Hazardous material use in ship repairs

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Summary

This scoping study examined how hazardous materials are recorded and managed during ship repair and maintenance, and whether current practices adequately protect workers from exposure. Eleven stakeholder interviews across six countries and a workshop with twenty-one participants were conducted to assess the use of Inventory of Hazardous Materials (IHM) processes, occupational safety and health (OSH) measures, and their enforcement.

Across the interviews, IHMs were seen as valuable in principle but inconsistently maintained or applied. Seven of eleven interviewees believe hazardous substances introduced during repair and maintenance are not effectively recorded, and the gap between documentation and day-to-day safety was a dominant concern. In high-income regions, stakeholders observed that IHMs contribute meaningfully to exposure management through enforcement, training, and integration into work systems. In contrast, in lower-middle income regions IHMs were often viewed as non-functional, overshadowed by socioeconomic constraints, limited inspection capacity, weak regulatory enforcement, and worker poverty. Workshop participants confirmed these disparities in IHMs use and emphasised that IHMs are rarely embedded into routine repair and maintenance processes.

Findings from stakeholder engagement (from interviews and a workshop) suggest that meaningful progress requires embedding IHMs within national systems, improving training and PPE provision, strengthening enforcement, and ensuring hazardous waste traceability. Key recommendations include improving IHM maintenance throughout a ship's operational life, enhancing institutional capacity in lower-middle income contexts, updating hazardous material listings, and improving supplier documentation and oversight.

This study makes a valuable contribution to the knowledge base on hazardous material use in ship repairs and maintenance, but further research is recommended to validate the findings and recommendations. The study could contribute to the evidence base for future policy decisions, for example further development of the Hong Kong Convention (HKC) and updating the list of hazardous materials in IHMs to better protect workers.

Introduction

Despite the existence of strict regulations on hazardous substances in the UK and EU, including long-standing bans on asbestos and PCBs, these materials remain in use in other parts of the world. Ships operate globally and frequently undergo repairs and maintenance in different jurisdictions, many of which have varied regulatory and OSH standards.

The International Labour Organization (ILO) estimates that the global merchant fleet contain substantial quantities of carcinogenic and toxic substances (ILO, 2015). These include asbestos, PCBs, PAHs, TBT, mercury, lead, and isocyanates. Asbestos alone has historically been used in a wide range of ship components, including engines, boilers, insulation, and fireproofing materials (IMO, 2023). Although phased out in the UK and EU due to its health risks, including cancer, its ongoing use elsewhere raises serious concerns about the effectiveness of current protective measures for workers and ship users.

Existing international guidelines, such as those issued in 2023 by the Marine Environment Protection Committee of the International Maritime Organization (IMO, 2023), primarily focus on hazardous materials at the shipbuilding and end-of-life recycling stages. There is insufficient emphasis on the repair and maintenance phase, during which hazardous substances may still be used or encountered. Consequently, it remains unclear how well stakeholders understand the associated risks, and whether effective mitigation measures, guidance, and training are in place.

This scoping study addresses a critical gap in knowledge and practice. It aims to examine the implementation of health and safety measures and identify current practices in the management of hazardous materials during ship repairs. This study aims to be a useful resource to inform policy and guide improvements in OSH for workers in ship repair and maintenance.

Contextual background

Ships have a typical operational lifespan of 20 to 30 years after which they are decommissioned and recycled (World Shipping Council, no date). The process of ship recycling aims to recover and reuse materials such as steel thereby reducing the environmental and financial costs associated with producing new raw materials (IMO, no date). However, the presence of hazardous substances – such as asbestos, polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and heavy metals – continue to pose serious risks to human health and the environment. Despite being banned in the UK and EU, these substances may be introduced during ship maintenance, repair, or recycling in other jurisdictions, sometimes without the knowledge of shipowners or workers. Safe handling and disposal are therefore essential not only during recycling, but throughout a ship's entire life cycle.

Presently, there are two regulatory frameworks to manage these risks:

- The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships (The Hong Kong Convention; HKC), which entered into force on 26 June 2025 (IMO, 2023), and;
- The EU Ship Recycling Regulation (SRR, Regulation (EU) No 1257/2013), which came into effect on 31 December 2020

Each of these legal instruments is applicable to different ship features, but both can apply to vessels equal to or above 500 gross tonnage (GT). Specifically, the HKC applies to vessels of 500 GT and which are operating globally, whereas the EU SRR applies to EU/EEA/UK-flagged vessels of the same size and to any third-country ships visiting European ports or anchorages (DNV, no date A). Both instruments focus on minimising risks associated with hazardous materials, however the EU SRR adds stricter requirements and mechanisms to enforce compliance, reflecting the EU's ambition to lead in environmentally sound ship recycling. Under both the HKC and EU SRR, ships are required to have on board an IHM. The IHM identifies and quantifies hazardous materials on board a ship; i.e. any materials or substances that can pose a risk to the health and safety of people or the environment (for example, asbestos, PCBs, or ozone-depleting substances) (IMO, no date A; IHM Expert, no date). For EU-regulated vessels, the IHM lists 15 substances; under the HKC, 13 are listed (DNVa, no date). Table 1 presents the overlap between HKC and EU SRR substances.

Table 1

Overlap of hazardous materials within HKC and EU SRR

	HKC	EU SRR
Asbestos	✓	✓
Ozone-depleting substances (ODS)	✓	✓
Anti-fouling systems containing organotin	✓	✓
Anti-fouling systems containing cybutryne	✓	✓
Perfluoro octane Sulfonic Acid (PFOS)		✓
Cadmium and Cadmium Compounds	✓	✓
Lead and Lead Compounds	✓	✓
Mercury and Mercury Compounds	✓	✓
Polybrominated Biphenyl (PBBs)	✓	✓
Polybrominated Diphenyl Ethers (PBDEs)	✓	✓
Polychlorinated Naphthalenes (>3 chlorine atoms)	✓	✓
Radioactive Substances		✓

Certain Short chain Chlorinated Paraffin (Alkanes, C10-C13, chloro)	✓	✓
Brominated Flame Retardant (HBCDD)		✓

Information and table adapted from DNVb (no date).

Shipowners are responsible for preparing the IHM Part I before construction or during operation, certified by the flag state or a recognised organisation. Maintaining the IHM is an ongoing responsibility. Shipowners must implement a formal IHM maintenance procedure, designate a responsible individual (the IHM Designated Person), and ensure all modifications, repairs, or new installations are reflected in the inventory. Suppliers must provide Material Declarations (MDs) and Supplier Declarations of Conformity (SDoCs) to verify whether installed components contain hazardous substances above threshold levels. Failure to maintain accurate IHMs can compromise both worker safety and regulatory compliance (DNVc, no date).

Whilst these instruments contribute towards improved safety and broader environmental outcomes, some challenges remain, as identified by a recent support study for the EU SRR (European Commission, 2024). Re-flagging vessels shortly before decommissioning can circumvent EU SRR requirements, with ships often ending up in facilities with weaker safety records in Asia. Compliance monitoring reveals persistent gaps, with roughly half of inspections of EU-flagged or visiting ships identifying deficiencies in IHMs or recycling documentation (European Commission, 2024). Disparities between EU-listed facilities and others continue, with fatality rates and environmental standards significantly lower in non-EU yards. Despite these challenges, the EU SRR has positively influenced global ship recycling practices. It has facilitated the ratification of the HKC, improved awareness of hazardous materials management, and encouraged investment in safer recycling facilities.

Both the HKC and EU SRR are critical to controlling hazardous materials risks across the ship life cycle. The respective IHMs for these regulations provide a framework for shipowners to identify, manage, and update inventories of hazardous substances during construction, repair, maintenance, and end-of-life recycling. However, stakeholder consultations conducted in 2020 and 2024/2025 for two European Commission studies (conducted by our research organisation: EC, 2021 and EC, forthcoming) provide compelling evidence that asbestos and other hazardous substances continue to be used during ship repairs and maintenance. These materials are frequently omitted from IHMs and are often only discovered retrospectively, once workers have already been exposed. In 2020 and 2024, stakeholders expressed concern about the widespread and ongoing exposure to hazardous substances, including asbestos, lead-based paints, and petroleum-derived chemicals. Exposed workers are often unaware of the risks; thus, they do not wear protective equipment and do not

follow safety protocols. Testing to detect such substances is typically conducted after exposure has occurred.

Objectives

This scoping study aims to examine the management of hazardous materials during ship repair and maintenance, with a focus on worker exposure, the effectiveness of current health and safety measures, and the factors contributing to effective worker protection.

The objectives of this scoping study are to:

1. Assess the extent to which hazardous substances or materials are recorded in IHMs and the reasons for this;
2. Assess whether IHMs are being used effectively to manage occupational exposure risks during ship repair and maintenance;
3. Examine the use of OSH measures and practices to mitigate worker exposure to hazardous substances or materials during ship repair and maintenance; and
4. Recommend improvements to policy and practice to prevent exposure to hazardous substances and materials during ship repair and maintenance.

Research questions

The research questions, aligning with the above objectives, are:

1. How effectively are hazardous substances or materials being recorded in IHMs?
2. If there are gaps in recording them in IHMs, what are the reasons for these discrepancies?
3. Are IHMs being used effectively to manage occupational exposure risks during ship repair and maintenance?
4. Which OSH measures are currently being used to protect workers from exposure to hazardous substances or materials during ship repair and maintenance?
5. Is there a need to improve policy or practice to protect workers during ship repair and maintenance? If so, how?

Methodology/approach

Stakeholder engagement took the form of interviews with key stakeholders followed by a workshop to present preliminary findings and capture further insights and comments from stakeholders.

Stakeholders invited to participate in interviews came from lower-middle income to high income countries with shipping industries, to enable us to make some general comparisons, including: Bangladesh, Brazil, Canada, China, Finland, Germany, Ghana, India, Japan, Kenya, Netherlands, Norway, Philippines, Poland, Singapore and the UK.

A range of stakeholders were invited to participate in the study, including:

- Industry or professional associations;
- Trade unions for the ship building industry;
- Shipping companies employing a significant number of ship builders / repair / maintenance workers;
- Hazardous substance / material removal companies; and
- Others such as academics or think-tanks with knowledge of the ship repair sector.

Semi-structured interviews were held with 11 stakeholders, using a questionnaire designed to gather information to answer the above research questions (Annex 1). Consent to participate in the study was obtained in writing or verbally. Interview notes were shared with stakeholders following each interview so that they could correct and approve them for use. Responses were anonymised unless stakeholders asked to be identified.

The evidence gathered during interviews was analysed, and key findings were presented at a workshop held on 4 December 2025. All stakeholders who had been contacted for the study were invited to the workshop and the workshop was advertised on LinkedIn via RPA posts which were shared by the LRF.

Interviews

Eleven interviews were conducted, with stakeholders from six countries (Ghana, India, Kenya, Japan, Poland, and Singapore) as well as two international organisations, headquartered in Belgium and Norway. The stakeholders interviewed included the following types of stakeholders:

- Industry or professional associations (3);
- Trade unions for the ship building industry (1);
- Hazardous substance / material removal companies (1); and
- Others such as academics or knowledge sharing networks with expertise in the ship repair sector (6).

Table 2 summarises the region and country of each stakeholder, along with the number of interviewees from each location.

Table 2

Stakeholders per country interviewed

Region / Country	Number of Stakeholders interviewed
Africa	
Ghana	1
Kenya	3
Asia	
India	2
Japan	1
Singapore	1
Europe	
Poland	1
Belgium (International)	1
Norway (International)	1

Workshop

On 4 December 2025, a workshop was held to present and validate the preliminary findings. Invitations were sent to all 63 stakeholders originally contacted for the interview stage, along with an additional ten individuals reached through LinkedIn outreach and third-party circulation by Lloyd's Register Foundation. In total 21 participants attended, with a small overlap between interviewees and workshop attendees.

Limitations

We note that the response rate was relatively low for invitations to stakeholder interviews (11/63 contacts). We suspect that this low response rate may be due to certain stakeholders, such as shipping companies, being reluctant to talk about worker exposure to hazardous materials. Indeed, one stakeholder reported that: "*I am afraid that I will be unable to persuade any Companies to share their experiences. Even my former employer did not assist me when I requested some data* [on this topic]"[1].

This might also be due to some stakeholders being concerned about sharing information due to the perceived reputational risk for companies.

Another factor could have been that there was not a strong regulatory or policy incentive for stakeholders to contribute to our consultation, beyond helping to raise awareness of worker occupational health and safety issues in this sector. For example, stakeholder consultations are often used for regulatory reviews (e.g. impact assessment), which ultimately lead to legal changes and policy decisions; stakeholders

[1] Email exchange with a stakeholder based in Asia, October 2025.

therefore have an incentive to contribute. Stakeholder consultations are also used to review of the effectiveness of a grant programme for which they had received a grant on the condition that they participate in future evaluations, for example, which was not the case in this study.

The sample of stakeholders interviewed was relatively small at 11 (see **Stakeholders per country interviewed**Table 2 above). We include stakeholders from two of the top 10 Ship Repair Dock countries (India and Singapore) while we acknowledge that the sample does not include interviewees from eight of the other key countries in the ship building sector (Maritime Education, no date A).

Further, despite the workshop consisting of 21 attendees, only a small number of participants actively engaged in the discussion However, at the conclusion of the workshop, all participants were invited to contact the study team with any follow-up questions or discussion points they had not raised in the session. None were received.

Finally, please note that this was a small scoping study to provide an indication of the factors involved worker exposure and identify areas for future research; and indeed, more research is needed to validate this study's findings.

Results and discussion

Below we present the four key findings from this scoping study, mapped to the research questions they address, followed by a discussion of the results supporting each finding. The four key findings were:

1. Recording of hazardous substances or materials in IHMs is inconsistent and often lacks enforcement.
2. Effective use of IHMs to manage occupational exposure risks occurs only where strong oversight and safety systems exist.
3. Formal OSH systems exist, but compliance and oversight remain inconsistent.
4. Stakeholders identified a need to extend IHM oversight and enforce existing conventions to strengthen worker protection.

1. Recording of hazardous substances or materials in IHMs is inconsistent and often lacks enforcement

Box 1: Research questions addressed:
RQ1: How effectively are hazardous substances or materials being recorded in IHMs?
RQ2: If there are gaps in recording them in IHMs, what are the reasons for these discrepancies?

1.

Most interviewees agreed that while IHMs are generally well-prepared at certification, their maintenance during ship operation was inconsistent. Updates to IHMs are reportedly often neglected following repairs or component replacements (7/11

interviewees). For some (8/11), issues regarding the ongoing effectiveness of IHM maintenance occurred after initial onboarding. One participant explained that "*…the problem happens when the initial IHM is prepared, certified, and goes on board. After that, ship staff and managers are supposed to maintain it"*[2]. However, this maintenance often failed to take place. The same participant later explicitly pointed towards a widening gap between documented and actual on-board hazards: *"…many operators fail to update the IHM after repairs or component replacements"*[3]. Eight interviewees identified asbestos as the leading hazard to which ship repair or maintenance workers could be exposed to.

Interviewees highlighted regional variation in compliance. Participants in the EU described better oversight, with port inspections and classification society[4] checks helping maintain accuracy. Conversely, interviewees from South Asia and Africa cited weak enforcement and a lack of institutional mandates. As one participant from Ghana explained, if the international HKC has not been transposed into national (domestic) law, this presents an obstacle for effective enforcement: "*We've just acceded [to the HKC]… we haven't domesticated them. International law is no law until it is domesticated*"[5]. IHM discrepancies were seen as being caused by systemic issues rather than individual negligence. Seven of the interviewees indicated a lack of continuity between initial certification and ongoing management. For example, when ownership of vessels changes, one participant described "*poor document handover…when management changes, IHMs are lost or ignored*"[6].

Indeed, several reasons for these gaps were captured across the interviews. Firstly, IHMs seemed to focus on initial inventories but failed to capture downstream handling or post-repair updates to IHMs. The gap between documentation and disposal was prevalent in contexts where waste tracking is poorly regulated. One participant mentioned that once the ship is "*out of the gate of the SRF* [Ship Recycling Facility]*, you don't know where it is going*"[7]. Interviewees also cited administrative and regulatory failings, particularly in African countries. As one participant put it "*There is no inspection or data trail*"[8], suggesting that even when policy exists, enforcement remains ineffective. It could be argued that this stems from international laws, especially in dualist states, lacking legal force until they are 'domesticated' through national legislation. Consequently, there is no foundation for their enforcement or regulation.

[2] Interview 8
[3] Interview 8
[4] Classification societies are defined as "organisations which ensure that ships are fit for purpose, safe and compliant with national and international regulations" (Maritime Education, no date B).
[5] Interview 5
[6] Interview 8
[7] Interview 2
[8] Interview 5

Finally, several participants observed commercial pressures that discouraged proper IHM document maintenance. It was noted that some shipowners or managers face practical limitations, such as being unable to replace components that are still in operation, particularly in high-temperature equipment like boilers, where replacement cannot be carried out safely until the system is shut down: "*If the boiler is in operation…it will not be feasible to take something out*"[9]. Another interviewee described a culture of compliance 'minimalism' with the "*bare minimum* [of] *records*" being maintained [10] . One participant highlighted commercial incentives to understate hazardous materials as a means of cutting disposal costs. One Asian yard operator admitted that "*Some companies don't want too much detail because it can make the work slower and more expensive*"[11].

Overall, only a minority of interviewees (4/11) believed IHMs to be recorded and updated to regulatory standards. Most interviewees (7/11) described significant discrepancies between policy and practice. As summarised by one individual: "*[the IHM list] is done properly, but how does it affect the workers and environment? That part is still a missing link*."[12].

Workshop participants strongly reinforced this finding. Several stakeholders emphasised that IHMs were never designed for mid-life operational use, which is congruent with evidence from the interviews that highlight weak maintenance once ships enter service. Workshop contributors also confirmed that poor supplier documentation, jurisdictional inconsistencies, and limited national enforcement continue to drive these gaps. No participant challenged the conclusion; instead, they collectively described similar problems across domestic ferries, European repair yards, and Asian shipyards, further corroborating the systemic nature of inconsistent IHM upkeep.

2. Effective use of IHMs to manage occupational exposure risks occurs only where strong oversight and safety systems exist.

Box 2: Research question addressed:
RQ3: Are IHMs being used effectively to manage occupational exposure risks during ship repair and maintenance?

Less than a third of interviewees (3/11) considered IHMs to be used effectively for managing occupational exposure limits during repair and maintenance. For some, IHMs were a 'paper exercise', disconnected from actual work planning rather than a tool embedded within OSH practice. Some interviewees felt like there was a lack of full

[9] Interview 8
[10] Interview 11
[11] Interview 4
[12] Interview 2

integration of IHMs: one participant said "*It's there on board*, *but sometimes not opened when repairs start*"[13].

Where integration exists, it tends to be in higher-income or tightly regulated settings. Interviewees operating within more regulated contexts recited positive examples of effective IHM usage. A European representative[14] described IHMs as being "*central to planning any work involving insulation, paints, or lagging materials*", also commenting on how contractors receive only sections of the IHM extracts relevant to their work before entering the dock. Similarly, another participant explained how in Singaporean yards, "*the IHM forms part of the work permit system…it's actually checked and signed off*"[15].

This type of systemic use was described as absent in lower-middle income countries. An interviewee based in Kenya reported that "*the IHM, if it exists, sits in a folder at the port authority. Workers never see it*"[16]. Concerns about awareness were reiterated elsewhere; another interviewee based in Kenya gave the comment "*It's management-level information…not something the welder knows about*" [17] indicating a prevalent gap between documentation and hazard communication.

Interviewees repeatedly linked this gap to structural issues such as disjointed governance, lack of inspections, and limited awareness of OSH practices amongst port and yard operators. As stated by one participant: "*Inventory without enforcement is just paperwork*" [18] . Overall, IHMs are effective only where OSH standards are valued, embedded in daily practice, and reinforced through training and oversight.

Workshop discussion aligned closely with this analysis. Participants agreed that IHMs are useful only when embedded within broader safety systems but stressed that IHMs should not be treated as a definitive or stand-alone source of risk information. This view extends the interview findings by suggesting that IHMs must be supported by strong OSH processes, trained supervisors and workers, and regulatory oversight to be effective in repair contexts. The two stakeholders from high-income regions in the workshop reiterated the interview findings by offering examples of effective integration, whilst those with experience in Africa and Asia described almost identical gaps in hazard communication and supervision.

[13] Interview 10
[14] Interview 1
[15] Interview 5
[16] Interview 6
[17] Interview 4
[18] Interview 2

3. Formal OSH systems exist, but compliance and oversight remain inconsistent

Box 3: Research question addressed:
RQ4: Which OSH measures are currently being used to protect workers from exposure to hazardous substances or materials during ship repair and maintenance?

All interviewees reported that some OSH measures exist, however, their quality and enforcement once again varied by region. PPE was mentioned by all interviewees, but some (5/11) noted that it was inconsistently used, as observed by one individual who stated that "*Workers will wear gloves for [during] inspection, but not for hot work*[19]"[20]. In African and South Asian yards, PPE shortages and worker-paid schemes[21] were common. In lower-middle income nations, there was even mention of external socio-economic circumstances that impact the application of OSH measures. One manager [22] in Bangladesh admitted that "*If we give them gloves and shoes, within a few days they'll sell them in the market*" [23] illustrating how in some contexts, poverty can exist as an exacerbating factor hindering compliance.

In contrast, respondents from high-income regions (Singapore, Europe) described more stringent systems of OSH measures. Although it is a legal requirement for employers to provide PPE to protect employees from workplace hazards in all of the interviewees' countries[24], the implementation of this seems to vary due to internal factors. This suggests that effective OSH measures depend not only on formal policies but also on consistent provision, enforcement, and supervisory oversight.

The implementation of engineering and administrative controls further exacerbates the divide between regulated and informal contexts. Although certain organisations had established engineering controls like enclosed blasting areas and asbestos-removal bays [25] , many still lacked comparable formal controls. In Ghana and Kenya, ship dismantling and repair often took place informally on open beaches: "*There's no controlled environment, no waste system…everything is manual*"[26] .

Despite the variance in the effectiveness of OSH measures being implemented, training was universally acknowledged as the cornerstone of risk prevention. "*The biggest*

[19] "Hot work", according to the interviewee, is any task relating to metal welding, exposing the worker to fumes and particulates.
[20] 04_DA_ 25
[21] Worker-paid schemes are instances wherein the workers are expected to pay for protective equipment themselves.
[22] Interview 2
[23] Interview 2
[24] For example under PPE Regulation ([EU) 2016/425; and the Singapore Workplace Safety and Health Act (2006).
[25] Interview 8; Interview 4
[26] Interview 5

weapon is awareness"[27] was mentioned in reference to regular toolbox talks, posters, and asbestos-zone barricades in the workplace. In some circumstances, training is repeated in local languages, so even migrant workers are able to understand hazards[28].

Monitoring and waste tracking were described as the weakest OSH link across all settings. One participant revealed that "*Once the hazardous waste leaves the yard, tracking stops*"[29]. Still, eight of eleven participants described gradual improvement in this area, particularly over the last five years. This shift has been largely driven by international buyers demanding compliance and safety documentation as part of due diligence processes.

Workshop insights provided additional confirmation of this finding. Participants reiterated that PPE use, ventilation practices, and adherence to safe work procedures vary widely across countries and even within yards. Several stakeholders described cultural and economic pressures leading workers to bypass safety measures, supporting the conclusions that compliance remains uneven, even where systems formally exist. The workshop also introduced further nuance to this by highlighting the nature of hazardous material exposures, which were reported to sometimes be deprioritised in favour of immediate safety risks. This reinforces the need for continuous supervision and training.

4. Extend IHM oversight and enforce existing conventions to strengthen worker protection.

Box 4: Research question addressed:
RQ5: Is there a need to improve policy or practice to protect workers during ship repair and maintenance? If so, how?

All eleven interviewees called for improvements, however the most frequent recommendation (raised by seven participants) was to extend IHM traceability beyond initial certification to include repair, refit, and waste disposal. This was exemplified by one participant who stated that "*[The] IHM [is] only the initial part of it…when you get rid of the hazardous materials as waste, how do you manage that?*"[30].

Five interviewees emphasised the need for domestic enforcement of international conventions. This was most salient within lower-middle income nations, particularly those with dualist systems of governance [31] . Interviewees from these contexts acknowledged the barrier and expressed a desire for change. "*We need to move from*

[27] Interview 8
[28] Interview 4
[29] Interview 6
[30] Interview 2
[31] A dualist government is one wherein international treaties or laws do not automatically become part of domestic law, and must be implemented through separate national legislation. In the context of this study, a treaty like the Hong Kong Convention has no legal force until enacted into national law, or, domesticated.

signing conventions to implementing them"[32] said one participant, while a Ghanaian respondent put it more directly: "*Accession without inspection is meaningless*"[33].

Practical reforms were also suggested. Several (3/11) interviewees advocated for mandatory IHM briefings before repair work, digital access to IHM data for supervisors, and summary hazard information sheets for workers. One interviewee suggested that the IHM should be presented during every major job briefing, not "*just kept in the captain's safe*"[34]. Furthermore, a longstanding industry expert, suggested that "*IHM should be updated based on materials used now by this industry*"[35]. Indeed, three interviewees felt that IHMs required urgent updating to include emerging materials containing hazardous substances, especially PFAS and new fire-retardant foams.

Once again, regional perspectives and contrasts were apparent. European and Singaporean interviewees believed that necessary updates were achievable within their current legislative frameworks. In contrast, those in Ghana, Kenya, and Bangladesh viewed any changes as being dependent on external funding, capacity building, and political commitment. As one interview concluded "*Without resources, laws remain on paper*"[36] .

The workshop strongly endorsed this finding, with multiple participants advocating for IHM obligations during repair and maintenance to be incorporated directly into the HKC. This went further than many interview recommendations and suggests strong stakeholder inclination for regulatory expansion. Participants also repeated key interview themes surrounding weak national enforcement and the need for improved waste tracking, supplier accountability, and due diligence by shipowners. No disagreement was raised, and the workshop validated and elaborated on the need for stronger governance mechanisms.

Study conclusions

Evidence indicates a broad agreement between stakeholders that IHMs provide a solid framework. However, practical implementation remains weak in places, particularly within lower-middle income countries. The evidence collected suggests that IHMs are initially documented thoroughly at the certification stage but are rarely maintained thereafter. This indicates a gap between formal regulatory requirements of maintaining documentation, and the realities of updating the documentation and OSH processes during the ship repair and maintenance. Three core issues emerged from the collected evidence:

[32] Interview 6
[33] Interview 5
[34] Interview 8
[35] Interview 1
[36] Interview 5

- **Lifecycle management as the weakest link**: Once ships enter service, IHMs seem to be rarely updated to reflect repairs or revisits; oversight is minimal. Limited regulator enforcement and institutional responsibility, particularly in lower-middle income contexts, exacerbates this issue.
- **Uneven integration of IHMs into OSH practice**: In regulated settings (EU, Singapore), IHMs inform work permits, briefings, and risk assessments. Elsewhere, they remain mostly administrative, inaccessible to workers exposed to hazardous materials.
- **Worker protection is dependent on regional and institutional capacity**: high-income contexts offered comprehensive OSH measures (PPE, training, engineering controls), whilst lower-middle income nations often relied on informal, poorly regulated work with minimal safeguards. Here, economic constraints and weak enforcement were recurrent causes.

Despite the limited scope of this study, the findings of this report highlight a persistent divide between high income versus low-middle income regions. In the high-income regions, IHMs are embedded in regulation and reinforced by commercial incentives; in low-middle income regions, resource limitations, weak institutions, and low market pressure impact progress. Interviewees also noted that IHMs currently lag on emerging materials, indicating a need to update lists of hazardous materials. Whilst there was little evidence of information withholding by the participants interviewed, the low response rate to interview invitations and limited data-sharing suggest hesitancy, which could be due to commercial sensitivities.

Overall, interviews indicate, albeit partially, that IHMs and OSH systems provide a framework for safe ship repair and worker protection. However, the effectiveness of these systems is dependent on practical implementation of regulations, enforcement, training, and institutional capacity to close regulatory and economic gaps between regions.

Recommendations

Based on all evidence collected for this study, we draw the following four recommendations.

1. **Strengthen IHM implementation and integration into safety practice:** IHM management should extend beyond certification. Regular updates after repairs, refits, or ownership transfer should be mandatory. Verification should take place during inspections and flag changes. IHMs should be integrated within job planning using digital or simplified formats accessible to both supervisors and workers. Information should be presented in clear formats and local languages to further strengthen understanding and compliance.

2. **Build enforcement and institutional capacity, especially in lower-middle income nations:** The contrast between formalised systems and enforcement between high-income / lower-middle income countries indicates a need for targeted support. Strengthening inspectorates, harmonising regulatory frameworks, increased testing to improve compliance, and offering technical or financial assistance would assist countries domesticate and enforce international conventions. Long-term investment in training and infrastructure will be key.
3. **Enhance protection for worker OSH:** Employers should ensure that PPE is supplied by the company, routinely replaced, and its use by workers is monitored for compliance. Engineering and administrative controls should be introduced wherever feasible. Regular safety training remains essential for embedding safe practices across facilities. Employers could make use of the European hierarchy of prevention and control measures (EU-OSHA, 2012) as structured guidance on the order of priorities for adopting worker protection measures and combinations of measures. Stricter enforcement, targeted awareness-raising and training would also enhance safety.
4. **Update IHM content, transparency, and data-sharing:** IHM requirements should evolve to reflect emerging hazardous materials (for example PFAS and flame retardants). Establishing mechanisms for confidential data-sharing could encourage greater transparency and reduce reluctance to disclose information. Improved collaboration between flag states, classification societies, and recycling facilities could improve data consistency and verification across the ship lifestyle.

Impact of study

The findings of this scoping study provide an early evidence base that can support improvements in policy and practice on hazardous material management during ship repair and maintenance. Although the study has identified clear systemic gaps, further research with a larger and more diverse set of stakeholders, including shipowners and operators who may be reluctant to participate due to commercial sensitivities, would strengthen and validate these results. Expanding the geographic scope and stakeholder representation is likely to be essential for capturing the full range of operational contexts and enforcement scenarios.

The study's findings can help shape future regulatory development. Workshop participants noted that the HKC is expected to evolve in the coming years, particularly during the IMO's experience-building phase commencing in 2027. Recent developments at the IMO support this view. At Marine Environment Protection Committee (MEPC) 83 (2025), the IMO adopted amendments to the IHM Guidelines including updated hazardous substance thresholds such as revised limits for cybutryne in anti-fouling systems, showing that the IHM substance list is already under active review (Lloyd's Register, 2025).

MEPC 83 also confirmed the start of an IMO "Experience Building Phase" to support HKC implementation, signalling further adjustments in the coming years. With the HKC entering into force on 26 June 2025, national administrations and classification societies now face legally binding obligations, increasing the relevance and timeliness of the evidence generated in this study. These developments create a clear opportunity for this research to inform ongoing IMO work on lifecycle hazardous material management, including extending guidance to repair and maintenance stages. Evidence presented in this report, especially around weak lifecycle maintenance of IHMs, poor supplier documentation, and the absence of repair-stage obligations, offers an appropriate contribution to discussions on strengthening the HKC and updating the list of substances included in the IHM.

Stakeholders also emphasised that hazardous substance exposure is a labour rights and worker well-being issue, not solely a maritime regulatory concern. This perspective is strongly supported by wider literature on hazardous maritime work. Studies of the ship recycling sector, for example, document pervasive failures in worker protection - including high mortality, chronic exposure to asbestos and heavy metals, lack of PPE, unregistered labour, and limited enforcement, illustrating the consequences of inadequate oversight in practice (Zarqa et al., 2020). Although repair and maintenance differ operationally from recycling, the structural drivers of harm identified in that literature mirror those described by interviewees and workshop participants in lower-middle income repair contexts. Accordingly, several workshop contributors argued for formal involvement of the ILO including alignment with OSH directives and the Maritime Labour Convention (MLC), to strengthen worker protections across the ship lifecycle.

To achieve impact, coordinated action is needed across international bodies (IMO, ILO), classification societies, national regulators, and shipowners. This includes contributing the study's evidence to upcoming HKC consultations, integrating IHM use into national OSH systems, strengthening inspection and enforcement capacity, improving supplier documentation and hazardous-waste traceability, and embedding IHM awareness into worker training. In combination, these steps would help ensure that IHMs evolve from a largely administrative requirement into a practical tool for reducing hazardous material exposure during ship repair and maintenance.

References

Det Norske Veritas (DNV) (no date A) *IHM and Ship Recycling*. Available at: https://www.dnv.com/maritime/insights/topics/ihm-ship-recycling/ihm-part-1-certification/ (Accessed: 3 November 2025).

Det Norske Veritas (DNV) (no date B) *IHM Part I Certification.* Available at: https://www.dnv.com/maritime/insights/topics/ihm-ship-recycling/ihm-part-1-certification/ (Accessed: 3 November 2025).

Det Norske Veritas (DNV) (no date C) *IHM Part I Maintenance.* Available at: https://www.dnv.com/maritime/insights/topics/ihm-ship-recycling/ihm-part-1-maintenance/ (Accessed: 3 November 2025).

European Commission (2021) *Study on collecting information on substances with the view to analyse health, socio-economic and environmental impacts in connection with possible amendments of Directive 98/24/EC (Chemical Agents) and Directive 2009/148/EC (Asbestos) – Study overview and key findings.* Luxembourg: Publications Office of the European Union. Available at: https://data.europa.eu/doi/10.2767/030815 (Accessed: 3 November 2025).

European Commission (2024) *Support study for the Evaluation of Regulation (EU) No 1257/2013 on ship recycling.* Available at: https://environment.ec.europa.eu/document/download/f717f65b-7293-43eb-9b52-2890277bc6d8_en?filename=Support%20study%20to%20the%20evaluation%20.pdf (Accessed: 3 November 2025).

European Commission (no date) *The European Green Deal: Striving to be the first climate-neutral continent.* Available at: https://commission.europa.eu/strategy-and-policy/priorities-2019-2024/european-green-deal_en (Accessed: 3 November 2025).

European Commission (forthcoming): *Guidance for the safe management of asbestos at work.* Publications Office.

EU-OSHA (2012) *Hierachy of prevention and control measures.* Available at: https://oshwiki.osha.europa.eu/en/themes/hierarchy-prevention-and-control-measures (Accessed: 14 November 2025).

Grevfors Ernoult, C (2024) Letter of support to stakeholders regarding the 'Guidance for the safe management of asbestos at work' project for DG Employment, Social Affairs and Inclusion, European Commission. Available at: https://rpaltd.co.uk/wp-content/uploads/2024/07/Letter-of-introduction-_signed.pdf (accessed 4 December 2025).

IHMExpert (no date) *What is IHM:*
Detailed Document Outlaying All Potentially Hazardous Material Onboard a Vessel.
Available at: https://www.ihmexpert.net/what-is-ihm/ (Accessed: 3 November 2025).

International Labour Organization (ILO) (2015) *Ship-breaking: A hazardous work*. Geneva: ILO. Available at: https://www.ilo.org/resource/ship-breaking-hazardous-work-0 (Accessed: 3 November 2025).

International Maritime Organization (IMO) (2023) *Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009.* Available at: https://wwwcdn.imo.org/localresources/fr/Documents/HKSRC.1-Circ.21%20-%20Accession%20by%20Bangladesh%20and%20LiberiaEntry%20into%20force%20(Secretariat).pdf (Accessed: 3 November 2025).

International Maritime Organization (2023) *2023 Guidelines for the Development of the Inventory of Hazardous Materials (Resolution MEPC.379(80) adopted 7 July 2023)*. Available at: https://wwwcdn.imo.org/localresources/en/OurWork/Environment/Documents/RES.MEPC.379%2880%29%20IHM.pdf (Accessed: 3 November 2025).

International Maritime Organization (no date) *Recycling of ships and the Hong Kong Convention.* Available at: https://www.imo.org/en/mediacentre/hottopics/pages/recycling-of-ships-and-hong-kong-convention.aspx (Accessed: 3 November 2025).

Kleinschmidt, R (2024) *Guidance for the safe management of asbestos at work*. Presentation given "Asbestos at Work Directive: Challenges and Opportunities" conference, 24 November 2024, DG Employment, Social Affairs and Inclusion, European Commission. Available at: https://webgate.ec.europa.eu/circabc-ewpp/d/d/workspace/SpacesStore/4cdbae1c-225b-46b9-a062-40b1aaa1b58b/download (accessed 4 December 2025).

Lloyd's Register, 2025. *MEPC 83: Summary Report.* Available at: https://www.lr.org/globalassets/pdfs/mepc_83_summary_report_rev3.pdf (Accessed: 5 December 2025).

Maritime Education (no date A) *Top 10 Ship Repair-Dock Countries in the World*. Available at: https://maritimeducation.com/top-10-ship-repair-dock-countries-in-the-world/ (Accessed: 14 November 2025).

Maritime Education (no date B) *Classification Societies and their Role in the Maritime Industry*. Available at: https://maritimeducation.com/classification-societies-and-their-role-in-the-maritime-industry/ (Accessed: 4 December 2025).

Official Journal of the European Union (2013) *Regulation (EU) No 1257/2013 of the European Parliament and of the Council of 20 November 2013 on ship recycling and*

amending Regulation (EC) No 1013/2006 and Directive 2009/16/EC. Text with EEA relevance. OJ L 330, 10 Dec. 2013, pp. 1-20. Available at: https://eur-lex.europa.eu/eli/reg/2013/1257/oj/eng (Accessed: 3 November 2025).

Official Journal of the European Union (2016) *Regulation (EU) 2016/425 of the European Parliament and of the Council of 9 March 2016 on personal protective equipment and repealing Council Directive 89/686/EEC. Text with EEA relevance.* Available at: https://eur-lex.europa.eu/eli/reg/2016/425/oj/eng (Accessed: 14 November 2025).

The Statutes of The Republic of Singapore (2006) The Workplace Safety and Health Act 2006. Available at: https://sso.agc.gov.sg/Act/WSHA2006 (Accessed: 14 November 2025).

World Shipping Council (no date) *Recycling Ships Responsibly.* Available at: https://www.worldshipping.org/ship-recycling (Accessed: 3 November 2025).

Zarqa, A., Shah, B.Z. and Zaidi, K.I., 2020. *Labor rights violation in ship recycling industry: A critical review of International Labor Organization (ILO) guidelines*. North American Academic Research, 3(12), pp.47–57. Available at: https://www.researchgate.net/publication/351903939_Labor_Rights_Violation_in_Ship_Recycling_Industry_A_critical_review_of_International_Labor_Organization_ILO_Guidelines (Accessed 5 December 2025).

Annex 1: Stakeholder consultation topic guide template

Questionnaire for shipbuilding/repair/maintenance industry

RPA is undertaking a scoping study, funded by Lloyds Register Foundation, to better understand the current situation regarding exposure to hazardous substances and materials during ship repair and maintenance. The study aims to:

- Assess the extent to which hazardous substances / materials are recorded in Inventories of Hazardous Materials (IHMs) and the reasons for this;
- Assess whether IHMs are being used effectively to manage occupational exposure risks during ship repair and maintenance;
- Examine the use of occupational safety and health (OSH) measures and practices to mitigate the exposure to hazardous substances / materials during ship repair and maintenance; and
- Recommend improvements to policy and practice to prevent exposure to hazardous substances and materials during ship repair and maintenance.

This interview includes questions related to these four areas of research.

Some questions ask for rough estimates / guestimates to the best of your ability. We need your expert judgement.

All responses to this questionnaire will be treated in the strictest confidence and will only be used for the purposes of this study. In preparing our report for Lloyds Register Foundation (which will be published on their website), care will be taken to ensure that specific responses are anonymised and cannot be linked to individual companies.

The purpose of this interview is to collect data and information that will underpin the assessment.

A supporting letter from Lloyds Register Foundation is available here, together with the privacy statement here.

Publication privacy

Confidentiality status: *Please note that information from interview notes will be used on an anonymous basis and in a way that cannot be linked to your company*
Privacy By checking this box, it is confirmed that the interviewee has read the Privacy Statement (in full) and agrees with the processing of their personal data for the purposes stated therein. They acknowledge that their views could be shared with Lloyds Register Foundation and published with information concerning the type of organisation that they represent, to which they hereby give their consent. ☐ (Tick box for verbal consent to the above)
Approval status ☐ Minutes have been agreed during the interview and do not need further approval ☐ Draft minutes to be sent to interviewee for approval

A) About the organisation

A1) Please provide the following details	
Name of interviewer	
Name of interviewee(s)	
Role of the interviewee(s)	
Organisation	
Type of organisation	☐ Industry or professional association ☐ Trade union for the ship building industry ☐ Company employing a significant number of ship builders/repair/maintenance workers ☐ Hazardous substance / material removal company ☐ Other, please specify
Number of ship repair/maintenance workers represented as members, workers, students, etc (approx.)	
Email address(es) of contact person(s)	
Telephone number of contact person(s)	
Country	

B) Main Interview Questions

An Inventory of Hazardous Materials (IHM) on a ship is required under both the Hong Kong Convention for the Safe and Environmentally Sound Recycling of Ships (HKC) and the EU Ship Recycling Regulation (EU SRR). The IHM is a record of the types and quantities of hazardous substances on board a ship (any substance that poses a risk to the health and safety of people or environment). Both the HKC and EU SRR are therefore critical to controlling risks from hazardous materials across the ship life cycle. By ensuring that shipowners identify, manage, and update inventories of hazardous substances during construction, repair, maintenance, and end-of-life recycling, these two instruments should enable more effective risk management of occupational health and safety risks throughout the ship life cycle.

1. In your view, to what extent are hazardous substances/materials recorded in the Inventory of Hazardous Materials (IHM)?
2. How does the recording of hazardous substances/materials differ between:
    a. Type of hazardous substances/materials
    b. Jurisdictions / countries?
    c. Stages of the ship life cycle: ship building, repair/maintenance, decommissioning, recycling?
    d. Dry docks / shipyards?
    e. Employment status of workers involved in updating the IHM: employed, contractors, temporary, informal workers?
    f. Any other factors?
3. If hazardous substances/materials are <u>not</u> being recorded in the IHM what are the reasons for this?

Let's focus now on the ship repair/maintenance processes.

4. Which of the hazardous substances/materials are most commonly introduced during ship repair/maintenance work? To what extent are these commonly introduced hazardous substances/materials recorded in the IHM?
5. What are the hazardous substances/materials which you believe require prioritisation for risk management measures to protect workers
6. In your experience are IHMs being used effectively during risk management to protect workers in ship repair/maintenance activities from exposure to hazardous substances/materials?
    a. If no - the IHMs are not being effectively used to protect workers –
        i. In your view what are the key factors that contribute to this:
            1. Jurisdictions / countries?
            2. Dry docks / shipyards?
            3. Status of employment of the workers e.g. employed, contractors, temporary, informal workers?
            4. Any other factors?
        ii. During which ship repair/maintenance processes are workers most likely to be exposed to hazardous substances/materials?
        iii. Which groups of workers are most exposed to hazardous substances/materials during ship repairs/maintenance?
    b. If yes, IHMs are being used to protect workers, in your experience when does this happen most effectively?
        i. Jurisdictions / countries?
        ii. Stages of the ship life cycle: ship building, repair/maintenance, decommissioning, recycling?
        iii. Dry docks / shipyards?
        iv. Employment status of workers most protected: employed, contractors, temporary, informal workers?
        v. Any other factors?
    c. If yes, IHMs are being used to protect workers, what OSH measures and practices are used to protect workers as a result? Can any of these serve as examples of good practices?
7. To what extent are workers aware of the risks of exposure? How does it differ between countries, occupations and types of workers (e.g. employment status)?
8. What additional OSH measures and practices should be implemented to further eliminate/minimise worker exposure to hazardous substances / materials in the ship repair / maintenance industry? *Prompt on factors listed above.* In your view, what is the likelihood of these measures and practices being implemented (for specific substances / materials, across countries, for types of workers etc.)
9. Do you have any recommendations on specific additional improvements to policy and practice to improve worker safety in the ship repair / maintenance sector from exposure to hazardous substances/ materials.
10. Do you have any further comments? Are there any questions that you thought we would ask but we didn't?

11. Can you provide the names of any companies which remove hazardous materials whom we could interview?
12. Can you recommend any other contacts in the global ship repair / maintenance sector which we should interview for this scoping study?

Contact: post@rpaltd.co.uk