

Marine safety: Asbestos in the maritime industry

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Abstract

Over the last decade the International Maritime Organization (IMO) has highlighted the negative effect for human health of exposure to asbestos. The process they undertook has culminated in the amendment of the relevant SOLAS regulations. Changes came into force on January 1st, 2011; in these changes the new installation of asbestos containing materials (ACMs) on ships has been forbidden. This work analyses the evolution of the international regulations related to this change. The involvement of the implied parts (ship owners, shipyards, etc.) in the fulfillment of these standards, as well as the presence and treatment of these materials onboard are also considered.

Keywords: safety; ships; asbestos; removal; rules.

Seguridad marítima: Asbestos en la industria marítima

Resumen

En la última década la Organización Marítima Internacional (OMI) ha puesto de relieve el efecto negativo para la salud humana de la exposición al amianto. El proceso ha culminado con la modificación de los reglamentos pertinentes del Convenio SOLAS. Los cambios que entraron en vigor el 1 de enero de 2011 han prohibido la instalación de materiales que contengan asbesto en los buques. En este artículo se presta atención a la evolución de las regulaciones internacionales relacionadas con este. A bordo también se consideran la participación de las partes implicadas (armadores, astilleros, etc...) en el cumplimiento de estas normas, así como la presencia y el tratamiento de estos materiales.

Palabras clave: seguridad; buques; amianto; eliminación; normas.

1. Introduction

World Health Assembly Resolution 58.22 from 2005 on cancer prevention and control [1] urged Member States to pay special attention to cancers for which avoidable exposure is a factor, particularly exposure to chemicals at the workplace.

Worker exposure to asbestos occurs through inhalation. The World Health Organization (WHO) estimates that over 107.000 people die each year due to asbestos-related diseases from occupational exposure.

In terms of the European Community Directive 2009/148/EC [2], "asbestos" is understood to be the following group of fibrous silicates, identified by their

number in the register of the Chemical Abstract Service (CAS): actinolite asbestos (CAS No. 77536-66-4), grunerite asbestos (amosite) (CAS No. 12172-73-5), anthophyllite asbestos (CAS No. 77536-67-5) chrysotile (CAS No. 12001-29-5), crocidolite (CAS No. 12001-28-4), and tremolite asbestos (CAS No. 77536-68-6). Chrysotile -also known as white asbestos- is the most commonly used (up to 90%), followed by crocidolite (blue asbestos), and then amosite (brown asbestos). The wide range of commercial applications of these materials is due to their excellent tensile strength, low thermal conductivity and significant resistance to chemical attack.

The maritime industry is concerned as the risk of being affected by the harmful effects of these materials not only lies

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with the people handling such materials during assembly, but also the crews that inhabit the ship during its operation. Even people from outside the ship (agents, inspectors, shipyard personnel, passengers, etc.) who occasionally visit facilities where such materials are present may be also affected.

To reduce risks of exposure, the International Maritime Organization (IMO), under SOLAS regulation II-1/3-5 [3], which has been in force since July 1st, 2002, prohibited any materials from being installed that containing asbestos on board a ship, except for some specific exceptional cases. This regulation must be applied to all materials used for the structure, machinery, electrical installations and equipment covered by the Convention. For ships built before that date, the presence of asbestos was allowed as long as its installation on board does not imply a risk for their crews' health. In addition, in the MSC/Circ.1045 [5] that was published the same year, a maintenance and supervision program of the ACM on a ship was established in order to minimize any person on board's exposure to asbestos fibers from.

Subsequently, successive amendments to the regulation [3] culminated in the prohibition, without exception, of the on board installation of asbestos containing materials; this has been in force since January 1st, 2011 [4].

However, despite this tightening of regulations, the IMO has identified serious contraventions, as stated in MSC.1/Circ. 1374 [6]. In some vessels certified as "asbestos free", dangerous materials have been found on board as a result of repairs having been carried out in shipyards or purchases of spare parts after the issuance of such certification.

Because of the serious risks to crewmembers, inspectors, and shipyard workers' health, every action must be taken to remove ACMs within a maximum of 3 years from the date found at which it was found on board. This task must be developed in close consultation with and be under the supervision of the Flag State concerned.

2. Impact of exposure to asbestos on health

Handling materials containing asbestos in assembly operations, cutting, maintaining, repairing and dismantling of facilities, etc., may rise asbestos fibers, which then remain suspended in the air. People present in the working area may then be at risk of inhaling these fibers.

The International Agency for Research on Cancer (IARC) has classified all asbestos fibers as "carcinogenic to humans". Asbestos is one of the most important occupational carcinogens, causing about half of all deaths from occupational cancer.

Asbestos is especially resistant to the internal defenses of the human body. Once inhaled and lodged inside the lungs, most fibers will not break up or dissolve, and they cannot be neutralized or removed. The most common asbestos related diseases are lung cancer, mesothelioma and asbestosis. Lung cancer is the major cause of death for workers exposed to inhaling asbestos. Its latency period is very long, as it manifests itself between 15 and 40 years after exposure. Mesothelioma is a malignant nodular cancer type in the membranes that line the lung cavity (80% in the pleura and

20% in the peritoneum). Generally, there is a latency period of 25 to 30 years. Asbestosis or pulmonary fibrosis is a thickening and scarring of lung tissue, which causes difficulty breathing. It usually has a latency period of 20 years.

There is no safe level of exposure to asbestos. The risk of occurrence of a disease associated with asbestos is related to the concentration of fibers in the air, exposure duration, exposure frequency, the size of inhaled fibers, and the elapsed time since the initial exposure. The higher the dose of exposure to asbestos, the greater the risk of asbestos related diseases. However, the amount of asbestos in a product is not necessarily related to an increased health risk.

According to the International Labour Office (ILO) [7], it is estimated that 4% of global gross domestic (incomings) product is lost in direct and indirect costs resulting from accidents, occupational diseases and deaths.

The dose-response related to asbestos exposure was not well known when this material was introduced into the industry. Thus, in Spain, in 1961 asbestosis was considered as the disease associated with exposure to asbestos; it was not recognized as carcinogen until 1978.

The regulation of occupational diseases is relatively recent. In Appendix III of [7], lung cancer and mesothelioma caused by asbestos appear as occupational diseases.

With European Commission Recommendation 2003/670/EC [8], the EU aims to improve understanding of asbestos-related diseases. Preventive guides for exposed workers are also given and it tries to relate the dose-response between exposure to a particular agent and disease. Annex I presents mesothelioma, pleura fibrotic diseases with respiratory restriction, and lung cancer, as well as diseases caused by inhaling asbestos dust. Annex II deals with lung cancer.

Directive 2009/148/EC [2] assumes that, in addition to the above, diseases such as bronchial carcinoma and gastrointestinal carcinoma may also be associated with exposure to asbestos.

International medical research has concluded that there is no level of exposure to asbestos below which clinical effects do not occur. The risks associated with low levels of cumulative exposure are, so far, not well known. Since asbestos fibers do accumulate in the lungs, and since the risk of developing disease does increase as the cumulative dose increases, exposure to asbestos should be controlled or avoided whenever possible.

According to the International Ban Asbestos Secretariat (IBAS), the use of asbestos is forbidden in 54 countries throughout the world, most of them industrialized; however, it is still extensively used in emerging countries.

3. The influence of international standards on preventive asbestos actions

According to the American Industrial Hygiene Association (AIHA), Industrial Hygiene is a science and art devoted to the anticipation, recognition, evaluation, prevention, and control of those environmental factors or

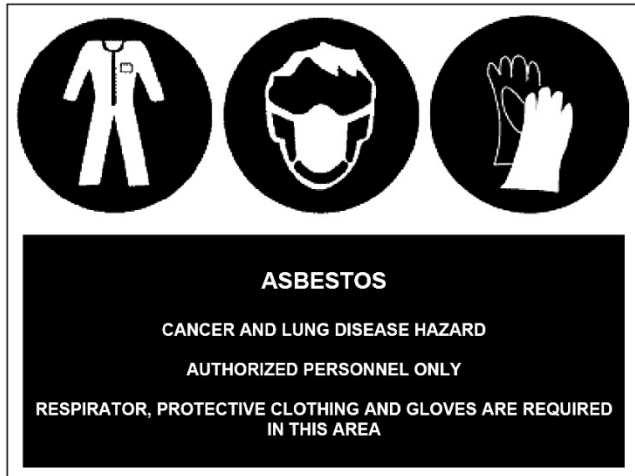


Figure 1. Asbestos warning signs
Source: The authors

stresses arising in or from the workplace. These may cause sickness, impaired health and well being, or create significant discomfort among workers or citizens in the community.

In the Industrial Hygiene field, preventive techniques are applied to the technical and human factors present in the workplace. However, those techniques can only be applied in accordance with up-to-date knowledge on the harmful effects of the materials used in a particular industrial process on people.

International laws consider aspects related to restrictions on the trading and use of certain dangerous substances [9-12], asbestos measurement methods and assessment in workplaces [13-15], analysis [14,16-18] as well as prevention and protection of workers exposed to this risk [19-25].

European Directive 2003/18/EC on the protection of workers from risks related to exposure to asbestos at work [24] contains the following elements: general provisions of employer obligations, exposure limits and prohibitions, evaluation and control of working environments, general organization and technical measures for prevention, personal hygiene, personal protection equipment for respiratory specific situations and certain activities, development and processing of working plans and training, information, consultation, participation, and monitoring of workers health.

This directive includes the maintenance, repair and removal of existing asbestos containing materials in equipment, units (such as ships), facilities and structures.

Worker exposure is allowed up to a concentration of airborne asbestos at or below the Permissible Exposure Level (PEL) of 0.1 fibers per cubic centimeter (f/cm^3), as an 8-hour time-weighted average (TWA).

Since January 1st, 2011, the new installation of materials containing asbestos has been prohibited for all ships covered by SOLAS Convention, and, consequently, the PEL has been limited to 0.0 f/cm^3 onboard vessels.

The present restricted exposure levels have been reached based on the results obtained by medical research into asbestos-related diseases, which has strongly recommended reducing exposure levels. EU countries have followed this tendency over the last 50 years. As a matter of comparative

interest, in Spain, the original permissible exposure level in 1961 was 175 f/cm^3 for all varieties of asbestos. In 1982 it was reduced to 2.0 f/cm^3 . In 1984 the PEL was once again reduced to 1.0 f/cm^3 for all varieties except for crocidolite or blue asbestos, the latter having been reduced to 0.0 f/cm^3 for. In 1993, the PEL was fixed at 0.6 f/cm^3 for chrysotile, 0.3 f/cm^3 for other varieties, and 0.0 f/cm^3 for crocidolite or blue asbestos. Although the PEL is now fixed at 0.1 f/cm^3 in a working environment, there are still an estimated significant number of between 3 and 4 asbestos-related deaths per 1000 workers.

4. Presence of ACMs on board ships

Due to the particular characteristics of asbestos, its most frequent applications on board ships are the following: bulkhead and deck insulation (blankets, panels and sprayed insulation); wall and ceiling panels (sandwich type); floating floors; floor tiles; cement, adhesive-like glue (e.g., mastics) and fillers; packing in pipe/cable penetrations; seals and sealing putty; gaskets (in pipe flanges and manhole covers of tanks); strings fastening insulation around valves in pipes; textile fabric in HVAC ducts as vibration dampener material; boiler insulation; steam pipe insulation; exhaust duct insulation; vanes used in rotary vane compressors; vanes used in rotary vane vacuum pumps; electrical cable material and fuses; friction material of brakes; paintings; fire blankets.

Since the largest amount of ACMs on board are installed as bulkhead/deck/pipe insulation, the most common places in which this material can be found is in the accommodation (or living area) and in the engine room.

Asbestos containing materials can be classified into two categories: friable and non-friable. The friable ACMs have their fibers weakly bound and, when dry, can be easily crumbled, pulverized and reduced to powder by hand pressure. When these microscopic mineral fibers are released into the air, human health can be negatively impacted via inhalation.

This type of asbestos is commonly used as insulation on exhaust pipes, as insulation in blanket forms on bulkheads and decks, as a rope for fastening isolation around valves, and as the filling material in wall and ceiling panels [Figs. 2 and 3]. The effect of typical vessel vibrations can cause the small fibers arising from asbestos or ACMs to remain suspended in the air.

In the following void spaces on ships, the content of fibers or asbestos dust in the air is likely to be high: the backside of partition walls in front of bulkheads; the space between partition walls; the space between ceilings and upper decks; the space between floating floors and decks; and inside escape trunks.

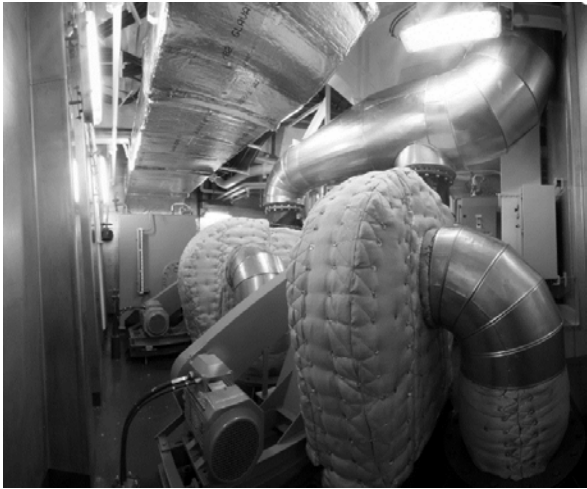


Figure 2. Insulation asbestos material covering equipment. On board arrangement.
Source: The authors



Figure 3. Lined bulkhead.
Source: The authors



Figure 4. Floor covering.
Source: The authors

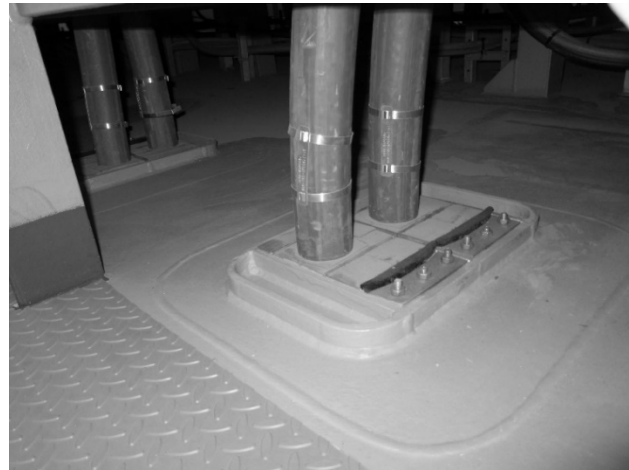


Figure 5. Sealed cables.
Source: The authors

As these spaces are not for regular crew access, they are usually not ventilated and friable ACMs with no cover are used in them. With ship vibrations, the fibers tend to release accumulating asbestos inside these spaces and create hazardous atmospheres that pose a serious risk when opening walls, ceilings or floors.

Moreover, non-friable ACMs are characterized by greater compactness of their fibers. Due to this, they cannot be simply pulverized by hand pressure. Hence, their level of danger to health is lower than for the friable, non-releasing fibers with the ship vibrations.

However, the non-friable asbestos can become friable and release fibers into the air when it are subjected to mechanical works such as sanding, cutting, grinding, drilling, especially when these are carried out with inadequate tools, or when they are burned or welded [Figs. 4 and 5].

This type of asbestos is often used as gaskets in pipe flanges and as manhole covers of tanks, in floor tiles (see Fig. 4), and paintings. The packing used in cable penetrations (see Fig. 5) and pipe penetrations is also non-friable.

5. Treatment of materials on board

In order to study the treatment and control of ACMs on board a ship, we will distinguish between two different cases:

- I. Ships containing ACMs that do not breach the SOLAS regulation II-1/3-5 [3], either because they were constructed before July 1st, 2002 and their ACMs do not pose a risk to the crew's health, or because, having being built later, the ACMs are on the list of the exceptions allowed by the regulation issued on that date.
- II. Vessels that contain ACMs on-board, are breaching the SOLAS regulations II-1/3-5. This means ships built on or after July 1st, 2002 and that contain ACMs not covered by the exceptions of this rule, or those ships built on or after January 1st, 2011 and that contain any type of ACMs on board, are clearly in contravention of [4].

In compliance with MSC/Circ.1045 [5], which was dated on May 28th, 2002, ships belonging to *group I* should implement in their Safety Management System (developed in compliance with the ISM Code) a maintenance and control

of ACMs program on board in order to minimize the exposure to asbestos of any person on board (passengers, crew, port stevedores, surveyors, etc.) while the vessel is "in service". The shipping company must identify and locate the presence of ACMs on board and make an assessment of their condition. This assessment is to be completed using an evaluation checklist shown in Circular Appendix 1 in Annex 1. This includes the materials accessibility, their protection characteristics, their degree of degradation, their exposure to shocks and vibration, and the presence of air currents in the area. Then, using Appendix 2 in Annex 1, a diagnosis of the conservation state of these materials shall be drawn up. Based on this diagnosis, the materials will be subject to a periodic check of the conservation state, to a monitoring of asbestos dust levels in the surrounding area, and to on board protection, repairing, or removal works.

When the material conservation or the asbestos fiber levels into the air make it appropriate, the following precautions are necessary: control (abatement actions) fiber release (friable asbestos) and maintain a safe health environment without resorting to remove onboard material. These actions include:

- **Enclose asbestos in some airtight material.** This could be a plastic wrapping taped over steam pipes, a new floor over an existing one, a steel plate put up over the exposed fibers of an insulation panel, etc.
- **Encapsulate asbestos in a material that will solidify and make them it friable.** This strategy only works when the surface of the ACM is slightly porous. A penetrating material should be used for the first layer. The finished material should be sprayed on rather than rolled or brushed to reduce the chances of altering the asbestos.

None of these methods should be used as a substitute for asbestos dismantling and removal in the case that it is in an advanced state of deterioration. They should be used only when asbestos is in a good state of repair.

Ships in *group II* are generally those that either, as a result of a repair made in a country where the asbestos is not prohibited, or an error in the provision of spare parts for the ship, have ACMs on board. The SOLAS regulation II-1/3-5 [4] is therefore broken. In this case, and according to MSC.1/Circ.1374 [6], the removal of such materials must be made within a period not exceeding 3 years from the date at which the infringement was detected. This action must be developed under the guidance and supervision of the Flag State.

6. Asbestos removal and recycling

Due to the danger in the direct contact with ACMs, asbestos dismantling and removal should be conducted by specialized companies that handling these materials, or by shipyard workers who have received special training.

Asbestos is listed in Annex VIII (List A) of the Basel Convention [26], and it is considered a hazardous waste for health, and therefore, should not be re-used or re-cycled. The potential health impacts associated with the use of ACMs are of such a serious nature that it is necessary to take extreme caution when drawing and handling these materials. Precautions include: protection of workers when removing

asbestos from the vessel; management of asbestos as waste; and measures to prevent asbestos from being used in other applications.

It is recommended that shipyards belonging to countries whose national laws do not address the above precautions implement a management plan for asbestos in their waste management plan. This plan will include an inventory of ACMs on board the vessel so that they can be located, quantified and identified before being removed (instead of extracting samples for analysis in a laboratory of all materials suspected of containing asbestos, it might be more feasible and economical to assume that such materials contain asbestos). In addition, this plan should include personal protective equipment (PPE) for workers removing the material and procedures for both removal and disposal. National legislation should determine the maximum permissible exposure levels (PEL).

Workers involved in the removal and management of ACMs will have to use certified personal protective equipment (PPE) with appropriate respiratory protective equipment (RPE) as well as protective clothing such as overalls, gloves and head coverings, face shield or vented goggles, and appropriate footwear. To comply with the rules of hygiene at work, the yard should have decontamination areas, equipped with a room to leave the equipment and work clothes, a shower area, and a dining room.

In asbestos extraction or removal works on a ship it is essential to keep the asbestos wet during such operations in order to avoid dispersion of fibers into the air. Thus, in this type of work, two people should be involved: one will ensure that asbestos is wet during removal, and the other one will be in charge of the extraction work.

The ACMs removed from a vessel will be introduced in airtight containers with lids and labeled for the transport to the disposal area. Generally, the ACMs are disposed of in landfills where they are buried underground.

7. Actions to be taken by the port state control inspectors (PSC) and classification society surveyors

MSC.1/Circ.1374 [6] underlines the importance of the proper training of inspectors/surveyors in the identification of ACMs on board ships. Asbestos can be found throughout ships from the top of the bridge to the bilge. Identifying the location and type of asbestos and assessing its condition involve qualified inspectors/surveyors. They should know the precautions to be taken in the presence of this material and should also be trained in taking samples.

As in many cases when there are suspicions that a particular material may contain asbestos (see Fig. 8), the visual identification of asbestos is not easy. If sampling and analysis of such material by experts cannot be conducted, both crew and inspectors/surveyors should consider the material to be an ACM in order to avoid possible health risks.

In the aforementioned Circular it is also recommended that inspectors make sure that whenever a new material is installed on board, it is delivered with a statement of compliance with a SOLAS regulation II-1/3-5, or similar. This may take the form of an "asbestos free declaration".

Table 1.
SWOT analysis.

Strengths	Weaknesses
<ul style="list-style-type: none"> - The Regulation MSC.1/Cir.1374 II-1/3-5 strongly contributes to global control of the presence of asbestos on board ships. - Vessels certified as "free of asbestos" are guaranteed to have no risk of exposure to asbestos. This will appear in its Safety Management System. - Avoid asbestos in new construction and repairs; this means controlling the risk in shipyards and for workers and surveyors, which implies a reduction and / or elimination of diseases resulting from the use of asbestos. - Reducing exposure to asbestos is a participatory process in which all stakeholders play an important role. Demands will be made from shipyards, shipping and inspection bodies, and there will be criminal, civil and administrative liabilities that arise from illness and death of those exposed. - There will be monitoring and verification by the MOU surveyors to make sure that these new preventive measures are being fulfilled. <p style="text-align: center;">OPPORTUNITIES</p> <ul style="list-style-type: none"> - For the ship-owners: <ul style="list-style-type: none"> · There is a new challenge in the implementation of these new requirements, in the Safety Management System, and identifying, locating and assessing risk. · Crews need to be trained and make aware of this risk. - These preventive measures may join the Voluntary IMO Member State Audit Scheme. - The safety management and safe operation of ships should be improved and be in line with the International Safety Management Code (ISM). - Vessels and operators that meet these standards may incorporate this information in the European Quality Information System (EQUASIS). 	<ul style="list-style-type: none"> - For ship-owners, the removal of asbestos from the ship represents, in general, a high cost, and in many cases it will be impractical for the following reasons: <ul style="list-style-type: none"> · Such withdrawal must be conducted by a certified company and specialized and under the supervision of the ship's flag. · During this process, the ship must remain immobilized. - There is a lack of knowledge about the risks and consequences of the use of asbestos as well as lack of training of preventive measures to control the risks. - The IMO's actual sanctioning capacity. - For shipyards: <ul style="list-style-type: none"> · It will be necessary to implement specific measures to control the risks of exposure to asbestos. · They will need to implement the prevention of this risk in their management system, and the management of toxic and hazardous wastes. · They will need to enable decontamination areas to be used exclusively for these exposed workers. - For the inspection services <ul style="list-style-type: none"> · There will need to be training, awareness and personal protective measures. <p style="text-align: center;">THREATS</p> <ul style="list-style-type: none"> - In many countries: <ul style="list-style-type: none"> · Asbestos is not prohibited. · There is a lack of awareness and political will to legislate on the control of exposure to asbestos. - Port states that allow the use of asbestos in ground facilities will not sanction its use on ships. - There is a lack of awareness and willingness to implement the measures by shipyards and ship owners. - There are ship owners with substandard ships and flags of convenience. - The assumption of obligations by ship owners and shipyards is a drastic change in risk management.

Source: The authors

The following precautions should be adhered to if inspectors/surveyors have to undertake their work on a ship on which repairs or other work such as grinding, welding or blasting is being carried out, and consequently, friable and non-friable ACMs may be affected.

- Do not enter in those atmospheres that may contain asbestos fiber concentrations in suspension until they have been properly ventilated. To ensure that the level of fibers in the air is within the levels permitted by local laws, measurements will be taken by experts.
- The inspectors/surveyors will carry a particle filtering half mask and disposable overalls as PPE to protect themselves in case they walk in an area containing high levels of asbestos fibers. In this case, the PPE will be used to leave immediately the area.
- The above PPE should not be ever considered as protective equipment for inspectors/surveyors who intend to enter a contaminated area and stay there performing their inspection work. Entry into these spaces will be reserved for specialized companies.
- Sampling and analysis of ACMs will be left to experts. The analysis of a sample to detect whether it is an ACM or not should be performed in a laboratory.

8. Conclusions

Research in recent years on the health effects of workers' exposure to asbestos has shown that this is a carcinogenic material and, therefore, poses a serious risk to health. As most industrialized countries have becoming aware of this, they have regulated the use of this material, which has had drastic reductions in the permissible level of exposure (PEL). *This pattern of reduction in both the level of exposure and the use of these materials in the industry is the expected trend in the coming years.*

In the field of shipping, the recent appearance of ACMs on ships certified as "asbestos free" has made alarms bells ring out, pushing the IMO to take a decisive step with their prohibition of the new installation of ACMs on board all ships on January 1st, 2011. In the fulfillment of this new regulation ship-owners will play a key role. *Asbestos will have a significant entry path into the vessels through shipyard repairs or purchases of spare parts in countries that are not Member States of the IMO or whose national laws do not control the use of these materials.* Therefore, in these cases, it is the ship-owners responsibility to be alert and to prevent asbestos from accessing their ships.

Owners of vessels that contain asbestos (vessels belonging to group I of item 5) will have to identify their type and location, assess their condition, and comply with a maintenance and control program. The friable ACMs are the most dangerous and the tendency is to wrap them into other material or encapsulate them while they are in an acceptable condition and then remove them from the ship when they deteriorate. Thus, void spaces on the backside of partition walls and above ceilings are areas likely to contain high concentration of airborne fibers, this being a considerable potential risk.

Inspectors/surveyors obtaining proper qualifications to be able to identify asbestos is another crucial point in tackling the challenge of getting ships asbestos free. Once identified on board, a professional decision should be taken as to whether to remove, encapsulate, or leave the asbestos undisturbed. If samples are taken, they shall be subsequently analyzed in duly equipped laboratories.

Captains and officers must know and be concerned about the importance of the presence of asbestos on board. Crews and workers on board should take into account authorities' recommendations. It is the responsibility of captains and officers to inform crew and workers as they sometimes do not have complete information regarding asbestos.

Asbestos removal operations requires the preparation of specific working protocols, workers specially trained and informed of the risks they are exposed to, and finally, its treatment by managers trained in hazardous wastes. The flag State of the vessel surveyors must be involved in its removal.

Despite great advances over the last decade, the war against asbestos in the maritime sector will not be won until there is full global commitment for asbestos control from all stakeholders, especially from the governments of the least developed countries.

A SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats) permits the strengths, weaknesses, threats and opportunities, of the implementation of the measures contained in Table 1 to be determined.

According to previous analysis, it is possible to determine the most appropriate strategies to reach a successful conclusion of the IMO rules.

Offensive strategies (strengths & opportunities): Assumption by ship-owners, shipyards, the MOU surveyors and operators, goodness and necessity of implementation of these preventive measures.

Defensive strategy (weaknesses & threats): with the conviction that these preventive measures will favor the health of crews, it will be possible to conduct risk assessments for exposure to asbestos, specific medical examinations in shipyard workers, crews and surveyors, and monitor the implementation of preventive measures.

Reorientation strategy (weaknesses & opportunities): the change in the provisions of the IMO should be used to manage these risks by all parties, and in particular by carriers with international information systems on improving the management of their vessels.

Survival Strategy (weaknesses & threats): the steps initiated by the IMO confirmed that there was a bad situation in terms of working conditions with asbestos. It is necessary to exploit the MSC.1/Cir.1374 II-1/3-5 and promote a change

in the way of thinking, working procedures, and the use of new available materials that do not contain asbestos. Maritime organizations' sanction capabilities of IMO member states should be fully exploited.

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