

MMVFs Onboard Ships: From an Observational Study to the Development of MMVFs Safety Plans [†]

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Abstract: Man-made vitreous fibers (MMVFs) are widely used in shipbuilding. Some MMVFs are “suspected of causing cancer” in Annex VI of Regulation (EC) 1272/2008 and can be easily found in ships (asbestos free or not ones). This study is an overview of the conditions/confinement of MMVFs onboard ships, focusing on the measures taken to reduce the risk of exposure and on the perception of risks, in analyzed ships. We suggest to improve on-board MMVFs safety plans (as for asbestos risk-management) and to strengthen National and European Authorities’ supervision/network on this theme also by the EU SHIPSAN ACT Joint Action’s tools.

Keywords: MMVFs; carcinogenicity; air dispersion; healthy working/living onboard; chemical risk management



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1. Introduction

Man-made vitreous fibers (MMVFs) are a widely used large subgroup of inorganic fibers also used in shipbuilding because of their thermal/acoustic insulating and fireproof properties. Some MMVFs can have effects on human health, including carcinogenic effects [1]. Moreover, Annex VI of Regulation (EC) 1272/2008 ([2], Table 3.1), includes them in the list of harmonized classification and labelling of hazardous substances: 650-016-00-2 MMVFs have carcinogen category 2, H351 “suspected of causing cancer” and 650-017-00-8 MMVFs have carcinogen category 1B, H 350i “may cause cancer by inhalation”.

Our aim is to study MMVFs onboard ships mooring in ports where the Territorial Unit of Porto Torres, USMAF-SASN Campania Sardegna, Italian Ministry of Health Office (UTPT) is the health competent authority, to detect their presence, to assess their state of conservation, risk of decay and air dispersion, the coexistence of asbestos and the prevention measures taken to reduce the risk of exposure.

2. Material and Methods

After the UTPT note n. 538, 6 July 2018 addressed to all shipping companies, asking for monitoring reports about MMVFs on board, in ships mooring in the UTPT jurisdictional ports, reports written by accredited laboratories after samplings in 2019 have been analyzed using a specific schedule to extract data and Excel[®] software to create a database and process data. During the COVID-19 pandemic, no laboratory performed samplings on board.

3. Results

In total, 349 mass samples and 219 air samples were taken in 22 passenger transport ships. Table 1 shows the distribution of mass samples.

Many of 43.8% of the MMFV samples come from panels. These are generally vertical sandwich-structured bulkhead panels with MMFVs inside two outer layers, or ceiling panels, placed above the metallic ceiling of cabins, halls, restaurants, consisting of pressed materials, without an insulating envelope. Another, 36.4% are textile pipe coverings and 17.5% are cushion pipe coverings at pipe intersection points.

Table 1. Sites of mass samplings.

Mass Sample Sites	N.	%
Generators/compressor/refrigerator room, other machinery spaces	90	25.8
Common spaces/hallway	56	16
Air conditioning/fire protection rooms	55	15.8
Cabins/café/restaurant/other passengers' spaces	43	12.3
Engine room	40	11.5
Offices/main deck/other seafarers' working spaces	35	10
Living spaces of seafarers	11	3.2
Not specified	11	3.2
Kitchen/pantry	4	1.1
Garage	4	1.1
Total amount	349	100

MMFVs were found in all ships analyzed: 33.3% of the ships have MMFVs H351 on board and the mean of positive samples is 51% (23.1–100%) for each ship.

The findings show that 9.1% of the ships have both asbestos and MMFVs H351, 22.7% have asbestos materials without findings of MMFVs H351, 22.7% have MMFVs H351 materials without asbestos and finally 45.5% only have MMFVs not suspected for carcinogenicity (MMFVsNSC).

A total of 55.8% of the 111 pictures attached to reports show MMFVs “on sight”, without containment/confinement of fiber dispersion (Figure 1).



Figure 1. Examples of pictures taken during mass sampling on board ships: (a) MMFVs H351, sampled in “air conditioning room 7.4.01 Deck n. 7”. (b) MMFVsNSC, sampled in “bow engine room—high temperature line P1 Deck 1”.

Regarding MMFVs H351, 96.2% of their pictures in the submitted reports show no measures of prevention of air dispersion.

Air samplings: Table 2 shows the location of air samples.

Table 2. Sites of air samplings.

Air Sampling Site	N.	%
Cabins/café/restaurant/other passengers' spaces	84	38.4
Offices/main deck/other seafarers working spaces	35	16.0
Common spaces/hallway	28	12.8
Kitchen/pantry	22	10.0
Engine room	16	7.3
Generators/compressor/refrigerator room, other machinery spaces	12	5.5
Air conditioning/fire protection rooms	12	5.5
Living spaces of seafarers	6	2.7
Garage	4	1.8
Total amount	219	100

A total of 68.2% of reports use the ACGHI TLV-TWA threshold [3], the same as the Circular note from the Italian Ministry of Health n. 4, 15 March 2000 [4]: 1 f/cm³ or 1 f/mL. A total of 31.8% use more restrictive Italian thresholds: standards for post decontamination of settings from asbestos [5]: 20 ff/L by phase-contrast optical microscopy (MOCF) and 2 ff/L by scanning electron microscopy (SEM). 100% of air samples are below the thresholds.

All ships have prescriptions from UTPT: confinement/safety restoration (100%); MMVFs mapping update (76.2%); MMVFs risk of decay assessment (71.4%); periodic assessment of the condition of MMVFs materials (71.4%); implementation of "prudent action to take", according to Regulation (EC) No 1272/2008 (71.4%); SEM air sampling (42.9%).

4. Discussion and Conclusions

The reports show the presence of MMVFs H351 in one-third of ships, in a considerable quantity, including ships not asbestos-free. The report pictures show evidence of remarkable decay of MMVFs and, frequently, absence of insulation, probably due to inadequate monitoring of the condition of materials. The lack of reports before UTPT note 538 may show a general low perception of risk.

MMVFs represent a chemical risk that should be effectively monitored by shipping companies, ship masters, occupational physicians and health authorities. Increased health risk could arise from co-presence of MMVFs H351 and asbestos, or from MMVFs H351 and past exposure to asbestos. This might be a matter of concern considering the incidence of mesothelioma in seafarers [6,7]. MMVFs of unknown chemical classification should be confined. MMVFsNSC should also be confined to avoid excessive fiber dispersion. We suggest improving on-board MMVFs risk management through the use of MMVFs safety plans (As for asbestos risk management or water safety management) based on standardized steps: identify the team; map the MMVFs onboard; identify the hazards that contribute to MMVFs decay and assess the risks while also prioritizing them, through Versar method-like models for instance; determine, validate and monitor control measures; develop, implement and maintain an improvement/upgrade plan; verify the effectiveness of the plan. Moreover, it is essential to implement education and information on this subject on board; to educate selected seafarers to periodically verify the condition of materials (with appropriate PPEs) and immediately communicate MMVF confinement problems; to involve shipping companies to get in touch with certified societies for MMVFs census, risk analysis, periodical reports, samplings and restoration of insulation.

To promote chemical safety on board, it could be useful to strengthen the supervision of MMVFs by increasing the number of ships screened at a national and European level. It would be useful to have a European partnership/network also for broader data collection and analysis. The EU SHIPSAN ACT Joint Action's tools could be helpful for these purposes.

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