

## **Workers in the Marine Industry Recommendations**

The marine industry consists of many various workers including, but not limited to, seafarers, shipyard workers, service technicians, marine consultants, agents and marine inspectors. Hazards in the marine industry are not limited to direct physical injuries but also occur from asbestos, polycyclic aromatic hydrocarbons, cargo, fumigants, petroleum products, benzene, adhesives, epoxies, paints, welding smoke, sandblasting and much more. These exposures may cause chronic lung disease, cancers or illnesses that often have latent effects. The effects of these exposures are often not discovered until 20 or 30 years later, making it difficult to pinpoint a timeline and location. Limited data exists on the occurrence of occupational diseases in the marine industry (Carter, Jepsen, 2014).

Regulations require companies to identify all hazards, investigate and report any incidents of exposures (International Labour Organization, 2006); however, chronic exposure over years of employment may go unnoticed due to the latent effects of symptoms. Workers are exposed to small amounts of a hazardous product, over time where symptoms may not appear until 20 to 30 years later making the timeline and location more difficult to determine (Greenberg, Madsen, 2011).

### **Typical Hazards in the Marine Industry**

#### **1.0 Asbestos**

Asbestos installation on new vessels, built after 2002, has been banned by the IMO; however, removal of asbestos on existing vessels is not required if it is managed (International Maritime Organization, 2002). Domestic vessels operating in Canada are

not required to remove the existing asbestos onboard. Asbestos must remain on the forefront of hazard awareness until it is completely removed from the marine industry. Aging vessels require frequent repairs that require removals of insulations, lagging, ceiling tiles, joiner work which frequently contain asbestos. This strip out or removal often involves *unknown* areas of asbestos that can produce very high breathing zone concentrations of fibers (Jones et al, 1984). Major repairs are typically done by a contractor or in a shipyard where shipyard workers, marine inspectors, contractors and ship's crew are all onboard the vessel during the repair. Vibrations of the ship, in service, can also loosen asbestos fibers which can be spread into the air (Saarni, Pentti, Pukkkala, 2002).

### **1.1 Polycyclic aromatic hydrocarbons**

Daily exposures to polycyclic aromatic hydrocarbons and nitroarenes have been noted as an area of concern for hazardous exposures to seafarers (Forsell et al, 2007). Exposures may be especially high during major work on the engines or auxiliaries (Forsell et al 2007). Urine samples taken from a select number of marine engineers found traces of degraded hydrocarbon products and other chemicals (Oldenburg et al, 2010). Brandt et al (1994) presented a study in the mortality patterns of Danish merchant seaman from the period 1970-1985. Marine engineers and crew were found to have excess mortality from cancer in the respiratory organs and, could be explained by exposures from carcinogens in the engine room (Brant et al 1994). Toxic substances including inhalation of polycyclic aromatic hydrocarbons and various oil mists occur frequently in the engine room (Rapiti et al 1992). Marine Consultants, shipyard workers, coating technicians and marine

inspectors spend a significant portion of their career inside confined spaces with these residues.

## **1.2 Fumigants**

The globalization of shipping has led to the requirement of preserving goods and protecting them from pests (Preisser et al, 2012). A sample taken in the port of Hamburg found that 15% of containers retained harmful concentrations of fumigants and toxic chemicals. (Preisser et al 2012). The sample of containers also revealed that the containers containing the harmful concentrations lacked the required warning labels in almost all cases (Preisser at al 2012). Fumigants such as bromomethane, hydrogen phosphide, 1,2 – dichloroethane, trichloronitromethane and ethylene oxide have been reported in air samples in containers (Lucas et al, 2016). Formaldehyde, benzene, and toluene are common gases released from certain goods, transported by containers that have also been found in freight container air samples (Lucas et al, 2016).

## **1.3 Petroleum Products**

Tankers are involved in shipping various chemical and petroleum products. Exposure risks from vents on deck to seafarers are highest during loading, offloading and tank cleaning (Saarni et al 2002). Kidney cancer was found to be significantly higher in deck officers on tankers and was comparable to kidney cancer rates for oil refinery workers in Finland (Saarni at al 2002). High levels of benzene of up to 100 ppm have been recorded on the deck of tankers during loading and unloading of cargo (Oldenburg at al, 2010). The acceptable threshold limit value (TLV) for benzene is 1ppm (Ion Science (n.d.)). Benzene exposure occurs through inhalation and is associated with both acute health effects and long-term occupational diseases, including cancer (World Health

Organization, 2010). Benzene occurs naturally in crude oil and also occurs during the processing of petroleum products, production of toluene, xylene and other aromatic compounds (World Health Organization, 2010).

#### **1.4 Welding Smoke**

Welding smoke is a common exposure in the marine industry when a steel vessel undergoes a repair. While the area is required to be properly sealed off and ventilated it is rarely done properly. Welding smoke has various hazards that can be found on the workplace NL website; however, there is an additional exposure hazard on aging vessels due to the layers of unknown coatings that the welder burns through. Existing coatings are seldom removed prior to welding due to the increased time and cost that would be required. Existing coatings have been found to contain lead, asbestos and other hazardous compounds. Typical welding smoke also contains various metals (figure 1) that may be inhaled.

Analyte	Concentration		Reporting Limit	Test Method	Date Analyzed / Analyst
	(µg)	(mg/m <sup>3</sup> )	(µg)		
Aluminum	32	0.037	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Antimony	5.2	0.0059	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Arsenic	5.3	0.0061	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Barium	2.9	0.0033	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Beryllium	<0.02	<0.000023	0.02	NIOSH 7303/7300 Mod	08/31/2011 DH
Cadmium	<0.5	<0.00057	0.5	NIOSH 7303/7300 Mod	08/31/2011 DH
Calcium	400	0.46	10	NIOSH 7303/7300 Mod	08/31/2011 DH
Chromium	9.5	0.011	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Cobalt	<1	<0.0011	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Copper	46	0.052	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Iron	3,700	4.2	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Lead	8.8	0.010	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Lithium	<1	<0.0011	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Magnesium	24	0.028	10	NIOSH 7303/7300 Mod	08/31/2011 DH
Manganese	230	0.26	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Molybdenum	3.1	0.0035	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Nickel	9.6	0.011	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Phosphorus	10	0.011	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Potassium	740	0.85	10	NIOSH 7303/7300 Mod	08/31/2011 DH
Selenium	<1	<0.0011	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Silver	<0.2	<0.00023	0.2	NIOSH 7303/7300 Mod	08/31/2011 DH
Sodium	<10	<0.011	10	NIOSH 7303/7300 Mod	08/31/2011 DH
Strontium	<1	<0.0011	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Thallium	<1	<0.0011	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Tin	4.3	0.0050	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Titanium	34	0.039	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Vanadium	<1	<0.0011	1	NIOSH 7303/7300 Mod	08/31/2011 DH
Zinc	520	0.60	1	NIOSH 7303/7300 Mod	08/31/2011 DH

**Figure 1: Air sample during welding in a confined space**

## 1.5 Sandblasting

Sandblasting (Abrasive blasting) occurs at local yards to remove the existing coatings on the ship. This can create high levels of dust and noise. Abrasive material and the blasted surface may contain toxic materials (i.e. lead paint, asbestos, silica) that are hazardous to employees. Natural ventilation alone will often not be sufficient to maintain breathable quality air. Silicosis, lung cancer and breathing problems could occur in exposed

workers. A recent example shows the unknown hazards that occur from removing layers of coatings through blasting and welding during a repair:

<https://www.cbc.ca/news/canada/nova-scotia/lead-paint-removal-hudson-coast-guard-ship-1.5185938>

### **1.6 Paints, coatings, epoxies, adhesives and solvents**

A wide range of paints, coatings, epoxies, adhesives and solvents are used on a ship.

While the outside contractor may have appropriate PPE others working in the area are typically unaware of the required respiratory protection. Ventilation is also often misunderstood. Common compounds found in these applied products contain xylene, benzene, styrene, and other hazardous compounds. The ship crew, marine consultants, service representatives and marine inspectors are often required to rely on the control measures put in place by the shipyard or facility where the work on the vessel is occurring.

### **Conclusion**

Workers in the marine industry are frequently exposed to numerous hazardous materials over the course of their career which can lead to a variety of latent occupational diseases including chronic lung diseases, lung cancer, kidney cancer, bladder cancer, blood cancers and asbestos related diseases. Hazard awareness programs in the marine industry typically focus on immediate, physical hazards that are easily identified and controlled. Hazard identification, elimination and control is imperative to protect workers from illness and disease. Documentation

of any possible exposure is equally important to increase awareness and aid in the prevention of future incidents.

## **Recommendations**

- 1. The government of NL amend the Workplace Health, Safety and Compensation Act to provide conclusive presumptive coverage for work related pandemic illness to those workers deemed essential.**
- 2. Further supports Recommendation on page 24 of the Newfoundland and Labrador Federation of Labour Submission to the 2019 Workers ‘Compensation Statutory Review, “That workplace NL, lobby the Federal Government to establish a strong national surveillance system for occupational injury and disease that allows for comparisons across industries and provinces/ territories, and that makes it possible to link compensation claims data with health data derived from medical records.”**
- 3. Further supports Recommendation on page 26 of the Newfoundland and Labrador Federation of Labour Submission to the 2019 Workers ‘Compensation Statutory Review (as documentation of possible exposures), “That all service NL Occupational Health and Safety Division stop work orders, administrative penalties, prosecutions and convictions be posted on the service NL website for two years and made accessible to the public”.**
- 4. That Workplace NL develops a comprehensive occupational disease prevention strategy for people working in the marine industry.**

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