The ABS Mariner Personal Safety research project provided input for this Toolbox Talk. This topic has been identified as a common safety concern. The information provided on this topic may serve as an overview and a refresher.

The purpose of this information sharing is to bring to light common hazards and safety behaviors. Alerting management, crew and visitors to these issues may lead to actions to prevent similar near misses from happening to others and to improved procedure development and ship design.

Toolbox Talk

Radiation Safety

Introduction

We are exposed to radiation every day with the most common example being sunlight. Radiation can also be found aboard vessels in items such as flow meters, density gauges, and smoke detectors. It is important to understand the different sources and types of radiation in order to minimize worker exposure. Radiation exposure limits are listed below and given in REM (Roentgen equivalent man).

- Whole body exposure 5 REM
- Skin and extremities 50 REM
- Eyes 15 REM

Sources of radiation

There are two types of radiation to which workers may be exposed. They are ionizing and non-ionizing radiations, both of which are described below.

Non-ionizing radiation

Non-ionizing radiation is a form of radiation with varying effects on the body depending largely on the radiation wavelength. A few examples of non-ionizing radiation are listed below.

- Low frequency – common to items such as power lines, transmission and shortwave radios. This type of radiation usually presents a low risk of health hazard to people, however the risk is usually based on proximity and intensity of the signal. It can aggravate existing dermatitis and also impair vision
- Microwaves – usually belonging to items used for radar, communications and cooking. This type causes heating of tissues, painful burns and cataracts in the eyes. The effect is related to wavelength, intensity and time of exposure
- Ultraviolet (UV) radiation – can be found around electrical arcs, such as electric welding arcs. This type usually results in skin burns or reddening of the skin. It may also cause eye irritation and conjunctivitis, which is very common with long exposure to electric welding arcs

In terms of radiation exposure: the closer to the source, the stronger the radiation. So it goes without saying, the further away from the source, the better.

Ionizing radiation

Ionizing radiation refers to a number of different types of radioactive energy of varying wavelengths, which produce electric charges in the air or other matter when they come in contact. Types of ionizing radiation are listed below.

- Alpha radiation is usually stopped by a sheet of paper. It can be emitted from smoke detectors at very low levels and is most hazardous when ingested
- Beta radiation is usually stopped by a layer of clothing and can be emitted by radon gas and some industrial gauges. It is most harmful when ingested but can cause burns since it is capable of penetrating the skin
- Gamma radiation and x-rays are eventually absorbed as they penetrate a dense material. It takes several feet of concrete or a few inches of lead to stop these rays. Flow meters are a source of this radiation type in addition to machines that use x-rays. Gamma rays are hazardous to the entire body and x-rays in a dose of 15 REM may cause temporary sterility in men
- Neutron radiation can be blocked using light elements like hydrogen which slow or capture them. It can be emitted by density gauges and can kill bodily cells, lead to cell mutation or cancer

Ionized radiation sources are usually protected by shielding or shuttering mechanisms which are closed when the radiation source is not in use. In the event of an accident or incident damage to such equipment may also damage the shielding device and may give rise to a radiation hazard if there is a leakage of the source.

Toolbox Talk

Radiation Safety

Discussion Date:

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Employee Participants:

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Actual Near Miss

A crew member was arc welding without wearing a welding shield in an engine room workshop. He was immediately stopped when spotted by another worker and was instructed to wear a welding shield at all times when performing arc welding for protection from UV radiation. It is important to remember that long-term exposure to UV light may lead to cataracts of the eyes in some people.

Precautions against radiation

It is important to follow safety precautions in order to protect individuals working in areas where they may be exposed to radiation and to minimize the chance of exposure and related risks of health hazards. Listed below are steps to help minimize radiation exposure.

- Always wear full PPE
- Equipment on board ships may contain radiation sources which could emit harmful radiation in the event of damage to the source; if damage is suspected, avoid areas where the equipment is located
- Employee exposure to radiation should be limited
- Employees at continuous risk should wear personal monitoring equipment
- Entry to radiation areas should be restricted and warning signs posted
- Radioactive materials should be properly labeled and stored
- Systems that produce radiation should be inspected and tested regularly
- Incidents involving radiation exposure should be reported immediately
- Radiography equipment contains large gamma sources; exclusion zones should be respected when this equipment is in use. Be on the lookout for exclusion zones and be aware of procedures in place involving this equipment

Personal monitoring equipment

Monitoring devices are to be used to detect and record the amount of radiation received by an employee. Examples are given here.

- Film or ring badges
- Electronic dosimeters
- Pocket ion chambers
- Neutron bubble dosimeters

Most badges are used for a period of three months before needing to be replaced and they should not be used by more than one employee.

Discussion

- In creating this Toolbox Talk, we contacted several experienced professionals to discuss near misses they have experienced concerning radiation: not many have been reported.
- The most important issue concerning radiation is that it may be around us at any time and most of us do not notice the effect it has on us until it is too late
- All near misses and injuries related to radiation safety should be discussed and reported to your supervisor immediately