



# Ships' radar in ports

## HSE information sheet

- [Introduction](#)
- [Operation of radar in docks](#)
- [Type of radiation and power of equipment](#)
- [Levels of radiation in ports](#)
- [Sensible precautions](#)
- [Further information](#)

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.

### 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 Docks National Interest Group, 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, eg 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 National Radiological Protection Board (NRPB) has published guidance on exposure to non-ionising radiation (Documents of the NRPB - Volume 4 1993 - *Board Statement on Restrictions on Human Exposure to Static and Time Varying Electromagnetic Fields and Radiation*). This document recommends investigation levels which set the power density above which people should not normally be exposed. In the relevant frequency range this is 100 watts per square metre ( $\text{Wm}^{-2}$ ): this is the same as 10 milliwatts per square centimetre ( $\text{mWcm}^{-2}$ ) or 10 000 micro watts per square centimetre ( $\mu\text{Wcm}^{-2}$ ).

---

## 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 meters 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  $100 \mu\text{Wcm}^{-2}$ .

The examples show that the expected power densities from exposure to ships' radar at a distance of 10 metres

are less than 1/100th of the investigation 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 NRPB recommendations has been established in the UK

among microwave communications and radar engineers in the armed services, electronics, broadcast or communications industries. The NRPB 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 that they put neither themselves nor others at risk.

---