The principles established by the United States Environmental Protection Agency's Marine Protection, Research, and Sanctuaries Act (MPRSA) can serve as a guiding framework in navigating these choices. This legal structure reinforces the importance of prioritising a balanced and sustainable approach, with a particular emphasis on land-based disposal methods such as ship recycling. The MPRSA underscores the significance of ecosystem preservation during ship disposal, marking a notable shift towards a heightened awareness of responsible practices that aim to shield marine environments from potential adverse effects.[13]

2 Rethinking Ship Recycling: A Fresh Perspective

Ship recycling, a multifaceted process involving the careful dismantling of an obsolete vessel's structure for recycling or disposal, unfolds at diverse locations, including beaches, piers, dry docks, and dismantling slips.[14] However, the industry faces a looming challenge with the impending phase-out of single-hulled tankers, intensifying concerns about industry standards. Thousands more ships are slated for recycling in the coming decade, many destined for the beaches of South Asia. Pre-covid periods have witnessed a significant surge, with a threefold increase in the tonnages of recycled ships due to the rise in the supply of end-of-life vessels resulting from a global market slowdown. Ship recycling statistics paint a vivid picture, projecting the need to scrap 10 to 15 million tons of obsolete vessels annually for at least the next decade.[15]

The ascendancy of ship recycling as an environmentally friendly and economically viable solution for EOL vessels reflects a noteworthy shift from Europe and the United

13 Disposal of Vessels at Sea, United States Environmental Protection Agency, accessed on 24 November 2023 https://www.epa.gov/ocean-dumping/disposal-vessels-sea

14 The Global Programme for Sustainable Ship Recycling, Secretariat of the Basel Convention and UNEP

15 Anand M Hiremath et al, "Significant steps in ship recycling vis-a-vis wastes generated in a cluster of yards in Alang: a case study", *Journal of Cleaner Production*, Volume 87, January 2015 https://www.sciencedirect.com/science/article/abs/pii/S0959652614009615

States to regions with more lenient regulations post-1970s. This transition, driven by stricter social and environmental laws in the Global North, initially prompted concerns about safety standards in ship recycling yards.[16] Presently, the ship-breaking industry has found its epicentre in South Asia, notably with Bangladesh, India, and Pakistan taking the lead.[17] Despite initial concerns about lax environmental laws, there is a growing optimism in acknowledging ship recycling as the optimal method for retiring vessels. The ship recycling industry is pivotal to the economies of developing Asian nations, offering employment to hundreds of thousands and supplying essential steel for development.[18]

The success of ship recycling in retiring vessels lies not only in the meticulous dismantling process but also in its ability to repurpose and recycle nearly 90% of materials.[19] This showcases a steadfast commitment to saving resources and embracing sustainable practices. Playing a pivotal role in guiding this industry is the International Maritime Organization (IMO), which has been actively addressing ship recycling concerns since the 44th Marine Environment Protection Committee (MEPC) session in 2000. The development of Guidelines on Ship Recycling in 2003 provided crucial advice to stakeholders globally. Recognizing the urgency, MEPC 53 prioritised a legally binding instrument on ship recycling, leading to the formulation of the Hong Kong Convention in 2009.[20] This convention is set to enter into force on June 26, 2025.[21]

16 Ananya Mukherjee and Bhavna Shri Harsha, "Maritime Pollution and the Shipbreaking Industry — Challenges and Mitigation-Options", National Maritime Foundation, 05 April 2021 https://maritimeindia.org/maritime-pollution-and-the-shipbreaking-industry-challenges-and-mitigation-options/#_ftn5

17 The Problem, NGO Shipbreaking Platform, accessed on 22 December 2023 https://shipbreakingplatform.org/our-work/the-problem/

18 Md. Golam Mohiuddin et al., "Analysis of Present Global Ship Recycling Status and Challenges for Bangladesh", *Global Scientific Journals* Volume 11, Issue 4, April 2023

19 Md. Golam Mohiuddin et al., "Analysis of Present Global Ship Recycling Status and Challenges for Bangladesh", *Global Scientific Journals* Volume 11, Issue 4, April 2023

20 Recycling of ships, International Maritime Organisation (IMO), accessed on 08 December 2023 https://www.imo.org/en/ourwork/environment/pages/ship-recycling.aspx

21 The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, International Maritime Organisation (IMO), accessed on 08 December

Despite its sustainability, the ship recycling industry grapples with persistent concerns over worker health and safety. Injuries, illnesses, and fatalities remain commonplace, casting a shadow over the sector's achievements. Environmental protection records also raise alarms, showcasing high incidences of pollution in local air, soil, and water sources.[22]

To make the ship recycling sector truly sustainable and environmentally friendly, the industry necessitates further field interventions and research agendas. Developing a comprehensive understanding of the number and types of ships broken, waste generation, and corresponding management plans based on extensive field data is imperative. Proper management of hazardous wastes generated during ship recycling requires articulating the tacit know-how practised in ship dismantling to influence preventive environmental strategies in dismantling yards.[23]

The ship recycling sector is experiencing a positive transformation, evident during the NMF team's visit to ASSRY in India. India's dedicated efforts are steering ship recycling towards sustainability and embodying environmental responsibility. Alang, Gujarat, stands as a beacon in this evolution, showcasing the industry's shift towards sustainable practices. It signifies a future where the ship recycling industry, far beyond breaking ships, integrates sustainability and responsibility at its core.

As India leads the charge, Alang emerges as a pivotal player striking a delicate balance between economic progress and environmental sustainability. Contributing approximately 3.50 Million Metric Tons (MMT) of steel annually, Alang achieves substantial steel production without depleting resources.[24] It positions itself as a green route for generating secondary steel, offering a sustainable alternative to conventional

2023 https://www.imo.org/en/About/Conventions/Pages/The-Hong-Kong-International-Convention-for-the-Safe-and-Environmentally-Sound-Recycling-of-Ships.aspx

22 The Global Programme for Sustainable Ship Recycling, Secretariat of the Basel Convention and UNEP

23 Anand M Hiremath et al, *Journal of Cleaner Production*, Volume 87, January 2015

24 Annual Report 2022-23, Ministry of Ports, Shipping and Waterways (MoPSW), Government of India, 2022-23 https://shipmin.gov.in/sites/default/files/Annual%20Report%202022-23%20English.pdf

ore extraction. Responsible ship recycling is redefining the industry, transforming it from an environmentally harmful process to a new future of reprocessing and recycling, emphasising sustainability and responsibility.

3 India's Dynamic Ship Recycling Landscape

India stands as the world's second-largest player in the ship recycling industry, trailing only behind Bangladesh.[25] The focal point of India's ship recycling prowess is the Alang facility in Gujarat, a coastal stretch in the Bhavnagar district spanning 10 kilometres.[26] Alang commands a staggering 98% of India's ship recycling capacity and significantly contributes 32.6% to the global recycling volume.[27] However, despite its substantial potential, the current state of affairs at Alang reveals a surprising statistic—48% of its existing ship-breaking capacity remains idle.[28]

The Alang ship-breaking yards consist of 153 plots, with 131 specifically designated for ship-breaking activities. Astonishingly, only 80 of these plots are currently operational, hinting at an untapped potential waiting to be harnessed. This underutilization contrasts with the industry's peak year in 2011-12 when 415 ships, totalling 3.85 million Light Displacement Tonnage (LDT), flocked to Alang. This period was the zenith, with shipbreaking activities almost reaching the full capacity of 4.5 million LDT. However, a subsequent decline ensued, exemplified by the fiscal year 2019-2020, witnessing only 202 ships with 1.62 million LDT. The current fiscal year, until January 2021, shows a modest improvement with 199 ships and 1.8 million LDT.[29]

25 Maritime *Amrit Kaal* Vision 2047, Ministry of Ports, Shipping and Waterways (MoPSW), Government of India, October 2023 https://shipmin.gov.in/sites/default/files/Maritime%20Amrit%20Kaal%20Vision%202047%20%28MAKV%202047%29_compressed_0.pdf

26 Annual Report 2022-23, Ministry of Ports, Shipping and Waterways (MoPSW), Government of India, 2022-23 https://shipmin.gov.in/sites/default/files/Annual%20Report%202022-23%20English.pdf

27 Maritime *Amrit Kaal* Vision 2047, October 2023, Pg. 218

28 *Ibid*

29 *Ibid*

Figure 2. Google Earth View of Alang Sosiya Ship Recycling Yard (ASSRY)
Source: Google Earth[30]

In a bid to fortify its position in the ship recycling landscape, India has ambitious plans to augment its recycling capacity up to 9 million LDT.[31] The industry currently provides gainful employment to an impressive workforce of 5.15 lakh people. Notably, over the last five years, the ship recycling sector has contributed an average revenue of INR 55 Crores per annum, underscoring its economic significance and sustained growth potential.[32] The ship recycling activities in India are also conducted in a limited manner at Kidderpore Docks, Syama Prasad Mookerjee Port, Kolkata, Mumbai Port, and by the Steel Industrials Kerala Limited.[33]

30 Google Earth, accessed on 14 December 2023 https://earth.google.com/web/search/Alang Sosiya+Ship+Recycling+Yard,+Alang,+Gujarat/@21.41210225,72.20119175,16.4660299a ,6518.53108701d,35y,-0h,0t,0r/data=CigiJgokCSD9530eOjRAER_9530eOjTAGf6tGZ-npThAIbyWaVjrRVPAOgMKATA

31 Annual Report 2022-23, Pg. 50

32 Maritime *Amrit Kaal* Vision 2047, October 2023, Pg. 218

33 Annual Report 2022-23, Pg. 50

As India forges ahead, the ship recycling sector at Alang emerges as a pivotal player, skilfully navigating the intricate balance between economic advancement and environmental sustainability. Alang's significance extends beyond its contribution to the global industry; it plays a crucial role in generating approximately 3.50 MMT of steel annually, producing substantial quantities of re-rollable steel without depleting natural resources or triggering the environmental impacts associated with traditional steel production processes, such as mining, energy consumption, water usage, and toxic effluents. This approach positions Alang as a green route for generating secondary steel, offering a sustainable alternative to extracting steel from ore. With nearly 100 recycling plots adhering to the Hong Kong Convention standards, Alang stands as a beacon of environmentally responsible ship recycling.[34] The resource requirements for producing 4 million tons (Mt) of steel through the conventional route and ship recycling route are illustrated in the accompanying Table 1. This underscores the environmental advantages and sustainability inherent in Alang's ship recycling practices.

S. No	Natural Resources	Steel Plant	Ship Recycling Industry	Saving in Ship Recycling
1	Iron Ore (t)	7,000,000	0	7,000,000
2	Refractory materials / additives (t)	2,800,000	0	2,800,000
3	Coal (t)	6,200,000	0	6,200,000
4	Process Chemicals (t)	160,000	0	160,000
5	Oxygen (Nm3)	260 x 106	72 x 106	188 x 106
6	Water (Million m3)	100 – 240	0.80	99.2 – 239.2
7	Fuel Oil (t)	120,000	220,000	-100,000
8	LPG (t)	0	16,000	-16,000
9	Energy (as fuel and electricity)	80,000 x 1012 J $	80,000 x 1012 J	0
$ Does not include energy required for transport of raw materials to plant site				

Table 1. Resource Requirements for Producing 4 Mt Steel by Conventional Route and by Ship Recycling Route
Source: Environmental Impact Assessment and Environmental Management Plan[35]

34 *Ibid*

35 Environmental Impact Assessment and Environmental Management Plan, Proposed Upgradation of Existing Ship Recycling Yard at Alang Sosiya, Gujarat for Undertaking

According to the Gujarat Maritime Board, a comparison of natural resource consumption in the production of 2 million tons of steel through a steel plant and ship recycling reveals significant savings in two key aspects. In terms of solid waste, the steel plant generates approximately 878,967 tons, while the ship recycling industry produces only 12,500 tons, resulting in a substantial total saving of 866,467 tons. On the cost front, the steel plant incurs a cost exceeding INR 1000 crore, whereas the ship recycling industry's expenses are less than INR 100 crore, culminating in an overall saving of around INR 900 crore.[36] Additionally, Alang Sosiya Ship Recycling Yard (ASSRY), with an existing ship recycling capacity of about 4.5 million tons per annum, has the potential to reduce annual CO_2 emissions by 7.34 million tons compared to conventional steel production from iron ore.[37] Therefore, responsible ship recycling emerges as a sustainable route, paving the way for India to become more environmentally conscious and contributing to the reduction of greenhouse gas emissions, aligning with India's net-zero emissions target by 2070.[38]

4 Major Challenges faced by Indian Ship Recycling Sector

The Indian ship recycling sector confronts a series of complex challenges that impact its overall functioning and growth trajectory:[39]

- The distribution of plots in Alang, with 131 out of 153 allotted and 22 remaining vacant, points to potential underutilization of the available

Safe and Environmentally Sound Ship Recycling Operations, Gujarat Maritime Board and Mecon Limited, July 2016 https://www.jica.go.jp/Resource/english/our_work/social_environmental/id/asia/south/india/c8h0vm00009ulddw-att/c8h0vm0000ahd7tr.pdf

36 Presentation on Alang Ship Breaking Yard, Gujarat Maritime Board (GMB), Government of Gujarat, accessed on 14 December 2023 https://www.imaritime.com/knowledgebase/test1.pdf

37 Alang-Sosiya: The world's biggest ship recycling yard gears up for eco-friendly recycling, CMO Gujarat YouTube, September 2022 https://www.youtube.com/watch?v=0ZZHw-N42c4&t=1s

38 "Net zero emission target", Ministry of Environment, Forest and Climate Change, Government of India, August 2023 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1945472

39 Maritime *Amrit Kaal* Vision 2047, October 2023, Pg. 218

infrastructure, suggesting a need for optimised resource allocation and plot utilisation strategies.

- One of the critical challenges faced by the industry is the higher legal and administrative costs incurred to comply with Health, Safety, and Environment (HSE) regulations. Meeting stringent regulatory standards necessitates significant investments in ensuring the safety of workers and environmental protection, contributing to an increased financial burden on the sector.

- Another noteworthy obstacle is the lack of recognition of recycled steel by the Bureau of Indian Standards (BIS). This poses a significant hurdle, especially concerning the reuse of recycled steel in other sectors such as real estate. The BIS's non-recognition creates barriers to wider acceptance and application of recycled steel, limiting its integration into various industries and potentially hindering the sector's growth.

- The underutilisation of approximately 50% of working plots in Alang is a substantial challenge. Despite having the capacity to handle an average of 2 million Metric Tons Per Annum (MMTPA) of Light Displacement Tonnage (LDT), the sector struggles with inefficient plot utilisation. This underlines the need for strategic planning and operational enhancements to maximise the potential of available resources.

- In addition to operational challenges, the sector contends with higher taxes, including a 2.5% Import Duty and an 18% Goods and Services Tax (GST). These tax rates contribute to the financial complexities faced by the Indian ship recycling sector, impacting its competitiveness and overall economic viability.

Collectively, these challenges underscore the imperative for comprehensive policy reforms, strategic planning, and collaborative efforts to address regulatory, operational, and financial constraints. Overcoming these hurdles is essential for the Indian ship recycling sector to thrive, contribute sustainably to the economy, and fulfil its potential as a global player in the ship recycling industry.

5 Alang: a closer view

The Alang-Sosiya Ship Recycling Yard stands as the world's largest ship recycling facility, boasting a rich history since its establishment in 1982. This expansive yard spans approximately 10 kilometres along the western coastline of the Gulf of Khambhat and falls under the administrative jurisdiction of the Gujarat Maritime Board (GMB). The GMB, formed in 1982 through the Gujarat Board Act, 1981, oversees the operations of this vital maritime facility. Accessible from the city of Bhavnagar via NH-8E and SH-37, with a concrete service road running the entire length of the yard, ASSRY plays a crucial role in the ship recycling industry, symbolising India's commitment to maritime activities and responsible environmental practices.[40]

Alang emerged as the prime location for ship-breaking activities, now commonly referred to as recycling yards, in response to the escalating demand for steel and recommendations from various committees. The GMB conducted a thorough survey of the coastal region, ultimately designating Alang as the most suitable site for developing ship-breaking operations. The endorsement of this selection by both the GMB and groups of ship breakers was grounded in several key factors:[41]

- Firstly, the site's positioning within the high tide zone, with tide reaching up to 10 to 11 metres, was deemed highly favourable for efficient ship-breaking activities.
- Situated in the Gulf of Khambhat, Alang's harbours are protected areas during the rainy season, providing an ideal environment for continuous ship-breaking operations.
- The sloping coast of Alang, coupled with a long dry area, facilitates the seamless reaching up of vessels, enhancing the overall handling of EOL vessels.

40 Environmental Impact Assessment and Environmental Management Plan, Pg. ES-1 https://www.jica.go.jp/Resource/english/our_work/social_environmental/id/asia/south/india/c8h0vm00009ulddw-att/c8h0vm0000ahd7tr.pdf

41 Hrudanand Misra, "Analysis of Alang Ship Breaking Yard, India", Institute of Management, Nirma University, Ahmedabad, Gujarat, India, Economic Affairs, Vol. 64, No. 2, pg. 417-424, June 2019

- Additionally, the seabed at Alang exhibits a quick drying capability, even during monsoons, streamlining the handling of various materials and equipment involved in the ship-breaking process.

- Furthermore, the coastal area of Alang is strategically free from other competitive users, such as merchant shipping, fishing, and salt work. This unique combination of geographic advantages makes Alang an optimal choice for the establishment of ship-breaking yards, responding to the demand for steel and ensuring the efficient handling of vessels reaching the end of their operational life.

Alang's ship-breaking yards have undergone substantial growth, employed over 50,000 individuals, and recycled more than 500 ships. Despite this, the industry has been under scrutiny for issues related to worker safety, environmental pollution, and inadequate regulations.[42] In response to these concerns, recent developments signal a positive shift in the industry's practices. Team NMF, comprising Commodore Debesh Lahiri (Executive Director), Rhythma Kaul (Associate Fellow), and Ayushi Srivastava (Research Associate), conducted a comprehensive field visit to the ASSRY in Gujarat. This visit is part of the ongoing project, "Sustainable Ship Recycling in India," supported by the Goa Shipyard Ltd. (GSL).

During their visit, the team engaged with key stakeholders, including officials from the Gujarat Maritime Board (GMB), owners and top management of Ship Recycling Yards, representatives from ASSRY and General Worker's Association (ASSRGWA), and leaders of the Ship Recycling Industries Association (SRIA). The team also inspected crucial sites like the Red Cross Multispecialty Hospital, residential quarters for ASSBY workers, the Safety, Training and Labour Welfare Institute, and the Treatment Storage Disposal Facility (TSDF). A notable highlight was the team's

42 "The Evolution of Alang: The Largest Ship Recycling Yard in the World", Priya Blue Industries Pvt. Ltd., accessed on 15 December 2023 https://www.priyablue.com/post/alang-the-largest-ship-recycling-yard-in-the-world

opportunity to board a ship in the process of recycling, providing invaluable insights for their project. Furthermore, Team NMF executed a pilot boarding vessel operation and visited the Bhavnagar anchorage area, where ships destined for recycling undergo inspection by customs and other port authorities before receiving clearance for beaching at the ship recycling yards.

Figure 3. Bhavnagar anchorage area
Source: Captured by authors during the visit

Upon entering the Indian Maritime Zone for ship recycling, vessels are mandated to notify both the Maritime Rescue Co-ordination Centre (MRCC) and the Indian Coast Guard of their intended destination at ship recycling facilities. Subsequently, the vessel proceeds to request anchoring permission, which is granted following a thorough desk review conducted by the Port Authority, Gujarat Maritime Board (GMB), and Customs. The Port Authority issues the authorization for secure anchorage, taking into account comprehensive inspections by relevant bodies such as the Gujarat Pollution Control Board (GPCB), Atomic Energy Regulatory Board (AERB), Petroleum and Explosives Safety Organisation (PESO), Customs Department, Directorate of Industrial Safety and Health (DISH), and other pertinent agencies. This assessment also applies to naval vessels and is conducted by the Indian Navy. Notably, it is imperative to acknowledge that none of the Indian ship-recycling yards are equipped to handle nuclear-powered ships or vessels, thereby precluding their entry into the country for recycling purposes. In the event that a ship fails to comply with the requisites outlined in the submitted documentation, and this non-compliance is verified by any or all of the aforementioned agencies, the ship may be directed for return.

Once a vessel enters a ship recycling yard, it undergoes a systematic series of steps, commencing with the critical process of beaching, where the ship is intentionally taken ashore or grounded in shallow water, rendering it immobile and irreversible.[43] This process is vividly illustrated in Figure 4 as a typical beaching scenario in Alang. The comprehensive cycle, spanning inspection, preparation, and certification, culminates in the recycling of the ship's steel. The duration for this entire process varies, ranging from 3.5 to 9 months, contingent upon factors such as the vessel's size, type, etc.

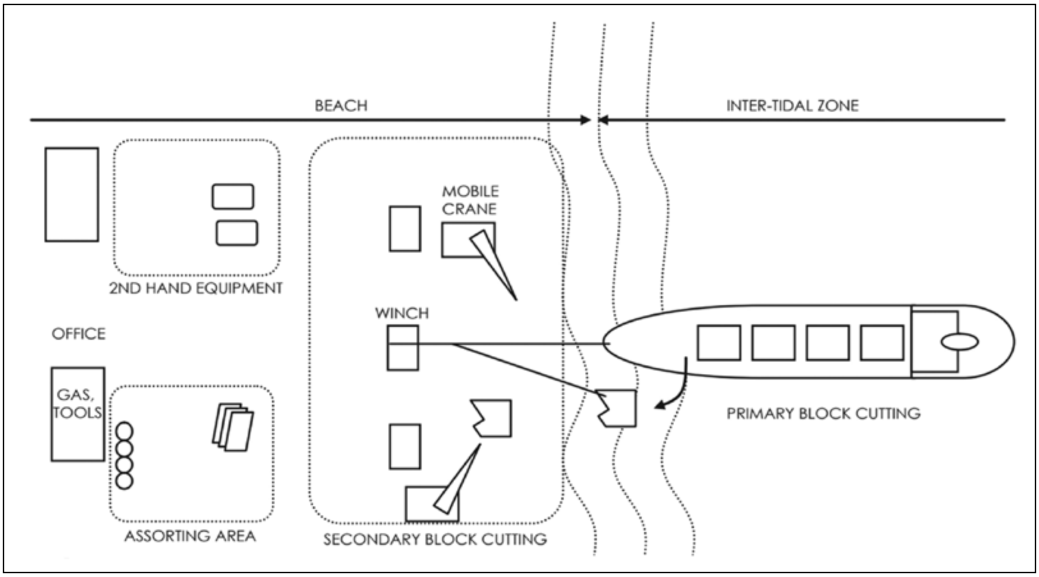

Figure 4. Typical Beaching in Alang
Source: Arya Steel Handbook[44]

43 Shipbreaking Code (Revised) 2013, Government of India https://shipmin.gov.in/sites/default/files/1157392371CBCODErevised201310022017_0.pdf

44 "Green Ship Recycling Facility", Arya Steel Handbook

5.1 Ship Recycling Step-by-Step Procedure

According to The Recycling of Ships Act, 2019, ships must be recycled according to the ship-specific recycling plan. There are ten essential steps that need to be performed, starting from the anchoring of a ship to finally sending the ferrous and non-ferrous parts for recycling as well as disposal of various waste material generated during the course of ship recycling.[45] These steps have been described below:

1. A ship upon entering India's internal waters, is anchored at about 12 nm from Ghogha Port, Bhavnagar, Gujarat. The ship is then boarded by Customs officials and accorded customs clearance, following which the GMB and the GPCB officials inspect the ship for Inventory of Hazardous Materials (IHM) and provide the necessary clearance certificate.

2. The next step after anchorage is seeking permission from the GMB and the GPCB for beaching of the ship at one of the ship breaking yards at Alang-Sosiya. The ship is allowed to be beached along the Alang-Sosiya coast for dismantling and recycling only after due permission is accorded.

3. After the ship is beached, oil is drained from the bilges and tanks, fuel tanks are cleaned, and fuel and lubricant lines are disconnected from the ship. Oily waste including oily sand, rags, garbage and plastic wastes are then transported to the nearby Common Hazardous Waste Treatment Storage Disposal Facility (CHW-TSDF) setup by GMB.

4. Thereafter, the Safety Officer of GMB inspects, identifies and marks the different types of gas cylinders, batteries and chemicals on board. The recovered empty cylinders, batteries and chemicals are safely carried from the ship to their assigned locations in the yard and temporarily stored

45 Anand M. Hiremath, Atil K. Tilwankar and Shyam R. Asolekar's article titled Significant steps in ship recycling vis-à-vis wastes generated in a cluster of yards in Alang: a case study, Journal of Cleaner Production from Centre for Environmental Science and Engineering, Indian Institute of Technology Bombay, Mumbai provides the knowledge base which has been enhanced by Team NMF's visit to Alang-Sosiya Ship Recycling Yard.

till they are transported by an officially contracted firm (assigned by the Regulatory Authorities) to a site where a final decision about their further usage/disposal is taken.

5. The next step is the collection and disposal of Bilge Water and associated wastes. The Bilge Water tanks after being emptied are cleaned with the help of beach sand.

6. The sixth step entails the obtaining of Decontamination Certificate from the GPCB and Hot Works Permit from the GMB to subsequently cut the ship using gas cutting method.

7. On receipt of the Decontamination Certificate and the Hot Works Permit, the usable materials on the ship are removed from the ship and sold to the highest bidder. These materials prior to their sale are identified by both the Safety Officer and the ship dismantling yard owner and an inventory list of such items is prepared.

8. In the eighth step, insulating materials including asbestos, glass wool and thermocol are removed from the ship by trained workers.

9. Gas cutting is the ninth step where a large section of the ship is cut with the help of gas cutting torches during high tide. Cranes and winches are used to pull the ship's cut sections resulting in the sections falling in the inter-tidal zone due to gravity. Once the water recedes completely to the low tide level, of this sliced section, pieces are cut in the inter-tidal zone itself so as to make smaller pieces which can be conveniently lifted by the cranes and carried to the work area ashore.

10. Lastly, steel obtained from cutting of ships, which is in good condition, is sent to the nearby re-rolling mills that convert it into plates, bars and rods for suitable reuse. The remaining steel called scrap which cannot be sent for re-rolling or cannot be used directly, is sent for melting.

Despite the distinctive recycling plans and procedures of each yard, a common and time-tested tacit know-how prevails in Alang, depicted in Figure 5 as the "typical ship recycling procedure." This standardised approach ensures economic, procedural, environmental, and work-safety advantages, with each work activity's duration and input/output meticulously outlined for efficient execution.

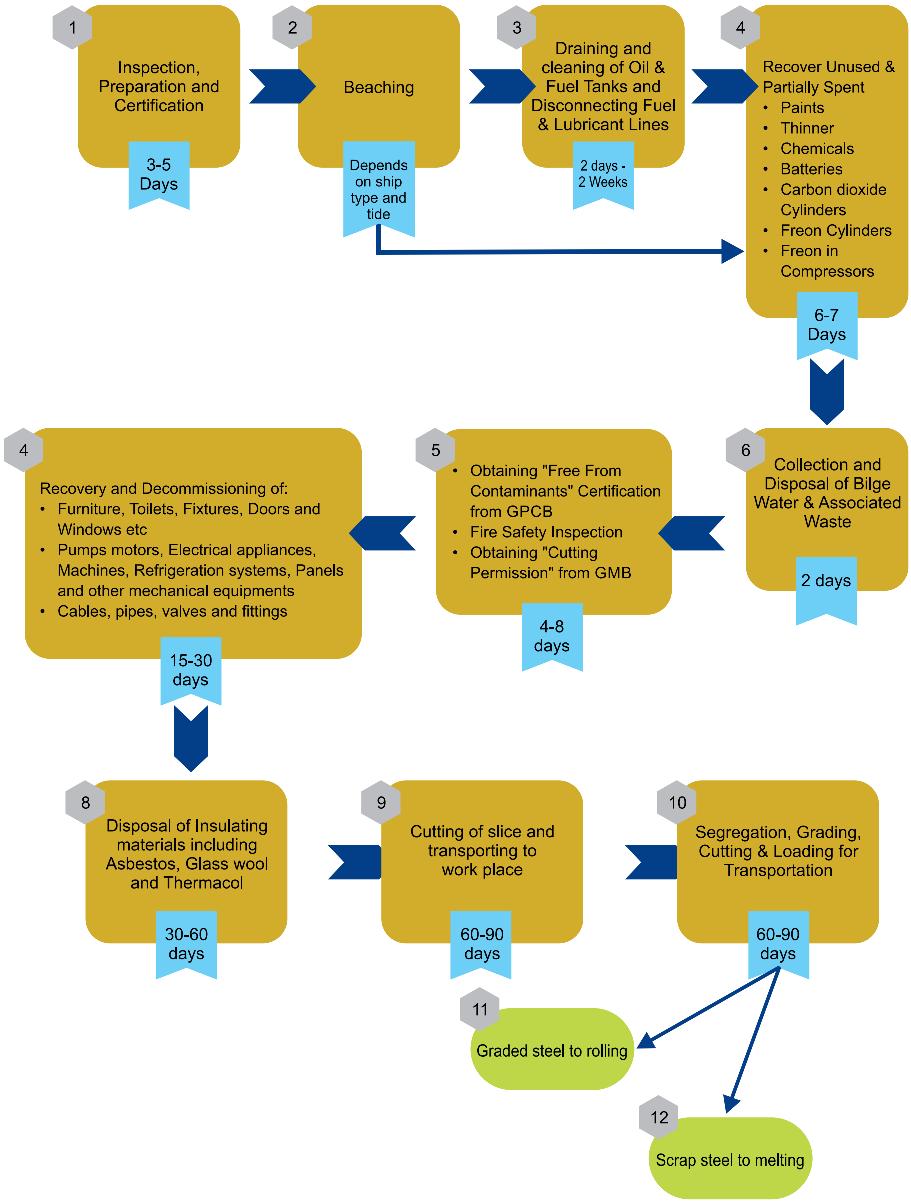

Figure 5. Typical Ship Recycling Procedure
Source: Collated by Authors

5.2 Is Alang truly as hazardous as it is commonly believed to be?

A questionnaire was designed to comprehensively explore the current state of ship recycling yards and their future plans regarding sustainable ship recycling practices. It was circulated among public and private sector individuals, and their responses were systematically collated. The questionnaire, consisting of nine questions covering various aspects of ship recycling, particularly emphasised emerging trends integrating green technologies. Using the responses received, a five-point Likert Survey Scale was constructed to gauge participants' opinions on specific aspects of ship recycling techniques. The Likert Scale, as depicted in Figure 6, categorises responses into five anchor points: 'strongly agree,' 'agree,' 'disagree,' 'strongly disagree,' and 'neutral.' The data obtained from the Likert scale provides valuable insights into the prevailing perceptions and opinions surrounding ship recycling practices, with a specific focus on Alang, one of the world's largest ship-breaking yards.

Analysis of the Likert scale data reveals significant trends and attitudes within the industry. For instance, concerning India's potential to double its ship recycling capacity

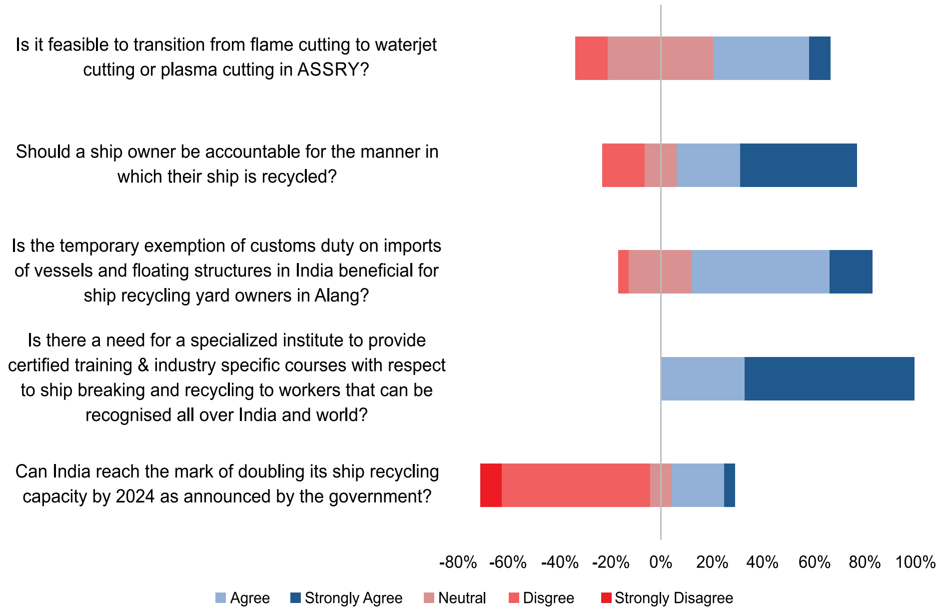

Figure 6. Likert Scale
Source: Collated by the authors

by 2023, a majority of respondents (66.6%) expressed scepticism, questioning the feasibility of achieving such a target within the given timeframe. Similarly, on the proposition of establishing a specialised institute for certified training and industry-specific courses in ship breaking and recycling, a substantial majority (66.7%) strongly advocated for such an institution, highlighting the consensus on the need to enhance skills and expertise within the ship recycling workforce.

Moreover, opinions regarding the temporary exemption of customs duty on imports of vessels and floating structures in India were varied. While a significant portion (71.3%) acknowledged the benefits, a notable percentage (25%) remained neutral, indicating uncertainty about its actual impact on ship recycling yard owners in Alang. Additionally, there was overwhelming support (70.8%) for holding ship owners accountable throughout the recycling process, signalling a growing expectation for environmentally and socially responsible practices.

The feasibility of transitioning from flame cutting to waterjet cutting or plasma cutting in the ASSRY elicited mixed responses. While half of the respondents supported the feasibility, a substantial portion (41.7%) remained neutral, reflecting cautious optimism or uncertainty regarding the practicality of adopting alternative cutting methods in ship recycling processes.

In conclusion, the Likert scale data provides a nuanced understanding of stakeholders' perspectives within the ship recycling industry, highlighting areas of consensus, scepticism, and uncertainty. To fully grasp the current standards and practices of ship recycling in Alang, further analysis such as SWOT and PESTLE may offer a comprehensive view, as discussed in section seven of this report.

6 Hong Kong Convention (HKC) vs. EU Ship Recycling Regulation (EU SRR)

6.1 Understanding the fundamental differences between the processes followed by India and other ship recycling countries

While understanding the process of ship recycling in India, it is vital to understand and compare India's processes with that of other countries in the Indian-Subcontinent and EU; where the ship recycling industry prevails and provides a competitive edge to

India. This comparison presents a case analysis and provides room for improvement for India, if need be. For the purpose of this report, we compare India's ship recycling industry with that of Bangladesh from the Indian-Subcontinent and Turkey from the EU into key areas i.e. regulatory framework, environmental standards, worker's training facilities, infrastructure and technology, compliance with international standards and economic visibility.

Factors	India	Bangladesh	Turkey
Location	Alang	Chittagong	Aliaga
Methods	Beaching	Beaching	Landing- Ships are partly pulled ashore and then dismantled both with floating and land-based cranes
Total number of Shipyards	153	150 (50-60 active all round year)	22
Number of ships dismantled and their Gross Tonnage (LDT) in 2023	140 Ships, 2,610,849 LDT	170 Ships, 3,232,593 LDT	44 Ships, 470,966 LDT
IHM under HKC & EU SRR	Following IHM under HKC	Following IHM under HKC	Following IHM under EU SRR
Domestic Law	Ship Breaking Code 2013 and Ship Recycling Act 2019	Bangladesh Ship Recycling Act 2018 (BSRA 2018)	Ship Dismantling Regulation 2004
Convention Applicable	Ratified Basel Convention and Hong Kong Convention and implementing HKC, but not part of Basel Ban	Ratified Basel Convention and Hong Kong Convention and implementing HKC, but not part of Basel Ban	Ratified Basel Convention, EU SRR and Hong Kong Convention and implementing EU S RR
Certifications	131 yards have acquired Statement of Compliance to the HKC and 9 have applied for EU SRR certification	3 yards have acquired Statement of Compliance to the HKC	9 yards have obtained Statement of Compliance with EU SRR

Training of Workers	Alang Safety Training Institute	Training provided by Bangladesh Ship Breakers Association (BSBA) through IMO's Safe and Environmentally Sound Ship Recycling (SENSREC)-Phase 1 Project	Training provided by Occupational Health and Safety Committee under Ministry of Labour
Ministries	DG Shipping, Ministry of Ports, Shipping and Waterways	Bangladesh Ship Reprocessing Board (BSRB) established under the Bangladesh Ship Recycling Act 2018	Ministry of Transportation, Maritime Affairs and Communication, Ministry of Labour and Social Security, Ministry of Education and Ministry of Environment
Ship Recycler's Association	Ship Recycling Industries Association (SRIA)	Bangladesh Ship Breakers Association (BSBA)	Ship Recyclers Association of Turkey, The International Ship Recycling Association (ISRA)
Worker's Association	Alang Sosiya Ship Recycling & General Workers' Association (ASSRGWA)	Ship Breaking Workers' Trade Union Forum (SBWTUF)	Izmir Labor and Democracy Forces
Cutting Methods	Welding, mechanical cutting and movable shear	Welding, mechanical cutting and movable shear	Welding, mechanical cutting and movable shear
Waste Management	CHW-TSDF	TSDF	Aliaga Waste Management Centre, IZAYDAS - Izmit Waste and Residue Treatment, Incineration and Recycling Co. Inc., Sureko Integrated Waste Management and Waste Energy Generation Incorporated Company
Level of Automation	Low	Low	Low

Table 2. Comparative Analysis among Top Ship Recycling Countries

Source: Collated by the authors

Based on this comparison, India could focus on improving its environmental standards, worker safety, and technology adoption to enhance its competitiveness in the ship recycling industry. Strengthening regulatory enforcement and investing in modernization could additionally help address these challenges and ensure sustainable growth in the sector.

6.2 Comprehending the distinctions between HKC and EUSRR in the context of the ship recycling market and recognizing their significance

Currently, two regulations are governing the requirements for safe and environmentally sound ship recycling i.e. the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 SR/CONF/45 (HKC) and the EU Regulation on Ship Recycling (EU) No. 1257/2013 (EU SRR). Both HKC and EU SRR aim at ensuring that ships, when being recycled, do not pose any unnecessary risk to human health, safety and environment. One of the main concerns that both the regulations address is the fact that ships contain hazardous materials such as asbestos, ozone-depleting substances, heavy metals and others, which have negative impacts both on worker's health safety and the environment, nonetheless there are certain differences between the two.

The HKC was developed with input from IMO member states and non-governmental organisations, and in co-operation with the ILO and the Parties to the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal, 1989. The convention intends to regulate the operation of ship recycling facilities, in a safe and environmentally sound manner. Additionally, it aims to establish an appropriate enforcement mechanism for ship recycling, incorporating certification and reporting requirements. The HKC puts the responsibility for its enforcement on the vessel's flag state and the recycling state. A ship to which the Convention applies may, in any port or offshore terminal of another Party – be subject to inspection by officers authorised for the purpose of determining whether the ship is compliant. If the ship is detected to be in violation of the Convention, the Party carrying out the inspection will take steps to warn, detain, dismiss, or exclude the ship from its ports. Some of the key highlights of HKC are as follows:

1. The Convention suggests an initial survey to be carried out to verify the IHM, additional surveys during the life of the ship and a final survey prior to recycling.
2. Ship recycling yards need a Ship Recycling Plan for each specific ship explaining the exact manner of the process and assuring the safe handling and disposal of hazardous materials.
3. An appendix provides a list of hazardous materials, the installation or use of which is prohibited or restricted in shipyards, ship repair yards and Parties to the Convention.
4. The Ship Recycling Plan has to be implemented safely by trained workers taking all safety precautions and having adequate updating on the progress.
5. A detailed ship recycling completion report is needed at the end of the recycling process for better transparency.

Under the EU SRR, EU-flagged vessels that reach the end of their operational lives will be recycled in facilities included on the European list of approved ship recycling facilities. Furthermore, EU listed ship recycling facilities are subject to more scrutiny; as compared to those under HKC, since independent certification and auditing third parties are allowed to submit complaints in case, they suspect that a listed facility is not complying with the Regulation. Overall, the EU List acts as an important market differentiator for shipyards that have invested in occupational safety and environmental standards. However, a major disadvantage of the EU SRR, is that shipowners can find a way around the laws by swapping their EU flag for a non-EU flag. This act, while strongly criticised, indicates the importance of more than flag state jurisdiction to hold the shipping industry accountable. Proper implementation of the Regulation necessitates that ship owners are given incentives to use EU-approved recycling facilities and not flag out to bypass the law. Some of the key highlights of EU SRR are as follows:

1. For ship recycling facilities, the national authorities of the member states inform about compliance to the Commission under EU SRR. Facilities in third countries that want to recycle ships with a flag of a member state of

the EU need to apply to the Commission in order to be included in the EU List.

2. Ships are obliged to carry onboard an IHM from December 2020, and EU-flagged vessels scheduled to be recycled after December 2018 ought to have a Ready for Recycling Certificate (RRC). Having a RRC means that those vessels will only be sent to the yards included in the European List of Ship Recycling Facilities.

In comparison, the EU SRR sets out a number of requirements that go beyond those set in the HKC. The EU SRR gives greater weightage; to the approval of ship recycling facilities based on the control of any leakage, in particular in intertidal zones, handling of hazardous materials and waste only on impermeable floors with effective drainage systems with the operation from built structures, which the HKC doesn't. Other requirements correspond to implementation of standards for downstream waste management and preparation and of the IHM on board ships either flying the flag of an EU State or a flag of another country.

The requirements outlined in the EU SRR for IHM development are closely aligned with the standards set forth by HKC. Additionally, the EU SRR also adheres to the relevant guidelines provided by the IMO such as improved compliance regulations for IHM under MEPC.269(68), preparation of a Visual Sampling Checking Plan -VSCP under MEPC.269(68) and conducting detailed inspections of ships under the Hong Kong Convention under MEPC.223(64). By aligning EU SRR requirements with those of the HKC and incorporating relevant IMO guidelines, the EU aims to ensure consistency and uniformity in the development of IHM. This approach facilitates effective compliance with international standards for ship recycling, promotes environmental sustainability, and enhances safety measures for workers involved in the ship recycling process.

The HKC under Appendix 1 "Controls of Hazardous Materials" and Appendix 2 "Minimum List of Items for The Inventory of Hazardous Materials", lists out 13 substances for the preparation of IHM. The EU SRR has added two more substances to these lists, namely Perfluorooctane Sulfonic Acid (PFOS) (listed in

Annex I) and Hexabromocyclododecane (HBCDD) (listed in Annex II). PFOS reporting is mandatory for EU-flagged ships but is not required for third country ships. HBCDD reporting is mandatory for EU-flagged new ships and should be reported as far as practicable for both existing EU-flagged ships and existing third country ships. According to the Regulation, PFOS on-board ships are prohibited for EU-flagged vessels. PFOS can be found in the Aqueous film forming foam (AFFF) type fire-fighting foams on ships carrying inflammable fluids and those with helicopter decks, hydraulic fluids, cable sheath, coatings and adhesives. HBCDD can be found in expanded polystyrene (EPS) used for cryogenic insulation, such as for liquefied gas tanks (LGT), refrigerated areas and similar, as well as in electrical extension cover, polymer material of switch board, fire sensor/alarm cover, light cover, cable sheath, polymer made fire resistance insulation, coatings and flooring material. Furthermore, unlike the HKC that allows new installations containing HCFCs until 1 January 2020, the EU Regulation (EU) No 1257/2013 does not permit such a relaxation.

Item	EU SRR	HKC
Entry into Force	31st December 2018	26th June 2025
Applicability	EU or UK flagged ships ≥ 500 (GT) and Ships ≥ 500 (GT) calling any EU or UK ports or anchorages	Ships ≥ 500 (GT) and Ship Recycling Facilities
Inventory of Hazardous Material (IHM)	IHM Part I investigates 15 hazardous materials listed in Annex I & II	IHM Part I investigates 13 hazardous materials listed in Appendix I & II
Authority for IHM Certification	Flag States or Recognised Organisations	Flag States or Recognised Organisations
Documents	Inventory Certificate or IHM Certificate for EU flagged ships and Statement of Compliance for third party flagged ships	International Certificate for Inventory of Hazardous Materials

Table 3. Difference between EU SRR and HKC

Inventory of Hazardous Materials (IHM)

The IHM is a list of hazardous materials that are present on a ship. This list quantifies and locates hazardous materials on board ships which are known to be hazardous to people (specific reference to workers) and the marine environment. The IHM consists of three parts i.e. Part I: Hazardous Materials contained in the ship's structure and equipment, Part II: Operationally Generated Wastes and Part III: Stores. Part I of the IHM, is prepared either during the construction of the ship or while the vessel is in operation. Part II and III of IHM, are prepared by the shipowner once the decision is given to send the ship for recycling. These two parts can also be prepared by the crew of the ship or by an Hazmat Expert; who is an individual from a third-party company or an employee of the ship owner who has received proper training.

The procedure to develop an IHM for a newly built ship and existing ship is different. For a new ship, the shipyard is responsible for the preparation of IHM. This is based on the documentation provided by the suppliers in the form of Material Declaration (MD) and Suppliers Declaration of Conformity (SDOC). Regardless of the scope of the IHM, whether HKC or EU SRR, the recommendation to shipyards is that; to instruct the suppliers to fill in and submit the material declaration forms for their products. For operational ships or decommissioned ships or EOL ships, the shipowner is responsible for the preparation of IHM. While preparing IHM, following steps are to be considered:

a) Collection of information about the ship being recycled

b) Assessment of the collected information

c) Prepare Visual and Sampling Check Plan (VSCP)

d) Visual and sampling check on the ship

e) Send collected samples for laboratory analysis and prepare IHM and Inspection Report once the report for the submitted samples is issued.

Once the IHM is prepared, it needs approval from certified engineers (Class Review). After the IHM is successfully approved, the ship owner needs to apply for an IHM initial survey on board ship done by a Class Surveyor. IHM certificate or Statement of Compliance will be issued by the surveyor with a maximum validity of 5 years in harmony with the ship's main class renewal date.

<table>
<tr><th colspan="2">Scope of the IHM</th><th>Ship Building & Operation</th><th colspan="2">Preparation prior to Recycling</th></tr>
<tr><th>HKC</th><th>EU SRR</th><th>Part I: Structure & Equipment</th><th>Part II: Operationally Generated Waste</th><th>Part III: Stores</th></tr>
<tr><td>APPENDIX 1
Mandatory for new/ existing ships & new installations</td><td>ANNEX I
Mandatory for new/ existing ships & new installations</td><td>yes</td><td>___</td><td>___</td></tr>
<tr><td>APPENDIX 2
Mandatory for new ships/ installations, as far as practicable for existing ships</td><td>ANNEX II
Mandatory for new ships/ installations, as far as practicable for existing ships</td><td>yes</td><td>___</td><td>___</td></tr>
<tr><td colspan="2">Table C Materials
Potentially Hazardous Items</td><td>___</td><td>yes</td><td>yes</td></tr>
<tr><td colspan="2">Table D Materials
Regular Consumable Goods Potentially Containing Hazardous Materials</td><td>___</td><td></td><td>yes</td></tr>
</table>

Table 4. EU SRR vs HKC
Source: IHM and Ship Recycling, https://www.dnv.com/maritime/insights/topics/ihm-ship-recycling/index.html

7 SWOT and PESTLE Analysis of Indian Ship Recycling Industry

In the ship recycling sector, particularly within ASSRY, the utilisation of strategic analysis tools like SWOT and PESTLE becomes imperative to grasp the multifaceted challenges and opportunities inherent in the industry. SWOT analysis, pioneered in the 1960s,[46] serves as a foundational method to discern internal strengths and weaknesses alongside external opportunities and threats. By employing SWOT analysis, individuals in ASSRY can identify advantages in implementing recycling plans, recognize barriers hindering goal achievement, pinpoint avenues for growth, and anticipate external challenges that may impact operations. This method offers a structured approach to strategic planning and decision-making within the complex realm of ship recycling.[47]

However, given the intricate nature of the ship recycling sector and its interaction with external forces, the integration of PESTLE analysis amplifies the strategic insights derived from SWOT analysis.[48] PESTLE analysis evaluates Political, Economic, Social, Technological, Legal, and Environmental factors, providing a comprehensive framework to understand the broader environmental influences on ship recycling operations. SWOT analysis evaluates Strengths, Weaknesses, Opportunities and Threat of the ship recycling sector. By combining SWOT and PESTLE analyses, individuals gain a holistic view of the internal capabilities and external dynamics shaping the ship recycling landscape in ASSRY.

The synergy between SWOT and PESTLE analyses enables individuals to navigate the complexities of the ship recycling sector effectively. SWOT analysis facilitates the categorization of internal and external factors influencing recycling operations, while PESTLE analysis further delineates these factors into distinct environmental domains.[49] Through this integrated approach, ASSRY can identify critical issues such

46 Anastasia Christodoulou and Kevin Cullinane, "Identifying the Main Opportunities and Challenges from the Implementation of a Port Energy Management System: A SWOT/PESTLE Analysis", Sustainable Maritime Transportation Management and Policies, 2019 https://doi.org/10.3390/su11216046

47 Faming Sun, "SWOT analysis of the authorization of Chinese ship recycling yards", World Maritime University, 2013 https://commons.wmu.se/cgi/viewcontent.cgi?article=1020&context=msem_dissertations

48 Nanimpo Kansongue, James Njuguna and Stephen Vertigans, "A PESTEL and SWOT impact analysis on renewable energy development in Togo", Frontiers in Sustainability, February 2023 https://doi.org/10.3389/frsus.2022.990173

49 *Ibid*

as regulatory compliance, economic viability, social responsibilities, technological advancements, legal constraints, and environmental sustainability. By understanding these factors comprehensively, ASSRY can formulate strategic plans that mitigate risks, capitalise on opportunities, and foster sustainable practices in ship recycling, thus enhancing its competitiveness and resilience in the global market.

7.1 SWOT Analysis

The EOL ships, once considered a liability by developed economies of the western world, have transformed into a valuable commodity for the developing economies of South Asian countries as these EOL ships are being recycled for commercial gains while contributing to the larger cause of having a circular economy. Ship recycling activities, although deemed hazardous by the International Labour Organization (ILO), hold the potential to contribute significantly to achieving circular economy goals and UN sustainable development objectives.[50] This study delves into recent developments in India, particularly focusing on opportunities and challenges within the ship recycling industry.

A strategic analysis using SWOT methodology is employed to dissect the ship recycling landscape in India, with a specific focus on ASSRY. This analysis aims to identify inherent strengths and opportunities that can be leveraged for sustainable growth, while also recognizing and addressing weaknesses and threats that require careful consideration in the execution of ship recycling operations. This comprehensive exploration emphasises the urgent need for a holistic understanding of the ship recycling industry, fostering dialogue and collaboration to promote responsible practices and maximise the positive impact of ship recycling on both local economies and global sustainability goals.

50 Bisma Mannan, Md Jahir Rizvi and Yong Ming Dai, "Ship recycling in developing economies of South Asia: Changing liability to a commodity", *Green Technologies and Sustainability*, Volume 2, Issue 2, May 2024 https://www.sciencedirect.com/science/article/pii/S294973612300057X#:~:text=Investigating%20SWOT%20for%20ship%20recycling,as%20external%20opportunities%20and%20threats.

SWOT analysis, comprising Strengths (S), Weaknesses (W), Opportunities (O), and Threats (T), provides a structured framework for strategic planning and decision-making. By assessing internal (S and W) and external (O and T) factors, organisations can develop cogent plans to strengthen their market position and navigate challenges effectively. While external factors may remain beyond control, internal factors offer opportunities for leveraging strengths, mitigating weaknesses, and addressing threats. The SWOT matrix enables organisations to synthesise these factors and formulate long-term strategies to achieve their goals and adapt to evolving market dynamics.[51] Originally developed by Weihrich in 1982,[52] the SWOT method has since been widely adopted across various industries and domains, offering a versatile tool for assessing market potential, anticipating future trends, and informing strategic decision-making at both organisational and national levels.[53]

In 2021, the Indian Finance Minister unveiled plans to quadruple the capacity of ship recycling by 2024, projecting a surge in imported ships from Japan and Europe. This ambitious initiative aims to create 150 thousand jobs and position India to capture 50% of the global share in shipbreaking. The enactment of the Recycling of Ships Act, 2019, endorsing the Hong Kong Convention (HKC), marks a pivotal shift in the industry landscape, fostering eco-friendly practices and ensuring labour welfare. Additionally, the Ministry of Ports, Shipping, and Waterways advocated for a 50% increase in financial allocation to enhance ship recycling capacity at the Alang Ship Breaking Yard, potentially elevating the sector's contribution to GDP.[54]

Strengths characterise the ASSRY, leveraging its geographical advantages with high inter-tidal levels facilitating efficient operations. The yard's capability to handle large ships underscores its relevance in the global market. Low-cost labour availability and a notable recycling capacity, coupled with an average annual revenue of INR 55

51 *Ibid*

52 H. Weihrich, The TOWS matrix—A tool for situational analysis, Long Range Plan. 15 (2) (1982) 54–66, http://dx.doi.org/10.1016/0024-6301(82)90120-0

53 Bisma Mannan et al, "Ship recycling", May 2024

54 *Ibid*

STRENGTHS

- Geographical advantages of high tidal level
- Alang's quick-drying seabed simplifies material handling during ship-breaking, even in monsoons
- The sloping coast and ample dry area ease vessel access, optimizing end-of-life vessel handling.
- Handle large ships
- Low - cost labour availability
- Recycling capacity
- Average Revenue Generated in last 5 years - INR 55 Crores per annum
- More than 200 shops as retail and wholesale market for recovered items
- 60+ induction furnaces and 80+ re-rolling mills in Bhavnagar
- Government Support

WEAKNESSES

- Lack of Transparency
- Environmental monitoring facility is under development
- Current TSDF of Alang can't handling of certain types of waste (such as e-waste, batteries etc)
- Human Resource management missing
- Higher Taxes (Import Duty 2.5 % and GST 18 %)
- BIS not recognising recycled steel - Challenges to reuse in other sector, i.e., real estate sector
- Approximately 50 % underutilization of working plots

OPPORTUNITIES

- Decarbonisation through sustainable ship recycling as compared to mining iron from oars
- In-direct market opportunity
- Boost economy
- Reduce reliance on steel industry
- Job creation
- Building a real time monitoring program to track key HSE KIPs across ship recycling areas
- To develop a sampling regime to identify equipment potentially containing hazardous materials

THREATS

- Legal issues due to lack of safety and health insurance facilities
- Lack of ship availability due to non- compliance to EUSSR
- Fluctuation in Foreign Exchange Market

Table 5. SWOT Analysis
Source: Collated by the authors

Crores over the last 5 years,[55] establish it as a significant industry player. Government support further enhances its position, fostering an environment conducive to growth and development.

However, the yard faces several weaknesses hindering its full potential. These include a lack of operational transparency and underdeveloped environmental monitoring facilities. Challenges in waste management, particularly with certain types like e-waste and batteries, present operational hurdles. Human resource management deficiencies and higher taxes exacerbate operational complexities. The non-recognition of recycled steel by BIS poses challenges in reuse, with approximately 50% under-utilisation of working plots highlighting operational inefficiencies.[56]

Despite these weaknesses, the yard is positioned to capitalise on emerging opportunities. Sustainable ship recycling offers a pathway to decarbonization, aligning with environmental sustainability goals. Leveraging indirect market opportunities can bolster the economy and reduce reliance on the steel industry. Job creation prospects align with national development objectives. Establishing real-time monitoring programs and sampling regimes for hazardous materials enhance operational efficiency and safety compliance.

Nevertheless, the yard is susceptible to threats that could undermine its operations and growth. Legal issues stemming from the lack of safety and health insurance facilities pose significant risks. Non-compliance with EU Ship Recycling Regulation may disrupt availability of ships for recycling. Fluctuations in the foreign exchange market introduce financial instability.

While challenges and threats loom, the ASSRY's strengths and strategic opportunities position it favourably in the dynamic industry landscape. Continued government support and investment, coupled with efforts to address weaknesses and mitigate threats, are imperative for sustained growth, innovation, and contribution to India's economic and environmental sustainability objectives.

55 Maritime *Amrit Kaal* Vision 2047, October 2023, Pg. 216

56 *Ibid*

7.2 Detailed discussion on PESTLE Analysis of Indian Ship Recycling Industry focused on ASSRY

While analysing India's ship recycling industry at ASSRY, PESTLE analysis is been deployed to amplify the strategic insights derived from SWOT analysis; as discussed above. The word PESTLE is an acronym for Political (P), Economic (E), Social (S), Technological (T), Legal (L) and Environment (E) and PESTLE analysis is a tool which assesses different factors and forces in the external environment that affect the success and failure of an industry. The term PESTLE was invented over 50 years ago by Francis Aguilar, who was an American scholar, whose expertise was in strategic planning. In the late 1960s, Francis Aguilar published a book titled Scanning the Business Environment in which the now known PESTLE tool was first identified.

Looking at different aspects of the tool; the political perspective covers all the political factors that can affect an industry, including government policies that influence, cause change or target issues in business and society. The economic perspective takes the current economy into account and how it could impact the industry in question. The social perspective focuses on the cultural factors and trends that impact society and social norms. Factors such as population growth, health consciousness, career attitudes and health and safety are also considered under it. The technological perspective looks at the technological factors to be considered in relation to automation, software development and technology incentives. The legal perspective, analyses the legislative changes that could alter procedures to meet new legal requirements. This could include tax, employment, licensing, import and export laws. There can be some overlap between legal factors and political factors, because legislation changes also result in policymakers forming new policies. However, legal factors always dictate what an industry can or cannot do by law. Lastly, the environmental perspective focuses on the sociological trends for green living, and increased pressure to reduce the rate of global warming.

When each category is considered under the PESTLE analysis, a full picture can be created that categorises all the external factors that can influence India's ship recycling industry at ASSRY. However, different sectors may place greater weight on different categories due to the differing nature of the industry, but all sectors can benefit from using the tool to inform key business decisions.

7.2.1 Political Perspective

The Government of India promulgated the "Maritime India Vision 2030" (MIV 2030) in February of 2021, subsuming within it, the SAGARMALA mega-project, and including the enhancement of the country's ship recycling capacity. This vision document promotes the concept of 'Waste to Wealth' through modification of Bureau of Indian Standards (BIS) regulations and the development of ship recycling infrastructure. The document also identified three major interventions to drive demand in the ship recycling industry:

1. Relaxation in BIS (steel scrap standards) to enhance the yield per tonne of scrap and exempt ship-scrap use in re-rollable bar manufacturing based on mechanical strength and quality in lieu of the earlier-specified norms of metallurgical history.

2. Redevelopment of plots at Alang-Sosiya and the creation of a ship-repair cluster on the east coast of India to enhance market share.

3. Set up a facilitation centre to promote India's ship recycling industry through the hosting of trade fairs and exhibitions.

As far as the modification of BIS regulations (IS 1786:2008) is concerned (which governs Thermo-Mechanical Treatment (TMT) bar production through ship scrap material), the current regulation limits the usage of recycled steel scrap in manufacturing re-rollable bars, driving prices in India lower. Due to the imposition of the Quality Control Order (QCO), the percentage share of recycled ship steel-scrap usage for re-rollable steel dropped from 70 to 80 per cent to 40 to 50 per cent. The Government of India, vide MIV 2030, has proposed two modifications to the BIS regulations on the requirement of metallurgical history of steel scrap from ship recycling:

1. Exemption to steel scrap from ship recycling for use in re-rollable bar manufacturing.

2. Use of quality and strength tests in lieu of metallurgical history for determining its end use.

Key initiatives for infrastructure development include the development of a ship recycling park behind the ship recycling yards at Alang. Secondly, MIV 2030 considers Alang-Sosiya as a 14 km "port" and stipulates an area of 2 km inland from the seashore as being a Port Area. This area is planned to be sealed-off with walls and gates and all re-rolling and melting mills would be housed inside this port, with only end-products such as steel bars and ingots, furniture, and wastes going outside the gates. Consolidating several small yards into large ones (each with a width of 120+ metres) and increasing the length of the current plots to about 200 m; and the development and establishment of an IS0 17025 accredited laboratory for the testing of hazardous waste, are the other two planned initiatives designed to promote infrastructural development. Finally, India has resolved to adopt a zero-residue model for ship recycling at all plots and work towards ensuring zero leakage of liquid waste to sea from underground waste water/oily water collection from all yards to waste treatment plant.

Maritime *Amrit Kaal* Vision 2047

The MoPSW released the Maritime *Amrit Kaal* Vision 2047 in October 2023, after extensive consultations with stakeholders across central ministries, state government departments, private sector, financial institutions, and academia. Building upon MIV 2030, this document articulates, *inter alia*, India's aspirations to be a global player in ship recycling and proposes various measures to facilitate an eco-system that provides adequate infrastructure and policy enablers to achieve its desired goal. The 2047 Vision intends to implement the following:

1. Short-, medium-, and long-term goals for ASSRY expansion, by relaxing annual charges for plots, allotting new plots and obtaining Coastal Regulation Zone (CRZ) clearance and initiating the widening of the current two-lane road to a four-lane one.

2. Reduction in tax/ duties, i.e., import duty (2.5 per cent), and GST (18 per cent), in line with the imported baled scrap.[57]
3. Collaboration with the EU by seeking the intervention of Ministry of External Affairs, Government of India to encourage EU and OECD countries to send their vessels directly to Alang-Sosiya (at present, owners of vessels flying the flag of EU member-States resort to first reflagging their vessels under Flags of Convenience (FOC) and only then send them to Alang-Sosiya) with subsidised selling price considering that many ship breaking yards in Alang-Sosiya are fully compliant with the Hong Kong Convention . In order to facilitate this line of effort, the Government of India invited a delegation from the European Union to visit Alang-Sosiya, to assess and analyse the actual conditions in the ship recycling yards and their level of compliance. It is reliably learnt that these visits would be regularly facilitated in the future to achieve transparency with respect to environmental compliance by yards.
4. Re-rolled steel, generated from the process of ship recycling, is of good quality. Thus far, however, BIS has not been permitting this steel to be used in large construction projects due to lack of metallurgical history or traceability. The effort is now to permit steel generated from ship recycling to be used for large construction projects based on mechanical tests and stringent quality checks rather than metallurgical history. This will not only increase the demand of re-rolled steel but also raise the competition for domestic virgin steel.

7.2.2 Environmental Perspective

In the pursuit of sustainable ship recycling, Mecon Limited conducted a comprehensive environmental assessment survey focusing on air and water quality,

57 Metal recycling is a process where metals are recycled and reused over and over again. Some of the most useful machines in the recycling process are shredders, conveyors, compactors and balers. Scrap metal baling is an essential process in the metal recycling industry. The process quickly and efficiently deals with metals, from small scrap pieces to washing machine and entire vehicles. Baling is an effective way to cut the cost of haulage and to maximise the payload on every waste collection. For further information, refer to https://www.morecambemetals.co.uk/the-importance-of-scrap-metal-baling/#:~:text=Scrap%20metal%20baling%20is%20an,payload%20on%20every%20waste%20collection.

noise levels, and ecological impact in the Alang region. The ambient air quality at five distinct locations, including Alang village and Sosiya village, was diligently monitored for Particulate Matter (PM10 and PM2.5), Sulphur dioxide (SO_2), and Oxides of Nitrogen (NOx). The results of the survey spanning a twelve-week period, revealed that the ambient air quality parameters in the villages adhered to the National Ambient Air Quality Standards, 2009 for "Industrial, Residential, Rural, and Other Areas." Work zone air quality within ship breaking plots and the Alang Waste Treatment Storage Disposal Facility (TSDF) met the stipulated norms outlined by the Indian Factories Act.[58] Water quality monitoring covered sea water, Pasvivali Creek, ground water, and effluents from ships and the Alang TSDF. Sea and creek water analysis indicated levels within limits stipulated in the "Primary Water Quality Criteria for Coastal Waters," while ground water from Alang and Mathavda villages was deemed unsuitable for drinking. In terms of noise pollution, continuous monitoring at Alang Fire Station and surrounding villages demonstrated that average noise levels met the standards for Residential and Industrial Areas prescribed by the Central Pollution Control Board.[59]

The ecological study revealed a semi-arid landscape with sparse vegetation dominated by *prosopis juliflora* (Gando-baval) and a limited variety of land animals. In addition to the absence of ecologically sensitive areas and mangroves, the study identified presence of common bird species but reported low biodiversity and biomass of marine life in the Alang area, with no commercial fishing activities.[60] Overall, this comprehensive environmental analysis, conducted by Mecon Limited and observed by the authors through engagement with individuals and authorities, forms a crucial foundation for ensuring responsible and sustainable ship recycling practices in the region.

58 Environmental Impact Assessment and Environmental Management Plan, July 2016 https://www.jica.go.jp/Resource/english/our_work/social_environmental/id/asia/south/india/c8h0vm00009ulddw-att/c8h0vm0000ahd7tr.pdf

59 *Ibid*

60 *Ibid*

Method of Identification, Removal, and Disposal

a. **Asbestos** is normally found in insulation areas like bulk head, pipe insulation, cold or hot areas needing insulation in machinery and engine room spaces. Ceilings are also often found containing asbestos in ships. Removal of asbestos is done in a negative pressure area wherever required. Special signage is used on vessels and on bags during compilation of the IHM for identification of items containing asbestos on ship. Green Gene Enviro Protection and Infrastructure Private Limited (GGEPIL) approved by the GPCB is contractually authorised to handle, transport, and dispose materials in accordance with laid down regulations from hazardous material storage to GGEPIL's processing plant. It bears mention that the quantum of asbestos being used on ships is constantly decreasing and most ship designs are aiming to be asbestos-free.

b. **Paints** used on vessels in the 70s and 80s used to contain asbestos and Tributyltin (TBT). In case, scrutiny of the IHM or available vessel data reveals that the paints used onboard the vessel contain any of the hazardous ingredients, then the paint chips are removed with utmost care by chipping method. Special signage is used on the vessel for bags containing paint chips, which is sent to the Treatment, Storage and Disposal Facility (TSDF) / GGEPIL in Alang.

c. **Oily Sand and Oily Rags** are generated during cleaning of different types of tanks and spaces of vessels during the entire ship recycling process. The sand used for cleaning oily tanks is resultantly contaminated with oil contents which makes it hazardous in nature. Oily rags used for cleaning cannot be reused in any way. The oily sand and rags are collected in bags and disposed to TSDF/GGEPIL site with special signage being used on bags containing oily sand and rags.

d. **Bilge Water** is normally removed by pumping out facility at ports but some bilge water remains on the vessel during beaching and is required to be pumped out by yard resources and sent to TSDF /GGEPIL located in Alang. Bilge water records are maintained onboard the vessel being recycled. Special signage is used for tanks containing bilge water in the yard.

e. Many usable batteries are recovered from the vessels being recycled and are reused in the yard utility equipments such as cranes and winches. **Batteries which are found unusable** are collected and sent for disposal to TSDF / GGEPIL site.

f. **Rubber and plastic items** are collected in the non-hazardous storage area of the yard. Both materials are collected in bags with special signage for identification and are disposed to TSDF / GGEPIL in Alang on periodic basis.

g. **Glass wool** is used in insulation onboard vessels like asbestos and normally is white or yellow in colour. The glass wool is collected in bags with special signage for identification and is disposed to TSDF / GGEPIL in Alang on periodic basis.

h. **Cement and ceramic waste** are collected in non-hazardous waste storage rooms in the yard in bags and then sent to TSDF site / GGEPIL on periodic basis.

7.2.3 Social Perspective

Workers' Training and Safety

Amidst concerns raised by organisations regarding worker safety and training in Alang, interactions with the workers at the Safety Training and Labour Welfare

Figure 7. Safety Training and Labour Welfare Institute
Source: Pictures taken during the interaction of Team NMF with the trainees at the institute.

Institute reveals a starkly contrasting reality. The institute, operating in Alang, has demonstrated significant success in reducing accidents through its rigorous training programs. Notably, the reported fatalities resulting from yard accidents have been limited to eleven between 2020 and 2023, showcasing the tangible impact of safety initiatives. The comprehensive approach to safety is amply evident in the assignment of a dedicated Safety Officer to each recycling plot, supported by one or more safety supervisors. Moreover, the office of the GMB at Bhavnagar has a Safety Department staffed with qualified Safety Officers, emphasising a systemic approach towards ensuring worker safety.

Accident Data													
Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
No. of Fatal	5	15	9	18	4	7	8	12	1	0	2	8	1

Table 6. Accident Data of ASSRY
Source: Data provided by ASSRY Authorities

Since its establishment in 2003, the Safety Training and Labour Welfare Institute has enjoyed the unwavering support of the Gujarat Maritime Board, resulting in the proficient training of 1,56,503 skilled professionals. The training program, comprising mandatory 12-day comprehensive safety training, an intensive 2-day gas cutter safety training customised for gas cutting activities, and a comprehensive 3-day refresher safety training for personnel with prior training, underscores a commitment to empowering workers with the necessary skill-sets for their tasks. Additionally, the institute conducts seminars at regular periodicities addressing pertinent subjects to meet the distinct requirements of individual yards.

In line with their commitment towards welfare of workers, Alang authorities have constructed seven residential blocks, providing well-designed accommodations for a total of 1008 workers. These initiatives reflect a proactive stance towards enhancing the comfort and safety of workers, challenging the negative perception propagated by external vested entities. The water supply to ASSRY is facilitated through a pipeline connected to the Gujarat Water Supply Board. The capacity of the clean water supply system is 3 million litres per day, which comfortably exceeds the daily requirement ranging from 1.6 to 1.8 million litres. As a result, there is generally no issue with water supply. However, occasional shortages may arise during the summer months. In such cases, additional fresh water is supplied through tankers to ensure that the balance requirement is adequately met.[61]

Figure 8. Multi-specialty hospital and Accommodation Block
Source: Pictures taken during the visit of Team NMF to Accommodation block and multi-specialty hospital

61 Preparatory Survey on the Ship Recycling Yard Improvement Project in India, Final Report (Draft), Japan Marine Science Inc., Padeco Co. Ltd and Japan Development Institute Co. Ltd., Japan International Cooperation Agency, July 2017

Medical Facilities

Significant strides have been made in improving the medical facilities in Alang, addressing concerns and enhancing the overall well-being of the workforce. Presently, three medical facilities operate in the area — a multi-specialty hospital, a primary hospital, and a mobile health unit — all managed jointly by the Indian Red Cross Society and the Gujarat Maritime Board. These facilities are equipped to handle routine medical care, attend to minor injuries, perform surgeries, and provide immediate relief in the event of significant accidents. The expenses associated with medical treatment are covered by the plot owner where the injured worker was employed, emphasising a collaborative approach to worker health. Complementing these efforts, the Ship Recycling Industries Association (SRIA) is at an advanced stage of establishing a Trauma Centre, Health Care Centre, and Welfare Centre dedicated to Alang's workforce. Furthermore, the Gujarat Maritime Board is converting a building owned by the Justice Dewan Charitable Trust into a comprehensive hospital specifically catering to ASSRY workers, with the SRIA covering all associated costs. To promote occupational health awareness, the GMB's Training Centre, SRIA's medical professionals, along with external experts, conduct informative campaigns, demonstrating a holistic commitment to improving and expanding medical facilities in Alang.

7.2.4 Technological Perspective

Alang has made significant strides in improving its ship recycling infrastructure and technology, introducing innovative measures to enhance safety and environmental sustainability within the ship recycling industry. The integration of liquid oxygen in the yards has streamlined gas cutting processes, providing a more efficient and controlled approach. Moreover, the strategic plans to transition towards plasma and water-jet cutting technologies in the coming years stresses the industry's commitment towards embracing advanced environment-friendly technological capabilities. Another noteworthy development is the incorporation of Geo-membrane layers in a majority of the yards. Comprising impermeable geosynthetic material, these layers act as a robust barrier, preventing the seepage of harmful contaminants and hazardous chemicals into the soil. This proactive measure not only safeguards the

Figure 9. Geo-membrane layer on the yard and Liquid Oxygen supply tank in a yard
Source: Pictures taken during the visit of Team NMF to ship recycling yards

soil from potential hazards but also demonstrates a conscientious effort to mitigate environmental impact.

7.2.5 Legal Perspective

In essence, ship recycling deals with end-of-life ships, which are considered to be a form of hazardous waste. Trading in hazardous waste from developed to developing countries has a history going back to the latter half of the 20th century, when the production and consumption of goods in developed countries increased exponentially.[62] Developed countries were introduced to mass marketing, high consumption, and improved ease of access to products. Consumers began to enjoy the availability of

62 The North-South divide has been a socio-economic and political division used often in the late 20th century. It divided the world into two, the Global North, and the Global South. The Global North were the developed countries of Europe, and the United States. Similarly, the Global South were developing countries, predominantly of Asia and Africa.

greater varieties of clothing, food, and other consumer goods. However, with the rise in consumption came a rise in the amount of waste generated. When people of these developed countries started protesting against the creation of landfills in their cities, legislations against the dumping of waste became stringent and, eventually, the cost of waste dumping increased. To solve this problem, these countries then began transporting their waste to developing countries, since the waste management policies there were lax and human resource available was cheap and readily available. The developed countries, having found inexpensive ways to process and dispose of their waste, adopted the system of "waste flow"— a phenomenon often termed as "garbage imperialism".[63]

Two decades into the 21st Century, these wastes continue to flow. The developing countries either find this waste directly dumped on its land or they recycle or reuse the dumped waste. An example of this are fast-fashion castoffs, which end up becoming fleece or mattress stuffing, or are directly sold in second-hand markets of Asian and African nations.[64] The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, 1989, was introduced due to this reason. Consequent upon increased environmental awareness and economic heft over the last few years, several developing nations have now begun to ban the import of all or specific types of waste. India, for instance, has banned waste dumping by passing the Hazardous and Other Wastes (Management and Transboundary Movement) Rules in 2016 and in 2019.[65] However, the global shipping industry remains an exception to this, especially with the passing of The Recycling of Ships Act of 2019, which allows the recycling or dismantling of end-of-life ships in India.

The relocation of the ship recycling industry from the developed to the developing countries has been complemented and further strengthened by rising

63 Pellow, David Naguib, "Resisting Global Toxics: Transnational Movements for Environmental Justice", Cambridge, MA: MIT Press, 2007.

64 Sitara Srinivas, "Stitching a New Narrative: Engaging with Sustainability in the Fashion Industry", Social Policy Research Foundation, https://www.sprf.in/post/engaging-with-sustainability-in-the-fast-fashion-industry.

65 Hazardous Waste (Management and Transboundary Movement) Amendment Rules, 2019, https://pib.gov.in/newsite/PrintRelease.aspx?relid=189227.

demand for steel in developing domestic markets, lax environmental regulations, and a cheap workforce. End-of-life ships that arrive in Alang-Sosiya for ship recycling are primarily sold based on weight to the shipbreaking companies either directly or through cash buyers.[66]

Overview of Governing Authorities at Alang-Sosiya

Several central and state government authorities are involved in the management of Alang-Sosiya ship breaking yards. These include the Ministry of Environment, Forest and Climate Change (MoEF&CC) and the Ministry of Ports, Shipping and Waterways (MoPSW) in New Delhi, and the Gujarat Maritime Board (GMB), the Labour and Employment Department of Gujarat, the State Coastal Regulation Zone Authority, the Gujarat State Pollution Control Board (GPCB), the Customs Department, the Occupational Health and Safety Inspector, and the Factories Inspector in the state of Gujarat.

The GMB is the nodal agency at Alang-Sosiya with the responsibility of allocating plots for shipbreaking, developing the required infrastructure, acquisition of land, planning and the provisioning of water, electricity, roads, and communication, and so forth. The GMB has been vested with the power to ensure that the shipyards follow the norms and regulations laid down under various state and central government laws and policies. All yards at Alang-Sosiya are mandated to have a Recycling Facility Management Plan and in case any component of the Recycling Facility Management Plan of a particular yard is not functional during the GMB inspection, then the GMB has the power to cancel the permission for that ship recycler to beach any ship until the non-functional components are made functional in accordance with the laid down requirements.

66 The ship owner may sell the ship directly to a shipbreaking company by taking charge of its transportation to the final destination (in this case the shipbreaking yards), or preferably sell it through a broker. Alternatively, a ship owner may sell the ship to a "cash buyer" company such as GMS or the Wirana Shipping Company. These companies buy the ships and resell them to shipbreakers.

International conventions relating to ship recycling are The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 (Hong Kong Convention), The International Convention for the Prevention of Pollution from Ships, 1973, and the amendment protocol of 1978, both of which are together known as MARPOL 73/78; The Stockholm Convention on Persistent Organic Pollutants, 2001; The Maritime Labour Convention, 2006; The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, 1989, (Basel Convention) and The Basel Convention Ban Amendment, 2019 (Ban Amendment). It is pertinent to note here that the European Union has its own regulations, i.e., the European Union Ship Recycling Regulation, 2013 (EU SRR), and the European Union Waste Shipment Regulation, 2006, with the EU SRR running parallel to the Hong Kong Convention. India is not party to the Ban Amendment and the EU regulations.

The most recent and relevant international convention is the Hong Kong Convention which will enter into force on 26 June 2025. It will introduce global regulations to ensure ships at the end of their operational lives are recycled safely and without posing unnecessary risks to human health and the environment. The convention had laid certain conditions and upon the fulfilment of which it was to enter into force 24 months after the following required criteria were met, viz., not less than 15 member states; not less than 40 per cent of the world's merchant shipping by gross tonnage; and ship recycling capacity of not less than 3 per cent of the gross tonnage of the combined merchant shipping of those States mentioned above. The date of the Convention's entry into force was triggered when Bangladesh and Liberia became contracting States to it, marking the moment that all necessary criteria were met.

The Basel Convention is an important legislation that came into force in the 1980s. It protects human health and the environment from the adverse effects of wastes, in particular taking into account the vulnerabilities of developing countries. It obligates member States to (1) reduce and minimise waste at source; (2) manage wastes within the country in which they are generated; (3) reduce transboundary movement of wastes to a minimum; (4) manage wastes in an environmentally sound manner; and (5) strictly control waste trade that does occur via a notification and consent mechanism known as "prior informed consent". In relation to the Basel Convention, the Ban Amendment is an agreement between the Basel Convention Parties to prohibit the member States of the Organisation for Economic Cooperation and Development (OECD), the European Union (EU), Liechtenstein, and the countries that have ratified the Ban Amendment from exporting hazardous wastes to other countries — especially developing countries or countries with economies in transition.

Alang-Sosiya houses 153 shipbreaking yards out of which only 131 are operational. Currently, 106 shipbreaking yards have received Statements of Compliance (SoC) under the Hong Kong Convention and around nine of them have applied for the certification under EU SRR.[67]

National Laws

Laws in India relating to ship recycling can be grouped in two segments, namely, labour laws, and environmental laws. There are a wide range of laws in India for the protection and improvement of working and living conditions at Alang-Sosiya. These include the Worker's Compensation Act, 1923; the Payment of Wages Act, 1936; the Factories Act, 1948; the Employee's State Insurance Act, 1948; The Minimum Wages Act, 1948; the Employee's Provident Funds Act, 1952; the Payment of Bonus Act, 1965; the Contract Labour (Regulation & Abolition) Act, 1970; the Payment of Gratuity Act, 1972; and the Inter-State Migrant Workmen (Regulation of Employment and Conditions of Service) Act, 1979. The applicability of these laws is discussed in the Economic Perspective below.

Environmental laws regulating ship recycling are the Water (Prevention and Control of Pollution) Act, 1974; The Air (Prevention and Control of Pollution) Act, 1981; the Environmental (Protection) Act, 1986; the Customs Act, 1962; and the

67 In-person discussion with Captain Rakesh Mishra, Port Officer, Bhavnagar, Gujarat Maritime Board, August 2023.

Explosives Act, 1884. Regulations framed under the Environmental (Protection) Act, 1986 are Hazardous Waste (Management, Handling & Transboundary movement) Rules, 2008; The Batteries (Management and Handling) Rules, 2001; The Bio-medical Waste (Management and Handling) Rules, 1998; the Noise Pollution (Regulation & control) Rules, 2000; the Municipal Solid Waste Rules, 2000; the Ozone Depleting Substances (Regulation and Control) Rules, 2000; and the Manufacture, Storage and Import of Hazardous Chemical Rules (MSIHS) Rules, 1989.

The Government of Gujarat has enacted some additional laws. These include the GMB Ship Recycling Regulations, 2003; the Petroleum Rules, 1937 & 1976; the Explosives Rules, 1983; the LPG/Oxygen Gas Cylinders Rules, 1981; the Hazardous Waste (M&H) Rules and other Environmental Rules, 1989; and the Provision of Heavy Penalty in case of Fatal Accidents, 1855. Lastly, India has also enacted the Ship Breaking Code (Revised) 2013 (Code) and The Recycling of Ships Act 2019.

India ratified the Hong Kong Convention by passing The Recycling of Ships Act, 2019 whose provisions are the same as those of the Convention. However, the Code was enacted in 2013. In accordance with the specific provisions of the code, whenever a new facility is being planned, an Environmental Impact Assessment (EIA) is required to be undertaken, and the facility should comply with appropriate Coastal Regulation Zone (CRZ) notifications.[68] The Code focuses on the safe disposal of hazardous material generated by ship recycling activities and suggests in detail the appropriate disposal options.[69] It mandates that ship recyclers hand over such hazardous materials to authorised waste management facilities, viz., CHW-TSDF for treatment and disposal.[70] The hazardous material from the ship recycling yards is to be transported to TSDFs, where the same is disposed of in an environmentally sound manner. The obligation of the ship recycler ends once the hazardous material reaches a TSDF. Additionally, the Code also mandates that the State Pollution Control Boards (SPCBs) (1) set up air quality monitoring stations within a ten-kilometre radius of shipbreaking facilities to take measurements in terms of National Ambient Air Quality Standards; (2) periodically monitor soil, sediment quality, work-zone air

68 The Shipbreaking Code 2013.
69 The Shipbreaking Code 2013, Rule 6.4.1 (X).
70 The Shipbreaking Code 2013, Rule 6.4.3.

quality, and marine water quality near shipbreaking facilities;[71] (3) create facilities for the removal, storage, and disposal of hazardous material and wastes;[72] and (4) register as members of the TSDF[73] facilities for treatment, storage, and disposal of hazardous waste in an environmentally sound manner.[74]

An end-of-life ship is simultaneously a ship and a hazardous waste. Ships have to remain compliant with the Admiralty and maritime legal corpus, and standards required by international laws on navigation, safety at sea, and flag-related issues, until they are delivered to the ship breaking yards. All international laws governing a ship and hazardous waste are applicable to an end-of-life ship, until the ship is anchored. Thereafter, from the time it is anchored to the time it is beached, domestic laws of the country where it is anchored are applicable to it. However, as soon as the end-of-life ship is beached, it ceases to be a ship and becomes a hazardous waste. The obligation of the ship recycler to dispose of the hazardous material begins as soon as the ship touches the beach head, which is governed under the Recycling of Ships Act and the Code. Waste material originating from the ship recycling process, which reach the TSDF, are governed by the Hazardous Waste (Management and Handling) Rules, 1989, and the Hazardous and Other Waste (Management and Transboundary Movement) Rules, 2016, which make the operator of the TSDF liable for environmentally safe disposal of the material.[75]

Breaking of a ship falls under the category of 'waste' under the Basel Convention,[76] and both the Basel Convention and the Ban Amendment apply to the process

71 The Shipbreaking Code 2013, Rule 6.4.

72 The Shipbreaking Code 2013, Rule 6.5 requires facilities be created for ballast water disposal, oil sediments removal; disposal of asbestos; to treat bilge water; and removal of waste oily sludge, mineral oil and paint chips generated during the ship breaking process.

73 The Shipbreaking Code 2013, Rule 5.3 (i)(b).

74 Hazardous Waste (Management and Handling) Rules, 1989.

75 Hazardous Waste (Management and Handling) Rules, 1989, Rule 4 (1) states that occupier and the operator of a facility shall be responsible for proper collection, reception, treatment, storage and disposal of hazardous material.

76 Conference of the Parties to the Basel Convention on the Control of Transboundary Movement of Hazardous Waste and their Disposal, Seventh Meeting, held at Geneva from 25 to 29 October 2004.

of ship recycling. India ratified the Basel Convention in 1992 and it has made changes to its hazardous waste management rules to align itself to the Convention.[77] However, India has not ratified the Ban Amendment[78] which prohibits export of hazardous wastes, including electronic wastes and obsolete ships from OECD to non-OECD countries. Consequently, Alang-Sosiya is exempt from the ambit of the Ban Amendment.

Beaching

At Alang-Sosiya, ships are beached for ship recycling. According to Rule 3.3 of the Code, beaching is "*the process in which a ship is taken ashore to land and grounded deliberately in shallow water, either on its own power or under tow. A beached ship is rendered immobile and cannot be re-floated. Beaching is thus irreversible.*"

India is in conformity with the Hong Kong Convention, 2009, which does not explicitly prohibit beaching. In 2020, India's National Green Tribunal (NGT) held that the beaching method was permissible[79] basing its conclusion on a 2007 Supreme Court of India judgement.[80] In that case, the Supreme Court of India had applied the principle of sustainable development based on the concept of "balance" to allow the dismantling of a ship at Alang-Sosiya, Gujarat, thus allowing and permitting the use of beaching for ship recycling. The NGT, in its 2020 judgement, opined that if the beaching method is not followed, there would be no shipbreaking activity in India, thereby depriving the country of a major business activity, which would in term

77 India became a party to the Basel Convention in 1992 and made numerous amendments to the Hazardous Wastes (Management and Handling) Rules, 1989 to give effect to the convention.

78 The Ban Amendment to the Basel convention prohibits shipments of hazardous waste from parties listed in the Annexe VII of Basel Convention which are destined for operations according to Annexe VI A, to States not listed in Annexe VII (Article 4A (1). The amendment also inserts a new preambular paragraph 7 bis, which recognizes that transboundary movements of hazardous wastes, with regards to developing countries, have a high risk of not being able to provide environmentally sound management facilities as required by the convention.

79 Conservation Action Trust v Union of India, (2020) SCC Online NGT 868, (37), ("Conservation Action Trust").

80 Research Foundation for Science Technology and Natural Resource Policy v Union of India and Other (2007) 15 SCC 193.

Figure 10. Beached Ships at Alang-Sosiya
Source: Captured by the authors

lead to unemployment of a large labour force.[81] The tribunal further observed that an expert study, independently conducted under its auspices, had not reported any adverse effect of the beaching method since 1982.[82] The observation of the tribunal, while aligned with the EU SRR (which does not ban the process of beaching), is in sharp contrast with the EU decision to ban beaching for the ship recycling process in respect of all EU-flagged ships, due to the safety and environmental issues arising from the beaching method, based on its independent scientific findings.

81 Conservation Action Trust v Union of India, (2020) SCC Online NGT 868, (37), ("Conservation Action Trust").

82 Mazyar Ahmad, "Ship recycling in India- environmental stock taking", *Indian Law Review*, Vol. 6(2022), No. 3: 465-478, https://www.tandfonline.com/doi/full/10.1080/24730580.2022.2082100.

7.2.6 Economical Perspective

As explained earlier, during the process of ship recycling, the ship's structural members are cut into pieces by trained personnel using the gas cutting method from the bow (front portion) of the ship and gradually working their way towards the stern (the rearmost portion). Even the most impregnable and sturdy ships are torn down in a matter of months by the assiduous labour of workers, assisted by variety of tools and machines such as acetylene torches, sledgehammers, winches and cranes, at the 131 operational yards (of the 153 shipbreaking yards in all)[83] in Alang-Sosiya. Currently, 22 plots are vacant and an overall employment — direct and indirect — of 515 hundred thousand (lakh) people is generating an annual revenue of INR 55 crores per annum.[84] Beachfront plots of various sizes are being leased out by GMB in Alang-Sosiya to the owners of shipbreaking yards. This practice has been going on since 1994. The beach-front width of these plots varies from 30 m, 50 m and 120 m. However, with the increase in the size of the ships there is a clear need to rationalise the beach-front width sizes to accommodate ships with wide beams.

The time taken for the complete dismantling process of a ship depends entirely on the type of ship in question. For instance, an oil tanker takes comparatively less time to be scrapped than does a passenger liner as the latter has a more complex internal structure than the former. Currently, an average ship of 10,000 LDT to 20,000 LDT is broken in approximately three to five months. Yards at Alang-Sosiya employ a variety of workers for the various shipbreaking operations. Workers employed at these yards hail from different states of the country, such as Odisha, Uttar Pradesh, Bihar and West Bengal, and are essentially migrant workers who come to Alang-Sosiya in Gujarat in search of employment.[85]

Depending on their skills and experience, workers are very often categorised into "Muqaddams" (supervisors), gas cutters (who work on the ships and at the

83 Maritime *Amrit Kaal* Vision 2047.

84 Maritime *Amrit Kaal* Vision 2047.

85 In-person discussion with Captain Rakesh Mishra, Port Officer, Bhavnagar, Gujarat Maritime Board, August 2023.

yards), winch and crane operators, loaders, and yard cleaners. They are paid daily wages according to these classifications. A gas cutter's wage is around ₹800 to ₹2000 per day, as compared to a yard cleaner who earns around ₹500 to ₹1000 per day.[86] The constant search for better employment opportunities than that available in their home states, brings large numbers of workers to Alang-Sosiya where they are termed "migrant workers". As such, they usually travel without their families and tend to stay and work at the shipbreaking yards for relatively short periods of time (6 months to 2 years). Accountability of workers and applicability of various domestic labour laws to the ship recycling Industry at Alang-Sosiya, has been a big challenge due to the transient nature of this migrant work force. Apart from direct employment, these ship recycling yards also create indirect employment opportunities for tens of thousands of workers employed in downstream industries, such as re-rolling mills, oxy-acetylene plants, and the real estate market, thereby contributing to the economic growth of the country.

Figure 11. NMF Team's visit to a Ship Recycling Yard in Alang-Sosiya

Price Structure of Ships Sold for Ship Recycling

Once ships are placed on the recycling market, they are no longer considered as means of transport but become mere commodities, viz., secondary raw material in the

86 In-person discussion with Captain Rakesh Mishra, Port Officer, Bhavnagar, Gujarat Maritime Board, August 2023.

form of a floating inventory of ferrous and non-ferrous metal. Shipping markets all around the world remain closely inter-connected, each having its own fundamentals, with the ship recycling market being dependent on several heterogeneous factors, two main ones being:

1. **Supply.** The supply of ships for recycling is driven by freight rates and is related to the international shipping market — impacted by global trade and world economy — and is common knowledge to the inter-connected global community of shipowners. The sales of ships are in hard currencies (currently US$).

2. **Demand.** The demand of ships for recycling is primarily driven by local demand in re-rolled steel and secondarily-driven by the demand for melted scrap products. The demand side is domestic and mainly concentrated in five shipbreaking countries, with around 400 significant players. Purchases are financed and executed in local currencies only.[87]

The above factors are the driving force in determining the price paid by ship recyclers for acquiring tonnage. The price offered for recycling ships also depends on how the shipbreakers anticipate the market and what they are ready to pay for ships considered as raw material. The re-rolled steel products produced from shipbreaking activities compete with other recycled products. Since these ships are purchased in hard currencies (mainly US$) but resold in local currencies, an exchange rate exposure affects the industry. Currently the number of ships being sent for ship recycling is low as shipowners continue to exploit their vessels to maximise their profits because of increased freight rates.

Each of the above-mentioned factors can have an impact on the ship recycling industry in India and the price offered for recycling ships. Five countries, i.e.,

87 Damien A Devault et al, "*Ship breaking or scuttling? A review of environmental, economic and forensic issues for decision support*", Springer Nature, Environmental Science and Pollution Research (2017) 24:25741–25774, https://economictimes.indiatimes.com/industry/transportation/shipping-/-transport/domestic-ship-breaking-industrys-revenue-to-rise-by-10-this-fiscal-says-crisil/articleshow/81509301.cms?from=mdr

Bangladesh, China, India, Pakistan, and Turkey, have emerged as major ship recycling centres in the world, primarily because they can afford to offer the highest prices to buy the ships for recycling. A pertinent point that merits mention is that the proportion of scrap from recycled ships versus imported ferrous scrap is not the same across all the aforementioned countries.[88] Bangladesh (and to some extent Pakistan) is much more dependent on recycled ships for the supply of steel to meet their domestic steel requirements than are the other three, viz., China, India, and Turkey.

During the COVID-19 pandemic, there was a plunge in global trade and lowering of freight rates. Ship owners now found it more profitable to simply sell their ships off for recycling rather than continuing to maintain them (in the absence of freight availability). Consequently, from the second quarter of 2020 onward, a noticeable rise in the number of vessels bought for ship breaking was observed as compared to the muted activity in the first quarter.[89] The key to profit-making in ship recycling lies in the sale of higher value non-ferrous metals, oil, and furniture found on the ship, all of which form a sizeable part of the recycled products other than steel. Our on-ground interactions in Alang-Sosiya revealed that the average purchase price of steel in the Indian sub-continent is around US$ 500 or EUR 458 (currency exchange rate of 0.92) per Lightweight Tonnes.[90] In comparison, the price offered in the EU countries for such product is around EUR 235 to EUR 250[91] with

88 Mikelis N (2013) Ship recycling markets, Bulletin 2013, Vol. 108 #3, https://www.bimco.org/Search-result?term=Mikelis+N+(2013)+Ship+recycling+markets%2c+BULLETIN+2013+VOLUME+108+&pn=3.

89 Damien A Devault et al, "Ship breaking or scuttling? A review of environmental, economic and forensic issues for decision support", *Springer Nature, Environmental Science and Pollution Research* (2017) 24:25741–25774, https://economictimes.indiatimes.com/industry/transportation/shipping-/-transport/domestic-ship-breaking-industrys-revenue-to-rise-by-10-this-fiscal-says-crisil/articleshow/81509301.cms?from=mdr.

90 'Lightweight Ton' is the unit for the fixed weight of the empty as-built ship, equivalent to the weight of water displaced, given in terms of the defined weight system, i.e. Metric or Long Tons. The 'Lightweight Tonnage' is the weight commonly used as the basis for determining the scrap value of ships. For further information, refer to https://www.steamshipmutual.com/publications/articles/articles/tonnage.

91 Federation Française de l'Acier, 'Prix moyen des ferrailles d'origine régionale- Données mensuelles', www.acier.org/pages/stat/ferrailles/scrap.htm.

the price gap being attributed to the fact that the end products of ship recycling in the Indian subcontinent are not primarily used as melting scrap for furnaces but as re-rolled steel for the construction industry.

Figure 12. A Ship Recycling Yard at Alang-Sosiya

Alang Market

Lastly, while discussing the economic aspect of ship recycling in Alang-Sosiya, it is important to note that ship recycling not only covers the steel of the hull and superstructure, but also includes the various fittings inside a ship. Items that are stripped from the ship, even before the commencement of the dismantling process, such as electronics, furniture, fitting, cooking ware, machinery, wiring, plumbing, and many other items, are sold in second-hand markets, collectively known as the "Alang Market". This market, which is one of its kind in the world, runs for miles and is situated close to the shipbreaking yards at Alang-Sosiya.

8 Discussion and Recommendations

8.1 From Challenges to Opportunities

In respect of ship recycling and India's evolving maritime practices, Gujarat Chief Minister, Shri Bhupendra Patel, made a significant announcement at an International

Seminar on Ship Recycling and Vehicle Scrap Policy in Gandhinagar. Drawing attention to Gujarat's extensive coastline and maritime heritage, he underscored the state's pivotal role in India's port-led development. The Chief Minister specifically addressed the burgeoning field of ship recycling, accentuating a transition towards green practices. This transformation aligns with the vision set forth by the government of India through the enactment of the Ship Recycling Act-2019. Gujarat aspires to position Alang as a leading green ship recycling hub, showcasing India's commitment to environmentally friendly practices while invigorating the ship recycling industry. The event served as a testament to Gujarat's integral role in India's economic development, shedding light on advancements in the ship recycling and broader maritime sector.[92]

Continuing the narrative on India's ambitious plans for the ship recycling industry, the government's forward-looking document, Maritime *Amrit Kaal* Vision 2047, extends the trajectory set by Maritime India Vision 2030. This comprehensive strategy outlines a timeline and collaborative efforts involving various bodies to address the major challenges confronting the Indian Ship Recycling Industry. The concerted efforts outlined in Maritime *Amrit Kaal* Vision 2047 represent a proactive approach to transform challenges into opportunities and position India as a global hub for environmentally sustainable ship recycling practices.

Sno	Issues/ Challenges	Present status	Proposed consideration	Action Plan for implementation	Timeline
1	Underutilization of the available infrastructure – – Of the 153 plots in Alang, 131 have been allotted and 22 are vacant	Revamp Alang plots and create an extra recycling cluster on the East Coast to bolster ship recycling infrastructure under the MIV 2030 initiative.	Enhancement of existing utilised capacity of 2 MMTPA (131 plots) to 5.24 MMTPA	• Relaxation in Annual fixed Charges • Amendment in Constitution changes of plot holder • Transfer of Plots	Q4, 2023

92 Gujarat has full potential to become a green ship recycling hub: Chief Minister, CMO Gujarat, 12 September 2022 https://cmogujarat.gov.in/en/latest-news/gujarat-has-full-potential-to-become-a-green-ship-recycling-hub-chief-minister/

	– ~48% under-utilisation of working plots handling average 2 MMTPA of LDT			Adding 22 plots to enhance capacity to 0.88 MMTPA • Auction of 8 plots as directed by the Honourable SC • Amendments in Reservation Policy in a non-arbitrary manner, as directed by the Honourable SC • Auction of 14 plots	Q3, 2025
				Adding 15 plots to enhance capacity to 1.20 MMTPA CRZ Clearance, Land Acquisition & Extension of road Adding 30 plots to enhance capacity to 2.40 MMTPA CRZ Clearance, Land Acquisition & PMC finalisation	Q3, 2025
2	Higher Taxes	Import Duty 2.5% and GST 18%	Reduction in tax rate in line with imported baled scrap	Detailed study to arrive at revised tax rates	Q4, 2023
				MoPSW to send representation to Income tax department	Q4, 2023
				Approval from Income Tax department	Q1, 2024
3	Overcoming the BIS Non-Recognition Barrier: Exploring Solutions for the Integration of Recycled Steel in Diverse Sectors, with a Focus on the Real Estate Industry	BIS not recognizing recycled steel Projects already identified under the initiative: - (Source: MIV 2030) Modification of BIS regulations (IS 1786:2008) governing TMT bar production to allow usage of ship scrap basis material composition and strength/ quality in place of existing requirement of metallurgical history	Amend BIS Regulation (IS 1768:2008) for TMT bar production to permit the use of ship scrap, focusing on material composition, strength, and quality, as an alternative to the current metallurgical history requirement	Proposal to BIS based on detailed study	Q4, 2023
				Approval from BIS	Q4, 2023

4	Limited Ship Recycling Clusters	Development of other ship recycling clusters	Development of other ship recycling clusters at West Bengal & Visakhapatnam	Conduct a comprehensive location study encompassing strategy, business modality, finance, taxation, commerce, industry, policy law, foreign trade, etc., to finalise destinations	Q4, 2023
				Prepare and submit a proposal to the MoPSW with the rationale, tentative budget, and suggested action for approval	Q4, 2023
				Land acquisition & CRZ clearance	Q4, 2024
				Issue RFP for development of ship recycling clusters with suitable business Modality	Q1, 2025
				Development of facility	Q4, 2026
5	Limited Marketability of ship by-products and lack of transparency	Collaborate with other countries through MEA to establish a ship recycling facilitation centre, promoting recycling activities and enhancing marketability of ship by-products via trade fairs at ship breaking yards, involving individuals from shipowners to downstream industries, as identified under the MIV 2030 initiative	Intervention of MEA, Govt. of India with European Union, OECD countries for sending their vessels directly to Alang without routing through Flag of Convenience (FOC) with subsidised selling price like Turkey MEA may also intervene with EU countries to send their vessels to Alang at subsidised rates considering HKC compliance status	Detailed study to arrive at sub sized rated in line with international bodies	Q4, 2023
				Proposal to Ministry of External Affairs (MEA) to collaborate with countries to send their vessels directly to Alang without routing through Flag of Convenience (FOC) with subsidised selling price	Q4, 2023
				Approval from MEA	Q2, 2024

Table 7. Action Plan of Indian Government for Ship Recycling Sector
Source: Maritime *Amrit Kaal* Vision 2047, Maritime India Vision 2030 and through interactions with individuals[93,94]

93 Maritime *Amrit Kaal* Vision 2047, October 2023, Pg. 429 - 433

94 Maritime India Vision 2030, Ministry of Ports, Shipping and Waterways (MoPSW), Government of India, February 2021, Pg. 163-165 https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/Air%20pollution/Maritime%20India%20vision%202030.pdf

8.2 Are Hybrid Shipyards the Future of Sustainable Practices?

In India's strategic pursuit of a sustainable future in ship recycling, the establishment of new ship recycling clusters stands out as a transformative initiative.[95] Authors, following a thorough literature review and in-depth interactions, introduce the notion of hybrid shipyards as a pragmatic solution, particularly in regions where shipbuilding or ship-repair yards experience seasonal operational constraints. The concept of a hybrid shipyard represents a paradigm shift in shipyard design, integrating ship recycling activities into a conventional shipyard. This innovative approach is centred around resource sharing and maximising facility utilisation.[96]

In a conventional shipyard, the intricate processes of shipbuilding and ship repairing involve activities such as cutting, surface treatment, blasting, painting, coating, solvent cleaning, degreasing, welding, and fibreglass manufacturing. Shipbuilding, being the most advanced and lucrative process, requires competency to handle multiple projects simultaneously.[97] On the flip side, ship repair focuses on the maintenance and repair of damaged ships, presenting its own set of operational challenges.[98] Ship recycling yards, dedicated to dismantling vessels for material reuse, involve complex processes, including the extraction of equipment, cutting down and recycling the entire ship's infrastructure, and handling hazardous materials.[99] A hybrid shipyard, as envisioned, brings together the strengths of shipbuilding, ship repair, and ship recycling, creating a comprehensive and sustainable approach.[100]

95 Maritime *Amrit Kaal* Vision 2047, October 2023, Pg. 429 - 433

96 Zainol et al, "Hybrid shipyard concept for improving green ship recycling competitiveness", IOP Conference Series: Earth and Environmental Science, Volume 1143, 2023 Hybrid shipyard concept for improving green ship recycling competitiveness - IOPscience

97 Sunaryo S, Pahalatua D 2015 Green Ship Recycle Yard Design. J Nav Archit Mar Eng 12(1):15– 20

98 Islam M K, Shaikh M A, Habib M M 2017 An Overview of the Shipbuilding Industry: A Literature Review. In: 1st International Conference on Business & Management (ICBM 2017). 2017. p. 185–90

99 Rabbi H R, Rahman A 2017 Ship Breaking and Recycling Industry of Bangladesh; Issues and Challenges. In: Procedia Engineering. Elsevier Ltd; pg. 254–9

100 Zainol et al, "Hybrid shipyard concept for improving green ship recycling competitiveness"

The integration of green ship recycling activities into an existing conventional shipyard, as illustrated in figure 9 and can be reviewed from studies by Zainol and his team, showcases the potential of this concept.[101] The proposed layout leverages established facilities in the conventional yard for sharing purposes, ensuring a seamless integration of ship recycling activities. Despite the differences between shipbuilding, ship repair, and ship recycling, the authors identify significant similarities that allow a ship recycling unit to utilise ready resources from a conventional shipyard.[102]

The technological infrastructure in the shipyard proves beneficial in addressing environmental, health, and competitive issues associated with ship recycling. Ultimately, the hybrid shipyard concept, if planned and managed in accordance with international laws, emerges as a forward-looking solution that not only enhances environmental sustainability but also brings economic advantages by reducing operational costs and increasing yard productivity.[103]

The potential of hybrid shipyards, where ship recycling is seamlessly integrated into conventional shipyards, comes with both promise and notable concerns. One key challenge arises from the intricate processes inherent in shipbuilding and ship repair, encompassing activities such as cutting, surface treatment, and welding. These critical shipbuilding processes may clash with the specific requirements of ship recycling, particularly concerning hazardous materials. Effectively managing the operational intricacies of shipbuilding and ship repair alongside the unique demands of ship recycling within a hybrid shipyard necessitates careful planning to ensure compliance with international laws and guidelines. Successfully addressing these concerns in the industry is crucial for overcoming potential process clashes and ensuring the proper handling of hazardous waste. This is essential for the seamless and successful implementation of hybrid shipyards, aligning with India's strategic ship recycling objectives.[104]

101 *Ibid*
102 *Ibid*
103 *Ibid*
104 *Ibid*

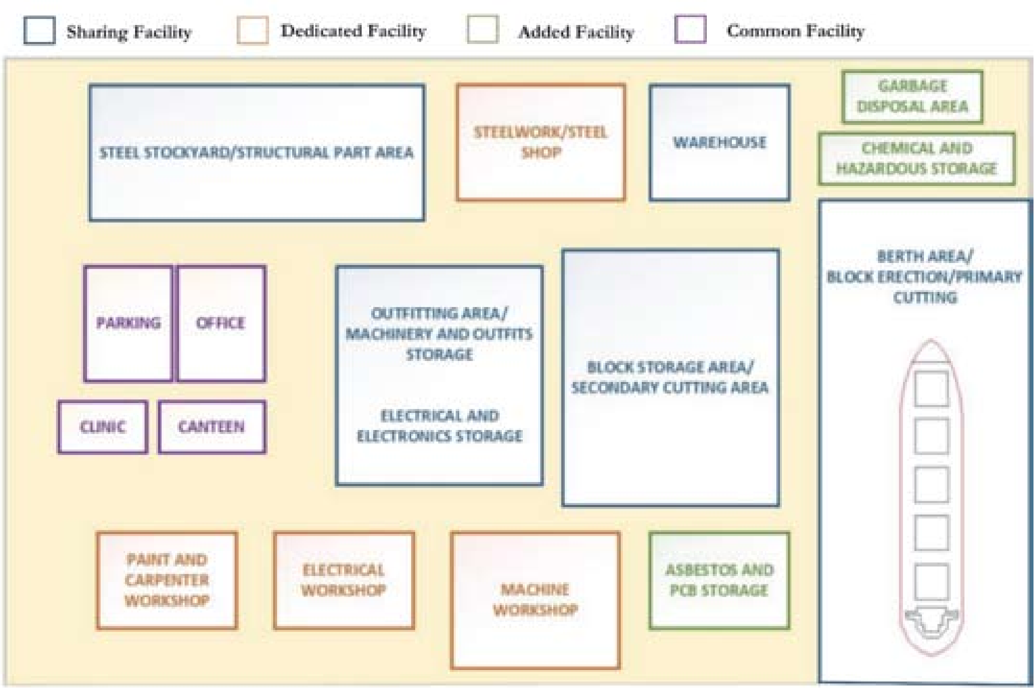

Figure 13. Typical design of Hybrid Shipyard
Source: Hybrid shipyard concept for improving green ship recycling competitiveness[105]

8.3 Recommendations

The ship recycling industry in Alang has witnessed positive changes in recent years, yet challenges persist, especially in environmental and safety aspects. To foster further improvement and sustainability, the following recommendations are proposed:

- Promotion of India's Ship Recycling Sector:
  - ➢ Organise annual seminars to promote sustainable ship recycling, emphasising benefits and solutions.
  - ➢ Improve transparency to enhance the industry's global image and showcase Alang's development.
- Inspection and Worker Rights:

105 *Ibid*

- ➢ Increase administrative and financial capacity for regular inspections.[106]
- ➢ Establish a comprehensive database on migrant workers with regular updates.[107]
- ➢ Provide detailed education on workers' rights under labour laws.

- Environmental Monitoring and Transparency:
  - ➢ Develop a transparent environmental monitoring system.
  - ➢ Conduct a GAP analysis to identify areas for improvement in medical facilities and waste management.
  - Enhanced Drainage System and Cutting Methods:
  - ➢ Address the effectiveness of the drainage system in the secondary cutting zone.
  - ➢ Analyse alternative cutting methods, emphasising water jet cutting to minimise risks.[108]
- Sustainable Coat-Stripping Techniques:
  - ➢ Explore sustainable coat-stripping methods, such as dry ice blasting, to reduce emissions of hazardous pollutants.[109]
  - ➢ Investigate the transition from traditional sand blasting to environmentally friendly alternatives.
- Circular Economy Transition:[110]
  - ➢ Work towards transitioning ship recycling into a circular economy.

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106 Geetanjoy Sahu, "Working, Living, Occupational Health and Safety Conditions of Workers in Ship Breaking Yards in Alang-Sosiya, Gujarat, India", Tata Institute of Social Sciences (TISS), Mumbai, 2019 https://www.shipbreakingplatform.org/wp-content/uploads/2019/12/Policy-Brief-TISS-Working-Conditions-ASSBY-2019.pdf

107 *Ibid*

108 "Breaking Out: Anchoring Circular Innovation for Ship Recycling", NGO Shipbreaking Platform, 20 September 2022 https://shipbreakingplatform.org/wp-content/uploads/2022/10/Breaking-Out-Magazine.pdf

109 *Ibid*

110 *Ibid*

- ➢ Implement circular economy policies for improved scrap steel availability.
- ➢ Utilise optical recognition and artificial intelligence for precise scrap quality assessment.

The ship recycling industry at Alang-Sosiya has the potential to not only significantly contribute to the economic development of Gujarat in particular and the country in general but also create substantial direct and indirect employment opportunities for the skilled and unskilled work force. All individuals in the ship recycling industry have shown a willingness to comply with environmentally sustainable norms. Some important recommendations that would aid in correctly projecting the environmentally sustainable ship recycling activities at ASSRY are:

1. Promote transparency by allowing public access to reports from monthly, quarterly and yearly audits.
2. Promote political will to adopt and execute stringent standards in accordance with the current international practices.
3. Evolve multi-pronged strategies to incentivise the migrant workers from returning to their home states after a span of six months to two years by providing married accommodation, better health care, education facilities for children etc. This would result in retention of skill sets thus preventing accidents and reduce the load of training a large number of fresh workers at regular intervals.

These recommendations encompass short-, medium-, and long-term strategies aimed at addressing immediate concerns while fostering the long-term sustainability of Alang's ship recycling industry. The implementation of these measures will contribute to enhancing environmental practices, worker safety, and the overall reputation of Alang on the global stage.

9 Conclusion

India's venture into sustainable ship recycling, particularly centred around the ASSRY, stands as a testament to the nation's commitment to balancing economic aspirations with environmental stewardship. The establishment of a robust governance and legal framework, as outlined in the Maritime *Amrit Kaal* Vision 2047, demonstrates India's dedication to meeting international standards while simultaneously addressing the employment needs of its citizens.

The field trip to Alang-Sosiya reveals commendable efforts by all individuals in fostering an environmentally sustainable and safety-conscious ship recycling industry. However, the sector faces challenges such as underutilization of plots, high compliance costs, and tax burdens, necessitating comprehensive policy reforms and strategic planning. Despite these challenges, Alang has made significant strides in addressing concerns related to worker safety, environmental pollution, and regulatory compliance, indicating a positive trajectory.

The concept of hybrid shipyards emerges as an innovative solution, offering economic advantages and enhanced environmental sustainability. However, careful planning is essential to navigate potential conflicts between shipbuilding, ship repair, and ship recycling processes. Recent developments, including the commitment to green practices and the vision outlined in Maritime *Amrit Kaal* Vision 2047, reinforce India's dedication to sustainable ship recycling practices.

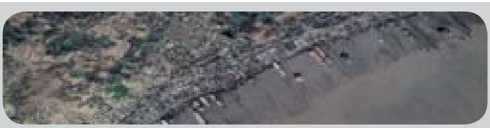
The recommendations provided, encompassing the promotion of the ship recycling sector, capacity building, addressing environmental concerns, and embracing circular economy principles, serve as a roadmap for the industry's sustained growth. If implemented diligently, these recommendations have the potential to elevate Alang's global standing, ensuring responsible ship recycling practices and aligning with India's aspirations for a green and economically robust maritime sector.

The evolution of Alang from overcoming challenges to embracing opportunities symbolises a commitment to environmental stewardship and responsible industry practices. This transformation sets the stage for India to emerge as a global leader in sustainable ship recycling, showcasing a beacon of environmental sustainability in the ship recycling landscape.

Appendix

Annex 1 : Survey: Assessing Public Awareness and Understanding of Ship Recycling Practices

In conducting our survey, we sought insights from a diverse array of individuals representing various sectors including architecture, political science, international relations, legal studies, ship recycling experts, professors, and more. The survey, comprising 24 inputs collected via the attached Google Form, aimed to gauge the level of public awareness and understanding regarding ship recycling practices. Participants were invited to share their perspectives on key aspects of ship recycling, ranging from environmental concerns and regulatory frameworks to economic implications and social responsibilities. The expected outcome from the survey was to glean insights into the existing knowledge gaps and misconceptions surrounding ship recycling within different demographic groups. Upon analysing the responses received, it became evident that while some participants demonstrated a nuanced understanding of the complexities associated with ship recycling, others exhibited limited awareness and misconceptions regarding its processes and impacts. The survey outcomes provide valuable insights for shaping educational initiatives, policy frameworks, and public discourse aimed at promoting sustainable practices and informed decision-making in the ship recycling sector.



Analysing the Ship Recycling Sector in India

Welcome to the "Sustainable Ship Recycling in India" project survey. We are delighted to have you onboard in this important initiative.

India has set ambitious goals to double its current capacity of 4.5 million light displacement tonnage (LDT) by 2024. To achieve this, efforts are underway to bring more ships from Europe and Japan, which is projected to create 1.5 lakh jobs. However, amidst this expansion, it is crucial to address various issues of the ship recycling industry such as waste management, unorganised labour market, lack of automation etc. These matters remain unanswered and require a thorough examination, particularly in light of the country's aim to double its recycling capacity. It is essential for India to understand its true holding capacity for attaining sustainable ship recycling and allowing us to gain an in- depth understanding of the problem.

*Indicates required question

Email*

Your email

Can India reach the mark of doubling its ship recycling capacity by 2024 as announced by the government?

- Strongly agree, India is ready
- Agree, if the right measures are imposed
- Neutral, because of national election are coming up next year
- Disagree, India needs to work on this sector
- Strongly disagree, this sector is unorganised

We have the pleasure of notifying you that the National Maritime Foundation (NMF) is presently involved in this project with a shipyard in India. The project team, comprising Commodore Debesh Lahiri, Executive Director of NMF, Rhythma Kaul, Associate Fellow and Ayushi Srivastava, Research Associate, are actively involved in this endeavour.

Our project involves various data collection methods, consultations, field visits and interactions with experts, academics, policymakers, and key stakeholders. We are conducting a comprehensive SWOT & PESTLE analysis of the Alang-Sosiya Ship Recycling Yard (ASSRY) and studying the entire process of ship recycling. Furthermore, we are exploring the latest global trends in making ship recycling more sustainable and strive at Incorporating green norms in this sector.

The aim of this project is to generate policy relevant recommendation to policy makers in the Indian Government. This project also focuses on giving short term, medium term and long term solutions for Improving ASSRY current standards.

Your participation in this survey is valuable to our research efforts. We appreciate your inputs and insights, as they will help shape our understanding of the challenges and opportunities in this sector.

In your opinion, what are the top three areas in the current scenario that could enhance the standards of Indian Ship Recycling Yards?

❏ Training of workers

❏ Safety insurances and equipments for workers

❏ Trained Inventory of Hazardous Materials (IHM) experts and Ship Recycling Facility

❏ Plan (SRFP)

❏ First aid availability and Hospital management near the shipbreaking yard

❏ Waste handling and management

❏ Alternatives for the beaching method

❏ Alternatives for cutting methods

❏ Enforceability of current domestic laws

Is there a need for a specialized institute to provide certified training & industry. specific courses with respect to ship breaking and recycling to workers that can be recognised all over india and world?

- O Strongly Agree
- O Agree
- O Neutral
- O Disagree
- O Strongly Disagree

Is the temporary exemption of customs duty on imports of vessels and floating structures in india beneficial for ship recycling yard owners in Alang"

- O Strongly Agree
- O Agree
- O Neutral
- O Disagree
- O Strongly Disagree

Should a ship owner be accountable for the manner in which their ship is recycledt

- O Strongly Agree
- O Agree
- O Neutral
- O Disagree
- O Strongly Disagree

In your opinion, which certification Le. EU Ship Recycling Regulation (EUSRR) or Hong Kong Convention (HICC) is better with respect to India's ship recycling industry?

- O EUSRR
- O HKC
- O None of the above

Is it feasible to transition from flame cutting to waterjet cutting or plasma cutting in ASSRY?

- O Strongly Agree
- O Agree
- O Neutral
- O Disagree
- O Strongly Disagree

In your opinion, which is the best method for ship dismantling in ASSBY?

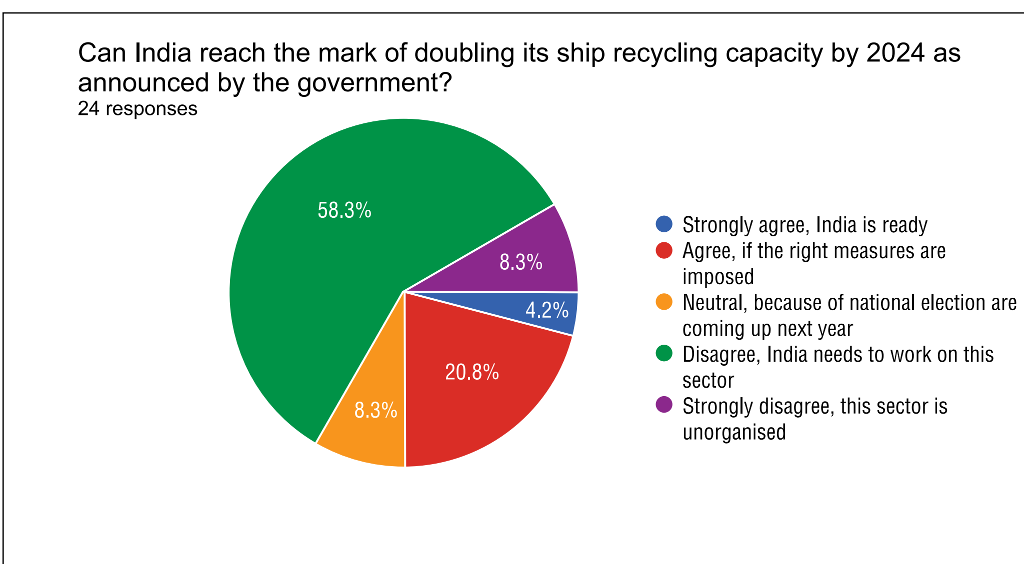
- O Dry Docking
- O Combination of Sloway and Pler
- O Slipway
- O Pier
- O Beaching
- O None of the Abave

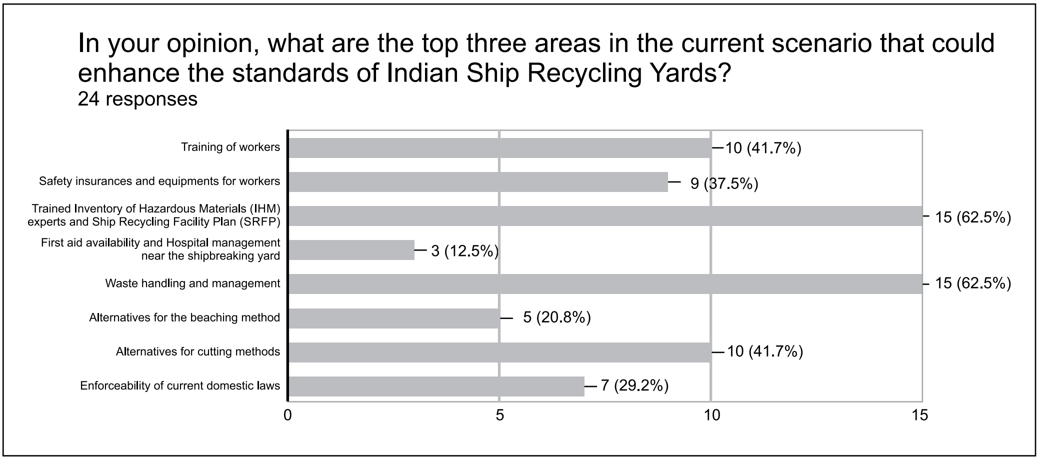
In your opinion, what are the three most effective long-term solutions for ensuring the sustainability of the Indian Ship Recycling Industry?

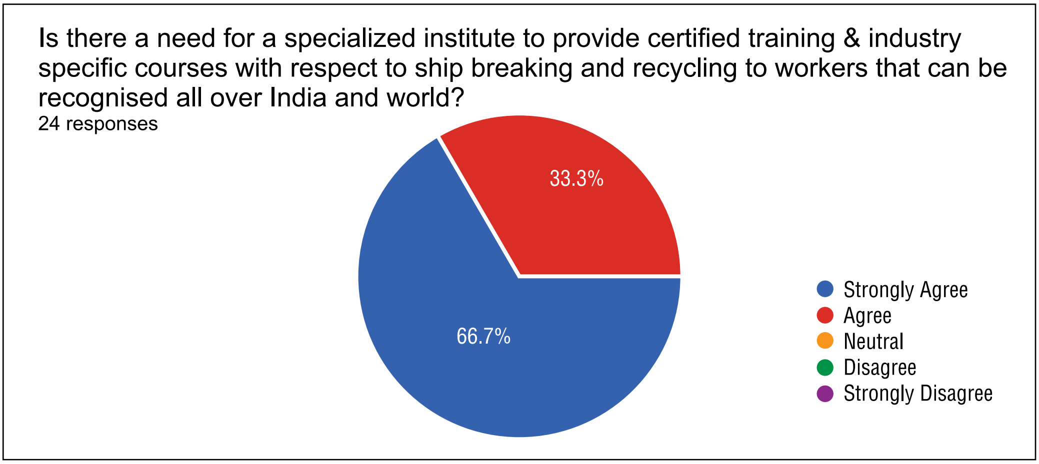
- ❑ Automation of the Industry
- ❑ Infrastructure modification Hybrid Shipyard (integrating activities of Shipbuilding, Ship-Repair and Ship Recycling together in a single yard)
- ❑ Hazardous Waste Treatment, storage and Disposal facility
- ❑ Regulating the labour sector
- ❑ Development of Circular Economy for Ship Recycling Sector
- ❑ Creating Sustainable Supply Chain from Ship to Green Steel
- ❑ Comprehensive occupational health and safety law

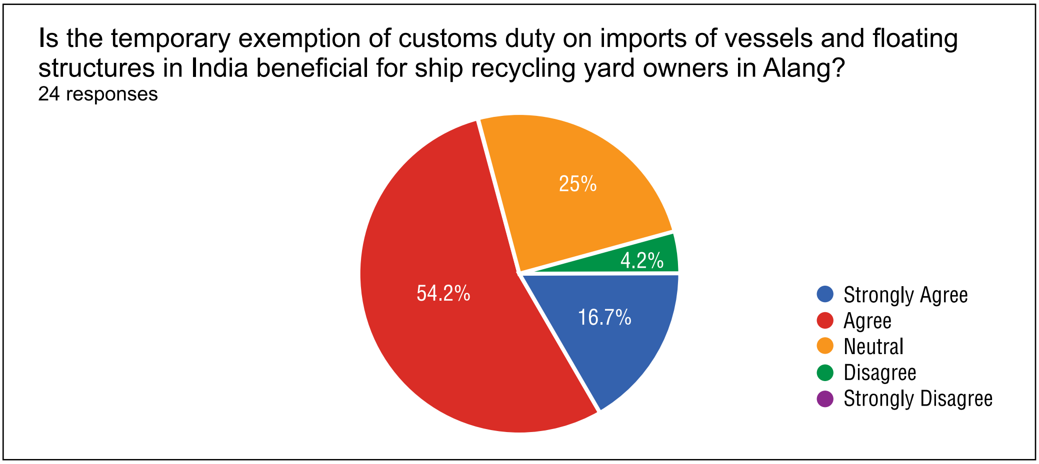
Figure 14. Google form designed by the authors for the survey

The following charts illustrate the responses received for each question, offering insights into public perception and understanding of the ship recycling sector, including perceptions of ASSRY. These visual representations in pie chart or bar chart form facilitate comparison and comprehension, shedding light on the common man's awareness and beliefs regarding ship recycling practices and their perceptions of ASSRY.

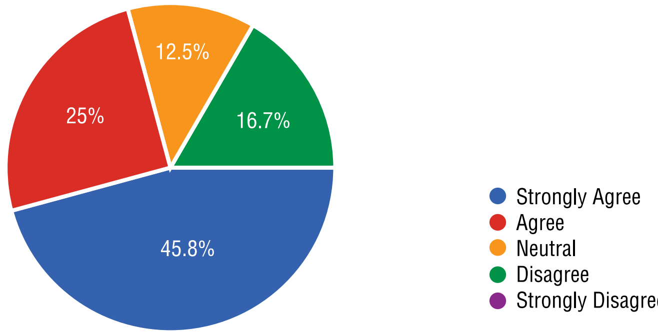



In your opinion, what are the top three areas in the current scenario that could enhance the standards of Indian Ship Recycling Yards?
24 responses
Training of workers
Safety insurances and equipments for workers
Trained Inventory of Hazardous Materials (IHM) experts and Ship Recycling Facility Plan (SRFP)
First aid availability and Hospital management near the shipbreaking yard
Waste handling and management
Alternatives for the beaching method
Alternatives for cutting methods
Enforceability of current domestic laws
10 (41.7%)
9 (37.5%)
15 (62.5%)
3 (12.5%)
15 (62.5%)
5 (20.8%)
10 (41.7%)
7 (29.2%)
0
5
10
15

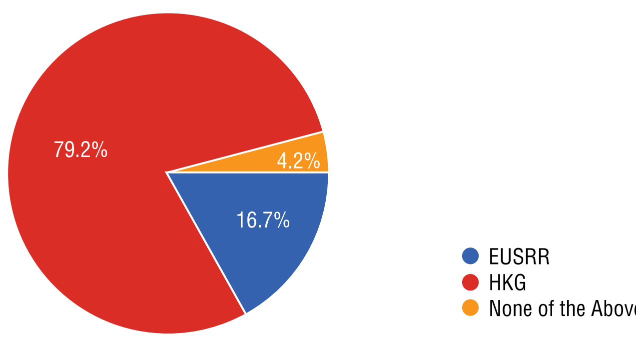

Is there a need for a specialized institute to provide certified training & industry specific courses with respect to ship breaking and recycling to workers that can be recognised all over India and world?
24 responses
33.3%
66.7%
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree


Is the temporary exemption of customs duty on imports of vessels and floating structures in India beneficial for ship recycling yard owners in Alang?
24 responses
25%
4.2%
54.2%
16.7%
Strongly Agree
Agree
Neutral
Disagree
Strongly Disagree

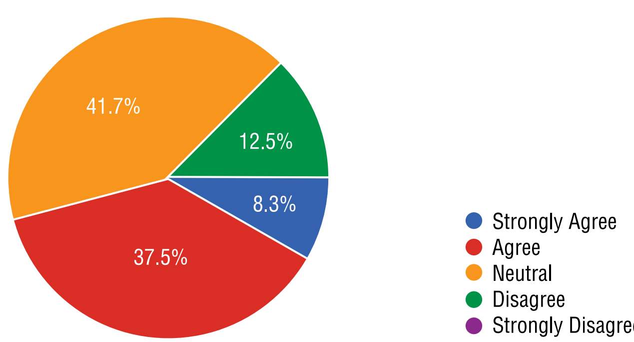
Should a ship owner be accountable for the manner in which their ship is recycled?
24 responses



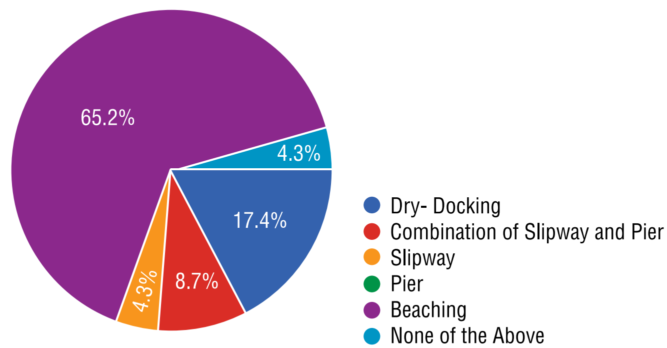
In your opinion, which certification i.e. EU Ship Recycling Regulation (EUSRR) or Hong Kong Convention (HKC) is better with respect to India's ship recycling industry?
24 responses



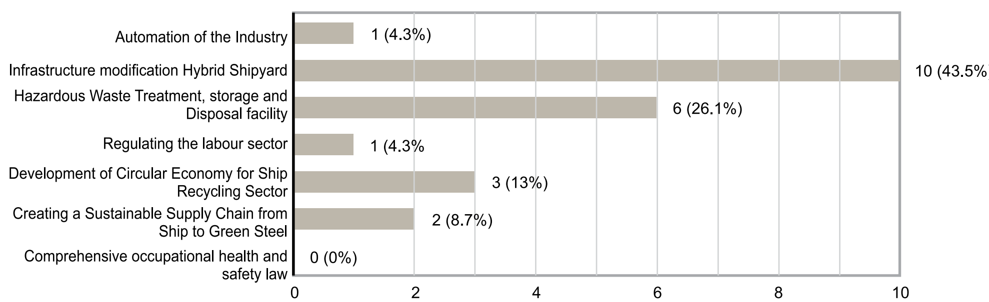
Is it feasible to transition from flame cutting to waterjet cutting or plasma cutting in ASSRY?
24 responses



In your opinion, which is the best method for ship dismantling in ASSBY?
24 responses



In your opinion, what are the three most effective long-term solutions for ensuring the sustainability of the Indian Ship Recycling Industry?
23 responses



Annex 2: Record Of Discussions

Interaction Between National Maritime Foundation (NMF) And Ship Recycling Individuals

The National Maritime Foundation (NMF) conducted a comprehensive series of interactions with individuals involved in ship recycling, employing various modes, including virtual meetings, offline discussions, and on-site field visits. These interactions have been pivotal in enhancing our understanding of the ship recycling sector, both within India and on a global scale, while also shedding light on pathways towards sustainability.

Through these engagements, we have gained valuable insights into the intricacies of ship recycling practices, not only in India but also worldwide. By engaging with individuals representing diverse perspectives, including industry experts, government officials, environmental advocates, and community representatives, we have been able to grasp the multifaceted nature of the sector.

Highlights of NMF and Elegant Exit Company, Bahrain

- EEC is exploring the production of Green Steel from ship recycling, aiming to reduce carbon dioxide (CO_2) emissions and promote sustainability. This eco-friendly, cost-effective, high-quality process offers a waste-reducing alternative to traditional steel production.
- Short- and long-term health effects on our workers and those of our partners are paramount concerns for us. The Elegant Exit Company (EEC), in addition to steel and waste, addresses the proper disposal of furniture, electronic devices, refrigerants, and more.
- While EEC is engaged in green ship recycling, it continues to use flame cutting and sandblasting methods that emit carbon dioxide, until a viable alternative is available.
- The carbon tax imposed on steel is increasing steadily. Companies that adhere to Environmental, Social, and Governance (ESG) standards benefit from lower tax rates as an incentive for their compliance.

- EEC conducts sustainable ship recycling by converting old ships into green steel, pricing its services based on maintaining high standards. This approach results in quotes half the price of those from Southeast Asian countries, attracting ethical ship owners seeking cleaner solutions.
- Under the Gujarat Maritime Board (Conditions and Procedures for granting Permission for Utilising Ship Recycling Plots) Regulations, 2015 does not allow the permission holder to construct or erect any permanent structure on the plot. The permission holder may, with the prior approval of the Chief Executive Officer and other concerned authorities, put up a temporary or semi-permanent structure on the plot at his risk and cost, to carry out ship recycling activities, after compliance with mandatory requirements under relevant laws/acts. No permanent structures can be built in Alang; only temporary or semi-permanent platforms are used by the ship-breaking yards.
- The PHP Shipbreaking Yard in Bangladesh has transitioned to a natural and concrete slipway, setting standards for green ship recycling.
- India faces pricing instability for shipbreaking, varying regionally and fluctuating due to external market factors like freight rates and currency devaluations.
- UAE is drafting Ship Recycling Regulations requiring activities to occur in dry docks, not on beaches, for ships under its flag or intended for recycling in the UAE. This regulation will be applied to UAE Flag ships and ships flying the flag of another country intended to be recycled in the UAE. The provisions of the regulations will not apply to ships under a gross tonnage of 500 and warships.
- Arab Shipbuilding and Repair Yard in Bahrain is a highly certified yard conducting shipbuilding and repairs in dry docks.
- EUSSR regulations focus on downstream waste management and preventing sediment contamination.
- Mr Roy suggests improving waste management and exploring alternatives to beaching for promoting green ship recycling in ASSRY.

- Mr Roy has provided two documents: EEC's "Ethical Green Ship Recycling Report" and a ship-to-green steel presentation from February 11, 2023. He also offered to connect with Capt. Sumitro Roy, Head of Middle East Operations, for technical insights and contacts in Alang's steel mills.

Satyajit Roy is a highly accomplished and globally-minded professional serving as the director of EEC Trading Bahrain. His passion for sustainability and his commitment to driving positive change in the steel industry is evident through his current venture, where he focuses on decarbonizing the steel-making process using scrap metal generated from ethical ship recycling.

Elegant Exit Company (EEC) is a pioneer in the field of ship recycling, committed to advancing both financial strategies and industrial processes. Focus on sustainability and efficiency by getting dedicated vessels for recycling. EEC is known for its eco-friendly and socially responsible approach, with a commitment to safety and compliance.

NMF and Green Ship Recycling Services, Germany

- Green Ship Recycling Services (GSR) manage the entire life cycle of ships, specialising in ship recycling and collaborating with manufacturers, suppliers, shipyard owners, recycling facilities, and ship owners. Ongoing projects with Class NK involve 40 ship recycling facilities in India for compliance with the Hong Kong Convention (HKC). Additionally, they've assisted 6 shipyards in India in applying for EU approval in Alang, Gujarat. EU audits were halted in 2019 due to the Basel Ban Amendment, causing legal issues.
- A major shortcoming of the EU Ship Recycling Regulation (EU SRR) stems from the Ban Amendment, intended to circumvent the Basel Convention. The EU SRR excluded ships from the EU Waste Shipment Regulation, but the Ban Amendment's entry into force challenges this, especially for Turkey.
- The dry dock ship recycling method poses risks in lifting, accessibility, and emergencies. Analysing the situation, accessibility to the ship and material transport are primary concerns. Plans for a safe working environment should vary based on situations, avoiding a one-size-fits-all approach.

- Mr Gramann suggests a peer method combining pre-cleaning, decontamination, and removing blocked weight, using a slipway. This aligns with the EU SRR's vague term "to operate from a built structure," open to interpretation.
- The EU's realisation a decade ago led to the creation of the EU SRR to retain resources like steel and generate labour. Due to the Russian-Ukraine war, the EU aims for direct control over resources, reducing dependence on scrap steel from other countries.
- The EU SRR, open to interpretation, doesn't expressly ban beaching but mandates showing the intertidal zone's safety. In contrast, the HKC focuses on measures, current status assessments, and environmental monitoring, without specifying intertidal zone protection.
- The Ban Amendment puts pressure on the EU under the EU SRR to provide sufficient recycling capacity. Non-OECD countries are crucial, but changing flags by European ship owners and theoretical capacity create implementation challenges.
- Major cutting work in ship recycling poses environmental risks. Innovative cutting technologies from outside to inside, like water jet technology or GSR's slack bag collecting material during cutting, provide safer alternatives than expensive dry docks.
- Ship recycling facility plans emphasise tank cleaning and gas-free certification. Validity challenges in Alang, Gujarat, led Mr. Gramann to devise standardised labelling in 2014 for rooms allowing hot work.
- Cutting piping systems without verifying emptiness and gas-free status led to a tragic accident in Alang. Training workers can prevent such incidents, highlighting the importance of well-trained workers over infrastructure.
- Under IHM certification, identifying hazardous substances requires detailed removal plans. While IHM experts do spot checks, GSR emphasises the need for thorough checks and equal treatment of similar items containing hazardous substances.
- Ship recyclers in Alang excel at trading reusable items, enhancing sustainability by higher ratios of reusable and recyclable materials compared to developed countries.

- GSR focuses on hazardous materials under IHM, helping yards segregate materials. Traceability is crucial to avoid uncontrolled distribution of hazardous materials.

- Investigation of hazardous materials considers 15 substances under the EU SRR. Discrepancies exist in IHM expert training costs, with GSR emphasising proper certification for risk reduction.

- GSR assists in asbestos disposal, advocating keeping it on operational ships if not an immediate danger. Most asbestos poses no threat undisturbed; disturbance during removal increases contamination risks.

- Many IHM expert companies profit from asbestos decontamination on operational ships.

- Despite similarities, EU SRR differs from HKC in managing the intertidal zone and handling wastes, emphasising recycling over considering the ship as waste. Downstream waste management and hospital management are distinctive aspects.

Mr Henning Grammann, Founder & Managing Director GSR Services GmbH. He has been working in maritime environmental protection since 1999, from project manager at GAUSS GmbH (1999 - 2003) to environmental officer at AIDA Cruises (2003 - 2004) to head of the ship recycling department at Germanischer Lloyd (2005 - 2010).

GSR Services GmbH (Green Ship Recycling Services – GSR) was founded by Henning Gramann near Hamburg in 2011 and is the long-standing, renowned partner of the international maritime industry for environmental protection, safety and responsibility. As a recognized quality leader, the GSR team supports shipyards and shipping companies, suppliers and recyclers in the implementation of international regulations, secures long-term business operations and opens up new perspectives.

NMF and Nirma University, India

- GMB provides medical care through the Red Cross Hospital in Alang, Gujarat, with 30 beds, but a shortage of doctors hampers addressing worker concerns. Accidents in Alang go unreported or are inadequately reported, contributing to a range of issues in the ship recycling industry.
- The ship recycling industry significantly contributes to the economy by selling everything on ships. "Alang Furniture," sold by weight (Kg), commands the highest prices compared to other furniture.
- Alang has around 300 re-rolling mills, producing 7%-10% of India's raw steel. The workforce is primarily migrant, and the labour industry is unorganised.
- National and international laws apply in Alang, but poor implementation leads to various issues.
- Dr Misra notes that workers from Orissa migrate to Alang for higher pay, despite high risks. Skilled workers, especially cutters, are prone to injuries with no compensation for accidents or deaths.
- Permanent structures are prohibited in Alang, setting it apart from Bangladesh, where PHP is a major competitor.
- Greenpeace opposes ship recycling in Alang, affecting its activity in Kakinada, Andhra Pradesh.
- Waste management, beaching, and asbestos disposal are unresolved issues.
- Water near the shore in Alang is reported to be completely black.
- Workers receive compulsory training, but loss of daily wages hinders attendance. There's a need for a specialised institute for worker training.
- Hazardous wastes like chromium and lead are dumped on land, posing risks to workers living in Alang.
- Pre-cleaning of ships is conducted outside India, raising questions about certification processes.
- Ship owners pay customs, and yards in Alang are given on rent or lease by GMB, some for 99 years.

- Shipbreaking is a major contributor to the economy, with the main product being steel (90%). The process is labour-intensive, and a ship takes 3 to 6 months to be dismantled.
- Due to high toxicity levels, workers are prone to diseases like cancer, but cases are underreported, and compensation is lacking. Women and children are not allowed to work, prompting migrant workers to travel alone.
- Ship recycling in India needs mechanisation to improve efficiency. The nodal officer for ASSBY is the port officer.
- Tracing ship material design by ownership can raise awareness among workers about potential hazards. To obtain HKC certification, considerations include worker safety, accident rates, cleaning and fire safety, and the number of ships broken.
- Alang ship recyclers have a strong lobby that is aimed at increasing profit margins within the industry. Data on workers is limited, but it appears that there are between 30,000 and 40,000 workers, and the company is emphasising the need to provide comprehensive training to these workers, especially the cutters.

Dr Hrudanand Misra, Additional Director, Faculty of Management, Nirma University. He is life member of Indian Health Economic and Policy Association and Indian Society of Labour Economics.

Nirma University is a research-oriented, student-centric, multidisciplinary, not-for-profit state private university.

NMF and Leviathan GmbH, Germany

- Leviathan, a startup, has successfully initiated the recycling of their first two ships in a dry dock facility. Their approach involves integrating high-water-pressure cutting technologies with robotics, adapting them for the ship recycling sector. The machinery, controlled by engineered robotics, makes precise kerfs or cuts to the vessel walls without requiring workers to be in close contact with the ship.

- The beaching process, deemed unsustainable due to scientific evidence, reveals that low-energy coastal environments hosting beaching facilities lack the capacity to support such activities. Driving vessels onto a beach result in significant friction, abrasion of antifouling paint, continuous emissions discharge (metals) into beach sediments, and continual beach degradation.
- The Green Deal and associated EU regulations governing European business supply chains aim to ensure that environmental and safety standards within the EU are effectively managed in businesses and industries outside the EU. This includes adherence to the EU taxonomy, particularly Article 17, which defines 'significant harm' to environmental objectives.
- Observing EU Taxonomy, ship breaking activities on beaches in south Asia are seen as non-compliant due to the significant increase in emissions of pollutants into air, water, or land. Financial portfolios containing vessels subjected to beach recycling practices are deemed unsustainable under the Green Deal.
- Ship recycling involves the dismantling of vessels to extract and recover materials, primarily steel. The Supply Chain Act of Germany mandates companies to monitor human rights and environmental risks, considering the trade-offs between financial and sustainable values. Preliminary findings indicate conflicts of interest among ship recycling individuals. Although regulations enhance transparency, they have not fully embraced social aspects such as domestic demand and employment dependence on the industry.
- The EU SRR Regulation aims to reduce disparities in health, safety, and environmental standards among operators in the Union, OECD countries, and relevant third countries. It directs ships flying the flag of a Member State to environmentally sound ship recycling facilities, aiming to increase the competitiveness of safe recycling practices.
- Driving a vessel onto a beach for recycling in the EU is impossible due to irreparable environmental damage caused by repeated beaching. While there is no explicit ban, the absence of beach recycling facilities in the EU aligns with member states' environmental laws and values, reflecting a consistent adherence to European societal values.

- In the near future, the EU will prohibit ship owners from reflagging vessels one year before the end of their life and selling them for recycling.
- The purpose of the EU SRR Regulation is to create uniformity in health, safety, and environmental standards among operators in the Union, OECD countries, and relevant third countries. It directs ships flagged by a Member State to environmentally sound recycling facilities, enhancing the competitiveness of safe practices. The principle of equality in Union law should be applied and monitored when updating the European List for ship recycling facilities.
- Despite no explicit ban on driving vessels onto beaches for recycling in the EU, the absence of beach recycling facilities underscores the overall consistency of member state environmental laws and values, aligning with European societal values and preventing such practices.

Bryce Lawrence is an Operations Director of Leviathan GmbH. He has 14 Years of experience as Environmental Regulation, Audit, Prosecution, Environmental and Civil Emergency Response and 13 Years of experience as Crew, Master, Senior Master and Operations Manager in Coastguard.

Leviathan is a high tech, sustainable ship recycler. By using extremely high-pressure water jet cutting tools controlled by Artificial Intelligence and Robots, they buy ships and provide the highest quality recyclable steel to steel manufactures with a near zero carbon footprint.

NMF and NGO Shipbreaking Platform, Brussels - Belgium

- Material Passports are a novel concept that demands attention. They encompass all materials within a vessel, providing a solution to transparency issues arising from suppliers' lack of clarity about the exact types and quantities of hazardous materials onboard a ship.
- India should transition away from the practice of beaching for ship recycling, as this method significantly impacts the intertidal zone. Exploring alternatives to the beaching process is imperative.

- Key aspects of the ship recycling process that require scrutiny include waste handling and treatment, proper worker training, accident prevention (advocating a zero-accident policy), transparency, and the effective implementation of domestic laws.
- The Hong Kong Convention (HKC) provisions focus on the internal operations of ship-breaking yards, neglecting the management of downstream waste in its regulations.
- LISNAVE, based in Lisbon, Portugal, is a ship repair company collaborating with Environmental, Social, and Corporate Governance (ESG) criteria.
- Many certification societies are not conducting thorough checks and are issuing certificates without proper scrutiny.
- Both HKC and EU SRR concentrate on the current owner of the vessel rather than the original registered owner.
- Ship recycling yards under EU SRR maintain exceptionally high standards, resulting in elevated recycling costs. Consequently, this has led to the recycling of ships outside the EU, contributing to the closure of such yards. Recent amendments to EU SRR provisions aim to prohibit the export of ships to the Indian Subcontinent for recycling.
- Proposed solutions include the implementation of health and environmental monitoring as short-term measures. For long-term measures, advocating for circular ship recycling hubs that cover the entire process from ship building to reuse/recycling is recommended (Refer to pages 24-25 of the NGO Shipbreaking Platform's publication, "Breaking Out").
- Turkey is in conformity with the Basel Convention and the EU SRR. It ratified the Hong Kong Convention (HKC) in 2019.
- Aliaga, Turkey, is the main place where ship dismantling takes place. Currently, small vessels of 10,000 LDT are dismantled.
- According to current trends, cruise ships and oil tankers above 500 GT are being dismantled the most.
- The Ministry of Labor is responsible for managing, recycling, and disposal of asbestos waste generated for the ship dismantling industry.

- Currently, there are 22 yards in Aliaga, and 9 of them have been approved by the EU.

Benedetta Mantoan is a policy officer in NGO Shipbreaking Platform. She holds a MA Degree in Politics, Society and Economy of Asia, from the University of Leiden. She has working experience in the shipping sector, specifically in export procedures and maritime cargo logistics.

Ekin Skin is qualified as an attorney in Turkey. Before joining the Platform, she was working as a parliamentary assistant with a specialisation in environmental and human rights law. She holds a LLB from Hacettepe University and a LLM in International and European Law from the University of Ghent.

The **NGO Shipbreaking Platform** is a global coalition of organisations working to reverse the environmental harm and human rights abuses caused by current shipbreaking practices and to ensure the safe and environmentally sound dismantling of end-of-life ships worldwide.

NMF and Priya Blue Industries, India

- Priya Blue has three ship recycling yards in Alang, and two of them are sea-facing. One of them is India's largest Class NK yard. All their yards are green yards and HKC compliant.
- Steel extracted from the ship recycling process is exported to Taiwan and the EU.
- As cash buyers, they liaise between ship owners and ship recyclers.
- Recycled Green Steel – We pick up the block from the ship and place it on the RCC end-to-end impermeable flooring, and we cut it. After cutting, we get different types of steel (different lengths and thicknesses). This steel is much more durable than any other steel produced. The procedure used to produce green steel reduces the emission of CO2 by 90%.
- Priya Blue is part of the Sustainable Shipping Initiative (SSI), a non-profit organisation, and they have recently published a document titled "Circularity in Green Shipping," which talks about green ship recycling.

- All asbestos-containing materials are removed by trained workers using Personal Protective Equipment (PPE). Once removed, they are then put into double plastic bags, and these bags are placed in designated storage areas to minimise exposure. Later, these bags are sent to TSDF sites. The final decision on the disposal of asbestos waste is in the hands of GMB. Other waste - lead, acid, batteries, waste oils, etc., is sent to authorised recyclers in Alang who are certified by GMB.
- Ninety-seven percent of a ship is being recycled, and the waste generated is from the remaining 3%.
- Training provided to workers has reduced the number of accidents in the shipyard. Priya Blue has had labour quarters since 1994; presently, a new building is being constructed which shall accommodate 1000 workers. This new building has a recreational facility, dining room, library, AV room, playground for children, and it is likely to be completed in September 2023.
- Priya Blue is compliant with First Aid Rules through 30 First Aiders in different departments, a 24-hour available ambulance, and a fully equipped first aid room. Apart from that, Alang has a Red Cross Hospital, a multi-speciality hospital, and a private hospital to deal with any accidental injuries.
- Contamination due to paint chips – Most ships are procuring anti-fouling certificates and IHM Part 1, and during the cutting process, a slag and paint chip collection box is kept underneath so that anything falling can be collected. These are then sent to GMB for further incineration and dumping at landfill sites. In India, there is no slug removal facility to remove slug during the ship-breaking process, and recommendations should be made to the Government of India in this regard.
- In heavy lifting and to reduce the dependency on labour, Priya Blue has the largest crane (L2) on the ground, which lifts blocks of heavy metal from one place to the other.

Priya Blue Industries Private Limited is operating the largest green ship recycling yard in India. It is largest Class NK certified, HKC compliant Green Ship Recycling Yard.

NMF and Alang Sosiya Ship Recycling & General Workers' Association (ASSRGWA), India

Figure 16. Meeting with Vice President of ASSRGWA

- The conversation kicks off with a promising focus on policy-level pay, signalling a proactive step towards establishing fair and transparent payment policies.
- The issue of insurance, whether medical or life, sparks curiosity, suggesting a potential opportunity to enhance employee benefits and welfare.
- Thoughtful consideration is given to complaint and feedback procedures, highlighting a commitment to fostering a supportive and responsive work environment.

- The emphasis on safety and compulsory ambulance services, demonstrates a strong commitment to prioritising employee well-being and security.
- Company training programs and subsequent employment opportunities reflect a positive outlook on workforce development and empowerment.
- Acknowledging family and living conditions underscores a compassionate approach to employee welfare, recognizing the holistic needs of the workforce.
- The discussion hints at exploring contractual solutions, indicating a forward-thinking approach to addressing challenges and fostering positive workplace dynamics.
- Various aspects of employment conditions, including payment frequency, benefits, and safety measures, are thoughtfully considered, reflecting a commitment to ensuring employee satisfaction and well-being.

The Alang Sosiya Ship Recycling & General Workers' Association (ASSRGWA) is the first trade union in the world for the ship breaking workers. The ASSRGWA functions in a democratic manner and with proper governance structure. At present, it consists of the President, Two Vice-Presidents, General Secretary, Two Secretaries, One Treasurer, Three Organising Secretaries, Twelve Executive Committee Members and around 16500 workers as its members.

NMF with Alang Today, India

- Alang Today emerges as the global beacon for ship recycling, offering comprehensive insights into ships undergoing recycling across major yards worldwide.
- Participants unanimously agree on the pivotal role of Alang Today as the singular platform for accessing vital ship recycling information and staying abreast of industry updates.
- The discussion underscores the importance of transparency and efficiency in ship recycling operations, with Alang Today positioned as the centralised hub

for tracking ships in recycling progress and facilitating machinery and item transactions worldwide.

- Key facilities provided by AlangToday to participants:
  - o Demolition & Recycling Report: Participants can obtain a detailed overview of ships undergoing recycling globally, including ship name, type, tonnage, and recycling progress.
  - o Ships Arriving Soon: Anticipation builds with insights into upcoming ships scheduled for recycling, complete with machinery and component details.
  - o Ship Recyclers Directories: Participants can easily access vital information about ship recycling yards worldwide, enhancing navigation and decision-making.
  - o Green Ship Recycling Advocacy: Participants rally behind the movement for environmentally-friendly ship recycling practices, with real-time reporting on hazardous materials inventory.
  - o Compliance Emphasis: The importance of regulation and compliance for ship recycling businesses is emphasised, with discussions on government roles, taxation systems, and the necessity for a transparent platform.
  - o Waste Management Focus: The discussion highlights waste management and transparency as critical issues in ASSRY, indicating a collective commitment to addressing these challenges.
- AlangToday.com discussion yields tangible outcomes, showcasing its pivotal role in shaping the future of ship recycling and fostering industry-wide transparency, compliance, and sustainability.

Alang Today is a platform dedicated to providing current information and resources about ship recycling, focusing on activities at the Alang shipbreaking yard in Gujarat, India. It offers updates on industry trends, regulations, and developments while also serving as a marketplace for buying and selling machinery and other items related to ship recycling.

NMF and Port Officer, Bhavnagar, India

Figure 17. Meeting with Capt Rakesh Mishra

- Ship Recycling Safety Training:
  - o The Port Officer emphasised the critical importance of safety training, especially CPR and safety protocols, for workers engaged in ship recycling.
  - o Acknowledged the inherent risks in ship recycling activities necessitating thorough training.
- Discussion on the duration and types of training provided to workers.
  - o Administrative Meetings and Confidentiality:
  - o Mention of administrative meetings and the importance of confidentiality regarding ship names.
  - o Emphasised the significance of positive recommendations for government actions.

- Accident Data and Safety Trends:
    - o The Port Officer stressed the need for data on accidents and casualties over the years.
    - o Highlighted the importance of analysing trends for safety improvements.
- International Regulations and Compliance:
    - o Discussion on international regulations, particularly the Hong Kong Convention, and compliance efforts such as certifications for EU standards.
- Impact of Steel Prices and Sustainable Practices:
    - o Concerns raised about the impact of steel prices on the ship recycling industry.
    - o Efforts mentioned to obtain steel samples for quality analysis and the need for sustainable practices.
- Environmental Concerns and Waste Management:
    - o Focus on environmental concerns including soil and water contamination.
    - o Importance stressed on proper waste management in ship recycling processes.
- Global Perspective and Regulatory Impact:
    - o Mention of countries like Bangladesh and Pakistan in the global context.
    - o Potential impact of regulations on the ship recycling industry discussed.
- Strategic Planning and Future-oriented Thinking:
    - o Emphasis on strategic planning considering the long-term impact of the industry on the environment and economy.
- Site Visits and Gathering Firsthand Information:

- o The Port Officer highlighted the importance of site visits and interaction with workers on-site.
- o Gathering firsthand information underscored for informed decision-making.

- The discussion emphasised the crucial aspects of ship recycling, safety training, environmental concerns, and regulatory compliance. Both parties acknowledged the need for collaboration and proactive measures to address challenges and ensure sustainable practices in the ship recycling industry.

Capt Rakesh Mishra is the Port Officer at the Gujarat Maritime Board in Bhavnagar, Gujarat, with over two decades of maritime experience. He has served for 12 years and 10 months at the Gujarat Maritime Board, overseeing port operations and ensuring compliance with industry standards. With prior roles as a Pilot at Essar Bulk Terminal Ltd and General Manager - Port Captain at RPTL, he has extensive experience in vessel piloting, inspection, and terminal equipment maintenance. Capt Mishra's expertise as a Master Mariner at ASP Ship Management and Chief Officer in various shipping companies underscores his valuable contributions to maritime operations and safety.

Established in 1982 through the Gujarat Maritime Board Act, 1981, the **Gujarat Maritime Board (GMB)** assumes responsibility for overseeing, regulating, and supervising Gujarat's minor ports. Currently, GMB oversees 41 minor ports within the state. The vision of the Gujarat Maritime Board is to elevate and leverage ports and international trade as catalysts for economic advancement, marking it as a standout maritime entity on both national and global scales. The mission of the Gujarat Maritime Board is to consistently nurture, facilitate, and excel in the development of versatile port and logistics facilities as well as the shipping-related industry, achieved through its proficient services and timely infrastructure enhancements.

Annex 3: Accident Records

The recorded accident data was provided by the ASSRY Authorities. Below, you can observe the year-wise data of different yards

YEAR-2011				
Sr.No	Date of Accident	Plot No.	Name of the plot	No. of Fatal
1	29.01.2011	72	Bohra Exports Pvt. Ltd.	1
2	08.02.2011	120M	G. K. Steel Pvt. Ltd.	1
3	11.03.2011	25	Bansal Ship Breakers Pvt. Ltd.	1
4	02.09.2011	91	K.P.G.Enterprises	1
5	06.09.2011	107	Unique Ship Breaking Corporation	1
TOTAL				5
YEAR-2012				
Sr.No	Date of Accident	Plot No.	Name of the plot	No. of Fatal
1	30.01.2012	20	Panchvati ship breakers	1
2	22.03.2012	25	Bansal Ship Breakers Pvt. Ltd.	1
3	25.06.2012	30	J.R.D Industries	1
4	21.08.2012	25	Bansal Ship Breakers Pvt. Ltd.	1
5	22.08.2012	72	Bohra Exports Pvt. Ltd.	1
4	07.09.012	41	Shanti Ship Breakers Pvt.Ltd.	1
5	12.09.2012	10	Shree Saibaba Ship Breaking Co.	1
6	19.09.2012	111M	Shiv Corporation	1
7	06.10.2012	82	Kiran Ship Breaking Co.	7
TOTAL				15

YEAR-2013				
Sr.No	Date of Accident	Plot No.	Name of the plot	No. of Fatal
1	11.01.2013	27	Shantamani Enterprise	1
2	29.01.2013	86	Kathiawar Steels	1
3	23.03.2013	41	Shanti Ship Breakers Pvt. Ltd	1
4	22.05.2013	84	Diamond Industries (SBD)	1
5	01.06.2013	121	M.K.Shipping & Allied Industries Ltd.	1
6	07.09.2013	16	Bhikkamal Chhotelal Pvt.Ltd.	1
7	02.10.2013	73	Pure Enterprises Pvt Ltd	1
8	06.12.2013	2	Leela Ship Recycling Pvt. Ltd	1
9	25.12.2013	54	Rushil Industries Ltd	1
TOTAL				9

YEAR-2014				
Sr.No	**Date of Accident**	**Plot No.**	**Name of the plot**	**No. of Fatal**
1	03.01.2014	158	Bansal Shipping Pvt. Ltd	1
2	25.01.2014	2	Leela Ship Recycling Pvt. Ltd	1
3	21.02.2014	9	Shree Ram Steel & Rolling Industries (Unit-2)	1
4	11.03.2014	20	Panchvati ship breakers	2
5	15.04.2014	5	Shubh Arya Steel Pvt Ltd.	1
6	25.05.2014	32	Samudra Alloys Pvt. Ltd.	1
7	23.06.2014	V-7	R.K. Industries (Unit-2)	1
8	28.06.2014	140	Paras Steel Corporation	5
9	28.06.2014	41	Shanti Ship breakers Pvt. Ltd.	1
10	16.08.2014	115	Kumar Steel (India)	1

11	05.09.2014	84-A	Lucky Steel Industries	1
12	22.09.2014	58	Malwi ship Breaking co.	1
13	22.10.2014	11	Shree Gautam ship breaking Ind.pvt.ltd	1
TOTAL				18
YEAR-2015				
Sr.No	**Date of Accident**	**Plot No.**	**Name of the plot**	**No. of Fatal**
1	21.05.2015	1	Bansal International Pvt.Ltd.	1
2	06.07.2015	135	Shree Saibaba Ispat (India) Pvt.Ltd.	1
3	06.07.2015	45	Inducto Steel limited	1
4	05.08.2015	124	United Ship Breaking Co	1
TOTAL				4
YEAR-2016				
Sr.No	**Date of Accident**	**Plot No.**	**Name of the plot**	**No. of Fatal**
1	13.01.2016	29	Kasturi Commodities Pvt.Ltd.	1
2	01.06.2016	169M	Bhuval Industries	1
3	07.06.2016	3	Kamdar & Associates	1
4	29.06.2016	66	Jai Jagdish Ship Breakers Pvt. Ltd.	1
5	12.08.2016	V5	Mahavir Inductomelt Pvt. Ltd.	1
6	14.09.2017	17	Chaudhry Industries	1
7	29.09.2016	107	Unique Ship Breaking Corporation	1
TOTAL				7
YEAR-2017				
Sr.No	**Date of Accident**	**Plot No.**	**Name of the plot**	**No. of Fatal**
1	07.01.2017	103	Honey Ship Breaking Pvt. Ltd.	1
2	08.02.2017	47	Marinelines ship Breakers Pvt. Ltd	1

3	01.03.2017	68	Saumil Impex Pvt. Ltd	1
4	04.03.2017	34	Madhav Industrial Corporation	1
5	14.09.2017	91	K.P.G Enterprise	1
6	07.11.2017	7	Nagarsheth Ship Breakers	1
7	12.12.2017	55	Hatimi Steels	1
8	28.12.2017	111M	Shiv Corporation	1
TOTAL				8
YEAR-2018				
Sr.No	**Date of Accident**	**Plot No.**	**Name of the plot**	**No. of Fatal**
1	08.02.2018	141	Shital Ispat Pvt.Ltd	1
2	14.03.2018	32	Samudra Alloys Pvt.Ltd.	2
3	15.04.2018	2	Leela Ship Recycling Pvt.Ltd.	1
4	17.04.2018	V-6	Khushboo India Pvt. Ltd.	1
5	22.06.2018	125	Mariya Ship Breaking Pvt.Ltd.	1
6	27.08.2018	11	Shree Gautam Ship Breaking Ind Pvt. Ltd.	1
7	31.08.2018	103	Honey Ship Breaking Pvt.ltd.	2
8	11.10.2018	133	Rudra Green Ship Recycling Pvt.ltd.	1
9	14.11.2018	121	M K Shipping & Allied Ind.Pvt.Ltd.	1
10	24.11.2018	103	Honey Ship Breaking Pvt.ltd.	1
TOTAL				12
YEAR-2019				
Sr.No	**Date of Accident**	**Plot No.**	**Name of the plot**	**No. of Fatal**
1	29.07.2019	V 1	PRIYA BLUE IND.PVT.LTD.	1
TOTAL				1

YEAR-2020				
Sr.No	Date of Accident	Plot No.	Name of the plot	No. of Fatal
1	NIL			
TOTAL				0
YEAR-2021				
Sr.No	Date of Accident	Plot No.	Name of the plot	No. of Fatal
1	05.01.2021	66	Jai Jagdish Ship Breakers Pvt.Ltd.	1
2	08.03.2021	1	Leela Responsible Recycling LLP	1
TOTAL				2
YEAR-2022				
Sr.No	Date of Accident	Plot No.	Name of the plot	No. of Fatal
1	08.01.2022	160	V M S Industries Ltd.	1
2	12.01.2022	47	Marinelines Ship Breakers Pvt.Ltd.	1
3	17.02.2022	41	Shanti Ship Breakers Pvt. Ltd.	1
4	21.04.2022	V-1	Priya Blue Industries Pvt. Ltd.	1
5	02.06.2022	77	Ashwin Corporation	1
6	03.06.2022	9	Shree Ram Green Ship Recycling Ind. (Unit-Ii) Llp	1
7	15.09.2022	V-7	R.K.Ind. (Unit-Ii)	1
8	02.11.2022	41	Shanti Ship Breakers Pvt. Ltd.	1
TOTAL				8
YEAR-2023				
Sr.No	Date of Accident	Plot No.	Name of the plot	No. of Fatal
1	10.01.2023	V-5	MAHAVIR INDUCTOMELT PVT. LTD	1
TOTAL				1

Annex 4: Beaching Records

The beaching records at ASSRY from 2016 to 2023 are available below for observation.

2016			2017			2018		
Month	**Ship**	**MT**	**Month**	**Ship**	**MT**	**Month**	**Ship**	**MT**
Jan-16	36	403357.05	Jan-17	28	285690.97	Jan-18	32	310224.35
Feb-16	50	478673.64	Feb-17	15	159079.14	Feb-18	30	194522.76
Mar-16	34	350813.75	Mar-17	21	182225.62	Mar-18	25	201941.32
Apr-16	30	298838.06	Apr-17	31	291508.02	Apr-18	20	131734.17
May-16	16	172701.26	May-17	15	112538.90	May-18	32	134133.17
Jun-16	19	217313.05	Jun-17	20	205866.84	Jun-18	32	262469.23
Jul-16	15	139007.27	Jul-17	14	152752.06	Jul-18	12	143935.35
Aug-16	21	228806.09	Aug-17	8	94638.28	Aug-18	11	89934.88
Sep-16	22	273622.19	Sep-17	17	257494.07	Sep-18	14	172322.32
Oct-16	30	335049.50	Oct-17	20	271901.44	Oct-18	18	128715.59
Nov-16	17	169319.74	Nov-17	16	89455.14	Nov-18	19	198716.12
Dec-16	25	314301.36	Dec-17	25	250504.17	Dec-18	13	153844.31
TOTAL	315	3381802.96	TOTAL	230	2353654.65	TOTAL	258	2122493.57
2019			**2020**			**2021**		
Month	**Ship**	**MT**	**Month**	**Ship**	**MT**	**Month**	**Ship**	**MT**
Jan-19	22	104095.14	Jan-20	32	217806.25	Jan-21	26	223839.94
Feb-19	12	110575.61	Feb-20	21	177235.51	Feb-21	12	91163.85
Mar-19	14	142773.63	Mar-20	7	76641.50	Mar-21	10	56867.77
Apr-19	20	143671.29	Apr-20	4	12194.68	Apr-21	16	142842.83

May-19	18	171958.65	May-20	5	78003.32	May-21	19	144182.26
Jun-19	20	138975.52	Jun-20	25	268058.77	Jun-21	25	152507.89
Jul-19	17	171230.47	Jul-20	20	338137.80	Jul-21	15	82634.34
Aug-19	13	102002.36	Aug-20	17	167715.64	Aug-21	16	90628.15
Sep-19	8	46578.55	Sep-20	6	75217.01	Sep-21	13	131861.48
Oct-19	15	155087.94	Oct-20	15	112588.64	Oct-21	21	132280.67
Nov-19	16	74946.98	Nov-20	19	156864.34	Nov-21	16	148116.55
Dec-19	15	146665.16	Dec-20	28	179989.52	Dec-21	18	123948.15
TOTAL	190	1508561.30	TOTAL	199	1860452.98	TOTAL	207	1520873.88
2022			2023					
Month	Ship	MT	Month	Ship	MT			
Jan-22	13	61755.82	Jan-23	16	116139.53			
Feb-22	16	88552.33	Feb-23	14	109929.87			
Mar-22	21	157344.65	Mar-23	10	61062.12			
Apr-22	20	208175.77	Apr-23	8	65903.92			
May-22	16	182616.41	May-23	8	54857.70			
Jun-22	12	74220.84	Jun-23	9	75845.95			
Jul-22	3	24198.70	Jul-23	8	76756.51			
Aug-22	3	29789.01	Aug-23					
Sep-22	10	69561.85	Sep-23					
Oct-22	7	83495.47	Oct-23					
Nov-22	11	112659.84	Nov-23					
Dec-22	9	75631.11	Dec-23					
TOTAL	141	1168001.80	TOTAL	73	560495.60			

Annex 5: Medical Facilities

In Alang, efforts are underway to bolster medical facilities for workers and the community at large. Workers benefit from coverage under the Employee State Insurance Corporation Scheme, ensuring access to medical services. Primary healthcare is provided at a hospital managed by the Indian Red Cross Society, with a dedicated doctor available on-site. Additionally, a 33-bed private hospital staffed by two doctors offers secondary medical care, with specialist consultations available when necessary. Tertiary treatment options are available at HCG Hospital and Bajarang Bapa Hospital in Bhavnagar. The Gujarat Maritime Board ensures prompt medical assistance through a dedicated 108 ambulance service.[1] To meet emergency needs, a new trauma centre is currently under construction in Alang, aimed at providing critical care for urgent cases. Furthermore, the Ship Recycling Industries Association (SRIA) has appointed two Factory Medical Officers to conduct mandatory medical examinations for workers in accordance with the Factory Act, 1948. Corporate entities such as Maersk contribute to the welfare of Alang through their Corporate Social Responsibility (CSR) initiatives, which have facilitated the establishment of mobile healthcare units, enhancing healthcare accessibility for the community.

1 All Ship Breaking Hazardous Waste Disposed off Safely at Alang Yard, Press Release, Ministry of Ports, Shipping and Waterways, Government of India, February 2017 https://pib.gov.in/PressReleseDetail.aspx?PRID=1482364

Figure 18. Photographs taken during the visit to the hospital in Alang

Figure 18. Photographs taken during the visit to the hospital in Alang

Annex 6: Accommodation Facilities available

Ship breaking operations commenced at Alang-Sosiya in 1983, offering significant employment prospects for approximately 60,000 unorganised migrant workers directly engaged in breaking nearly one ship per day. Nearly 98% of the workforce at Alang-Sosiya comprises migrant labourers from states such as Uttar Pradesh, Bihar, Odisha, Jharkhand, and West Bengal[1]. The working conditions have drastically changed and can be observed in pictures below.

Figure 20. Pictures captured during the visit to Leela Group's accommodation blocks for workers

1 The Untold Story of ASSRGWA, Pre-2005 Scenario of Working and Living Conditions, Alang Sosiya Ship Recycling & General Workers' Association (ASSRGWA), accessed on 23 February 2024 https://www.assrgwa.in/history.html

Figure 21. Pictures captured during the visit to accommodation blocks at Alang, showcasing planned recreational activities by the yards for the workers

Annex 7: Treatment, Storage, and Disposal Facilities (TSDF)

Table 8. Systematic Disposal of Waste

Waste	Disposal Mechanism
Ceramics, Garbage, Glass, Rusted Iron Scale, Incineration ash, Glass wool, Cooling Powder	Dumped at Secured Landfill Facility (SLF)
Asbestos and Asbestos Containing Material	Encapsulation – Solidification/ Stabilization then dumped at Secured Landfill Facility (SLF)
Thermocol, Puff, Oil Sludge, Pint chips, Rubber, Gasket, Contaminated Sand, Oily Rags	Incinerated in Common Hazardous Waste Incineration Facility (CHWIF)
Bilge water, Contaminated Water, Contaminated rainwater, oily water	Treatment in Effluent Treatment Plant (ETP)
POPs	Incinerated in CHWIF

Source: Green Ship Recycling, 3rd Global Maritime India Summit 2023[1]

Table 9. Capacity of Treatment, Storage and Disposal Facilities in Alang

Treatment, Storage and Disposal Facilities		Installed Capacity
Municipal Solid Waste Cell		30,000 m^3
Landfill cell for Hazardous Waste		70,000 m^3
Common Hazardous Waste Incinerator		5 Mt/day
Fire Hydrant System	Underground Reservoir	200 m^3
	Over ground Reservoir	5 m^3 x 2
Effluent Treatment Plant		30 KLPD

Source: Source: Green Ship Recycling, 3rd Global Maritime India Summit 2023[2]

1 Rajkumar Beniwal (IAS). 2023. "Green Ship Recycling" PowerPoint presentation, Gujarat Maritime Board, 3rd Global Maritime India Summit 2023, 19 October 2023

2 *Ibid*

HAZARDOUS WASTE RECIVED AT GMB TSDF SITE ALANG UP to April-23						
Sr. No.	Year	Type of Waste Received Qty. (MT)				
		LANDFILLABELE WASTE		Incinerable	Bilge Water	Total
		SLF	S/S			
1	2006-2007	160.461	653.077	219.323	0.000	1032.861
2	2007-2008	170.216	1578.666	268.143	0.000	2017.025
3	2008-2009	263.015	2934.815	803.806	1026.205	5027.841
4	2009-2010	131.265	2956.967	1054.588	1275.220	5418.040
5	2010-2011	183.425	5529.502	1347.404	1154.980	8215.310
6	2011-2012	56.175	6194.504	792.595	1275.705	8318.979
7	2012-2013	77.150	6526.305	607.175	3344.725	10555.355
8	2013-2014	73.085	5210.385	358.895	1863.525	7505.890
9	2014-2015	70.765	4541.570	545.095	2121.965	7279.395
10	2015-1016	50.585	2499.650	843.800	1602.275	4996.310
11	2016-2017	47.735	4313.870	407.435	1799.165	6568.205
12	2017-2018	44.355	4851.935	610.395	2286.775	7793.460
12	2018-2019	56.265	4377.940	593.875	1680.060	6708.140
13	2019-2020	53.560	5335.560	636.095	1871.920	7897.135
14	2020-2021	37.580	4045.980	758.960	2038.970	6881.490
15	2021-2022	62.305	6426.450	1124.715	2132.740	9746.210
16	2022-2023	31.625	4318.235	923.175	1981.565	7254.600
17	2023-2024	1.050	411.085	52.200	95.540	559.875
Total		1570.617	72706.496	11947.674	27551.335	113776.122

Figure 22. Hazardous Waste received at GMB TDSF site at Alang till April 2023
Source: Gujarat Pollution Control Board Inspection Report[3]

3 Gujarat Pollution Control Board Inspection Report- - Air, Water, Hazardous (Under Section 23 of The Water Act 1974, Under Section 24 of The Air Act 1981 and Under Section 10 of EP Act 1986), accessed on 23 February 2024 https://greentribunal.gov.in/sites/default/files/news_updates/Report%20by%20GPCB%20in%20OA%20No.92-2021%20(page%20nos.356-421).pdf

Figure 23. Pictures taken during the visit to TSDF in Alang

Figure 24. Pictures taken during the visit to TSDF in Alang

Annex 8: Yards Visit

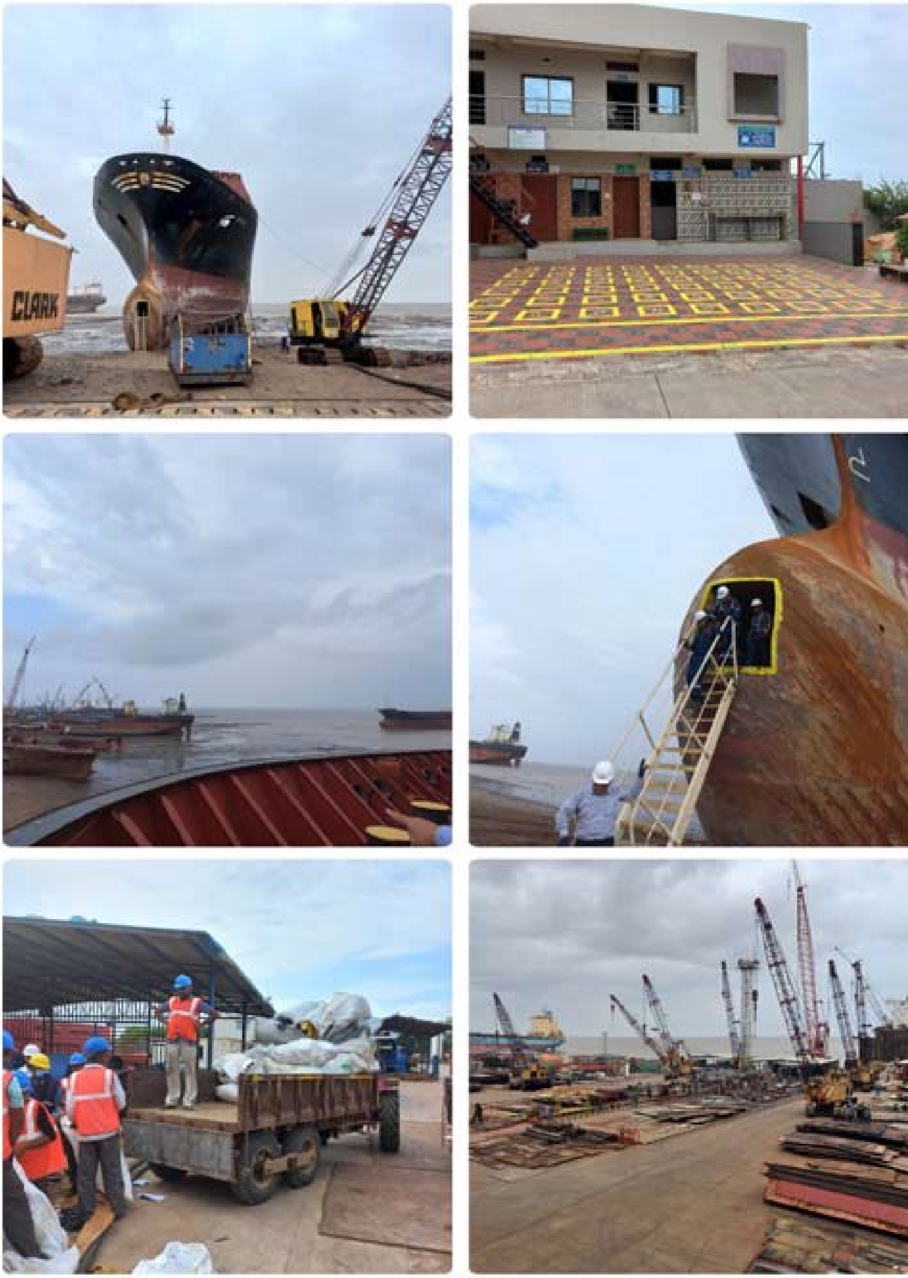


Figure 25. Site visit picture of ASSRY

Figure 26. Site visit picture of ASSRY