Ships' radar in port

HSE information sheet

Docks Information Sheet No 5 (revised)

Introduction

Vessels in port are often seen with their radar scanner rotating. Does this mean that port workers are being exposed to harmful radiation? This information sheet, which is one of a series issued by the Health and Safety Executive's Transportation Section, explains the hazard and level of risk associated with radar on civilian vessels in commercial ports.

Operation of radar in docks

A ship's radar equipment has three major components – the generator itself, the monitoring screen, usually on the ship's bridge, and the antenna or scanner, usually mounted high up on the superstructure.

Radiation from the scanner scans out almost horizontally in a narrow beam as the scanner rotates and when the ship is in port will encounter dock buildings and equipment such as cranes, gantries etc. The beam will not normally spread down to pick up the ship superstructure or deck.

Although a ship does not normally need its radar equipment operating while in port, many rapid turnaround, roll-on roll-off vessels and other short-stay or on-call vessels such as tugs may well keep their radar equipment operating at all times.

Additionally, longer-stay vessels may need to switch radar equipment on some time before they leave port, to enable the unit to stabilise – they may also need to keep the scanner rotating at all times to prolong bearing life and ensure smoothness.

The scanner may be rotating but the set itself may not be operating since it is common practice for short-stay vessels to put radars onto 'standby' while in port. No radar emissions occur on 'standby'.

It is sometimes possible to operate a radar set with the scanner stationary but this will usually require some action to override the system for any significant power to be used.

Radar equipment may also be operated in port for routine maintenance, servicing or repair work.

Type of radiation and power of equipment

Marine radar systems operate in the high radio frequency (RF) and microwave range. Unlike X-rays and nuclear radiation, the emissions are non-ionising radiation and do not penetrate the human body but can cause heating of the surface, particularly of the skin and eyes (cornea).

The output power from marine radar equipment can vary between similar radar sets and with a number of other factors, including:

- the overall power of the radar set (usually measured in kilowatts, for example 60 kW);
- the gain of the antenna (expressed in decibels, dB). This is a measure of the concentrating power of a directional aerial such as a rotating scanner, in comparison with one that radiates in all directions such as a whip aerial;
- the transmission pulse repetition frequency;
- the transmission pulse width; and
- whether the set is scanning or non-scanning.

The power level people might be exposed to near a radar scanner will also depend on a number of additional factors, including:

- the distance from the scanner;
- the type of scanner or aerial; and
- the presence of absorbing or scattering objects.

The Radiation Protection Division of the Health Protection Agency has published guidance on exposure to electromagnetic fields (Documents of the NRPB - Volume 15, Nr 2, 2004 – *Advice on Limiting Exposure to Electromagnetic Fields (0 – 300 GHz)*).

This document recommends that the guidelines published by the International Commission on Non-Ionizing Radiation Protection should be used in the UK. The ICNIRP Guidelines (www.icnirp.org)

establish basic restrictions in terms of specific energy absorption rates (SAR) for human exposure.

As these quantities are not easily assessed, reference levels have been derived on the basis of conservative assumptions. The reference levels at the frequencies at which radars operate are expressed in terms of the power density. If measured values of the EMFs are above the reference levels, it does not necessarily mean that the basic restrictions will be exceeded, but that a more detailed assessment is needed.

In the relevant frequency range the reference level is 10 watts per square metre (Wm^{-2}): this is the same as 1 milliwatt per square centimetre ($mWcm^{-2}$) or 1000 microwatts per square centimetre (μWcm^{-2}).

Levels of radiation in ports

A typical container ship (with a capacity of about 3000 TEU) might have radar sets of 50 kW (3 cm wavelength) and 60 kW (10 cm wavelength), and a smaller vessel such as a tug might be equipped with a 10 kW set.

Measurements taken in a port, 10 metres from the **stationary** scanner of a container ship fitted with both a 50 kW set and a 60 kW set, and tests carried out by a manufacturer of radar equipment 10 metres from a 10 kW set with a **stationary** scanner, have all shown power densities significantly less than 100 μWcm^{-2}.

The examples show that the expected power densities from exposure to ships' radar at a distance of 10 metres are less than a tenth of the reference levels even when the scanner is stationary. Marine radars normally operate with a pulsed signal and a rotating scanner, so people are not continuously exposed to radiation even if they are in a fixed position such as a crane cab or an office adjacent to shipping.

No link between ill health and exposure to microwaves at levels below the ICNIRP recommendations has been established in the UK among microwave communications and radar engineers in the armed services, electronics, broadcasting or communications industries.

The HPA Advisory Group on Non-Ionising Radiation has concluded that there is no clear evidence of a carcinogenic hazard from the normal levels of radio frequency or microwave radiation to which people are exposed.

It is unlikely that any port worker will be exposed to significant risks from the marine radar emissions of a commercial vessel, during normal port activities.

Sensible precautions

If radar equipment is to be worked on under power in port, sensible precautions would include ensuring that:

- no one is close to the scanner, ie within a few metres;
- the scanner is rotating or, if the work requires the scanner to be stationary, that it is directed to unoccupied areas, eg out to sea;
- no one looks directly into the emission side of a slotted wave guide (open-box type) scanner;
- no one is able to position themselves between the output horn of the transmitter and the reflector of larger scanners;
- the risk of being hit by a rotating scanner is not overlooked if work close to the installation is necessary.

Any work carried out on such equipment should be carried out by competent persons, operating a safe system of work, so they don't put themselves or others at risk.

Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice.

This document can be found at: www.hse.gov.uk/pubns/dis5.pdf.

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