



## Guidance Note GN-020

# Radio-Frequency Safety for Non-Telecommunications Workers



# MATS Group Guidance Note

## RF Safety for None-Telecommunications Workers

### 1 Introduction

This document is intended to provide basic guidance on radio-frequency (RF) safety to workers that do not work on telecommunications or broadcast systems but who may be exposed to these systems due to the environments in which they work e.g. use temporary access equipment to work at height. It is important that people are knowledgeable about RF as it is an invisible hazard.

Radio-frequency is non-ionising radiation which can cause molecules to vibrate and generate heat but **it does not have enough energy to cause chemical changes in the body**. Non-ionising radiation is very different to ionising radiation like x-rays or gamma rays (found in hospitals, nuclear energy plants etc) which has enough energy to cause chemical changes by breaking chemical bonds.

The key elements of this document are:

- At Risk Workers
- Sources of RF radiation
- Effects of Exposure to RF
- Risk Assessment when working near RF sources

### 2 At Risk Workers

The proliferation of cellular antennas and other RF-generating devices in areas where construction and maintenance work is regularly performed creates the potential for workers to be exposed to harmful levels of RF radiation.

At risk workers include:

1. Roofers
2. Electricians
3. Builders
4. Scaffolders
5. MEWP Operators
6. Emergency Services
7. Tree fellers
8. Local Authority maintenance workers
9. Anyone who works on rooftops, sides of buildings, street furniture or other locations where RF generating sources are located.

### 3 Sources of RF Radiation

Common sources of RF radiation include:

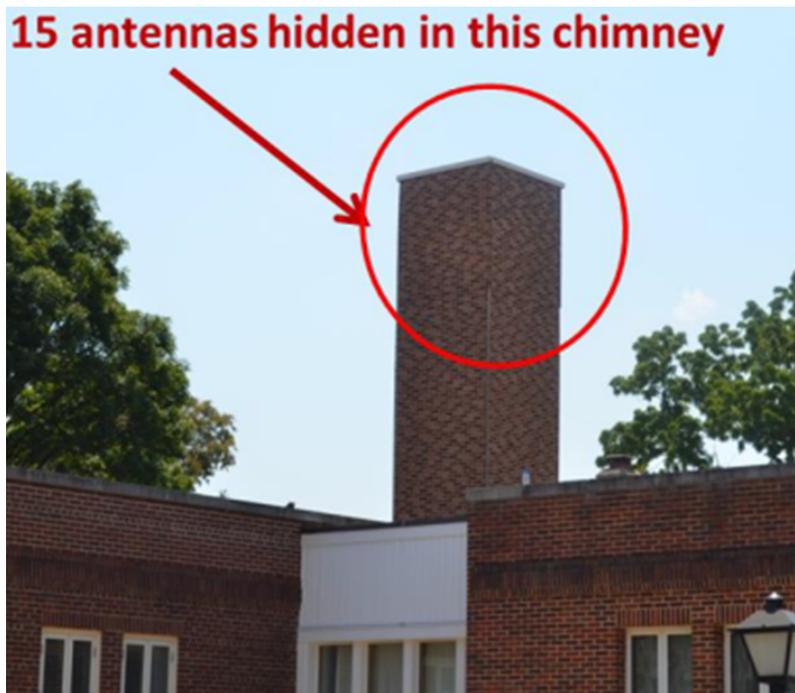
1. Microwave Ovens

2. Radar
3. Medical Appliances
4. Telecommunications and broadcast services.

This latter category includes cellular antennas and base stations, radio and television broadcasting, radio communications for police and fire departments, microwave point-to-point radio links, and satellite communications.

As demand for cellular service has grown, there has been a significant increase in the number of cellular sites in a relatively short period of time. Therefore it is absolutely imperative that workers always include RF within their work risk assessments.

Some RF sources may not be immediately obvious due to so-called 'stealth solutions' which are designed to be more aesthetically pleasing and to adhere to planning restrictions so it is important to look for potential sources of RF and signage indicating the presence of antennas as they are not always obvious as per the example in the photo below:



#### **4 Potential effects of exposure to RF**

Exposure to high levels of RF can give rise to effects that may be irritating, unpleasant or worse. The effects may be thermal or non-thermal effects:

Thermal effects:

1. Heating of tissues – eyes and testes are particularly vulnerable
2. Blindness and or Sterility \*mainly associated with broadcast antennae
3. Burns and or Electrical shocks \*mainly associated with broadcast antennae

Non-thermal effects including:

1. Alteration of body's circadian rhythms, immune system, and nature of the electrical and chemical signals communicated through the cell membrane
2. Interference with medical devices such as pacemakers
3. The World Health Organisation classifies radio-frequency electromagnetic fields as "possibly carcinogenic to humans" which is the same classification as Bacon and Caffeine.

Essentially, a person that has been exposed to high levels of non-ionising radiation may demonstrate one or more of the following symptoms:-

- Labored breathing
- Perspiring
- Headache
- Numbness
- A tingling sensation or numbness, skin crawling, or itching
- Malaise or an overall sense of feeling mentally or physically unwell
- Diarrhea
- Reddening of the skin due to inflammation

It is easy to associate these symptoms with a separate health issue such as the flu, the weather conditions or the strenuous nature of the work, so it is important that workers are aware of potential RF sources and the symptoms of exposure and that they cease works and move away from the source if they feel they have been exposed.

If medical attention is sought, the guidance document below can be used to assist medical practitioners who may not be used to treating RF exposure:-

[www.matsgroup.info/guidance-notes/](http://www.matsgroup.info/guidance-notes/)

GN-004 – Guidance for Doctors in the Assessment and Acute Treatment of a Patient Suspected of Over-exposure to Radio Frequency Radiation

## 5 Risk Assessment

Once RF sources have been identified, the next challenge is how to create a safe working environment for the workers. When deciding on the best protective measures to take, the following must be considered:

1. The distance from antennas,
2. Whether or not the antennas are emitting RF radiation in one direction or multiple directions,
3. The angle of the antenna. It is important to be aware that the angle of some antennas can be remotely adjusted, meaning the job may not be in the path of the antenna when work starts– but a change in the antenna's angle could put workers in harm's way while working, and
4. The height of the antennas from the work surface.

Given that power levels and, as a result, exposure levels are always fluctuating, it is best to exercise caution:

1. Assume all antennas are active and operating at full power, unless you have specific information in writing from the licensee that this is not the case.
2. Stay away from the source and the direction the RF radiation is being emitted.
3. If the work is near a cylindrical or rod-shaped antenna be aware that it emits RF radiation in all directions,

4. If the work is near a rectangular or dish-shaped antenna, which only emits RF radiation in one direction, then you can work safely as long as the antenna is not pointing at you or your work area. This also applies to antennas on nearby buildings – not just the building you are working on.
5. Request to have the antennas powered down,
6. Use a personal RF monitor and, if the antenna cannot be powered down or moved, use RF protective clothing. Use of personal monitors and protective clothing should be part of a larger RF safety program.

### Maintain a Safe Distance

Distance is important because the power density decreases the farther away from the source, both horizontally and vertically. Therefore, exposure drops the greater the distance or the higher up the antenna is from you. To maintain a safe distance:

1. Follow the instructions on posted signs.
2. Know how to recognize and understand any information on RF warning signs (typical RF hazard warning sign shown here)



3. Do not cross fences/barriers set up to restrict access
4. Pre-plan work tasks and travel routes to limit trips through and time spent in RF fields.
5. Limit the time spent performing tasks near antennas. Your risk increases the longer you spend in the RF field.

If signs or barriers are not present and the antenna owner(s) or building management cannot demonstrate otherwise, **always assume that all antennas are active.** This also applies to antennas on nearby buildings and poles, remember when ascending in a MEWP or climbing a ladder or pole, look around and include the RF assessment within your risk assessment.

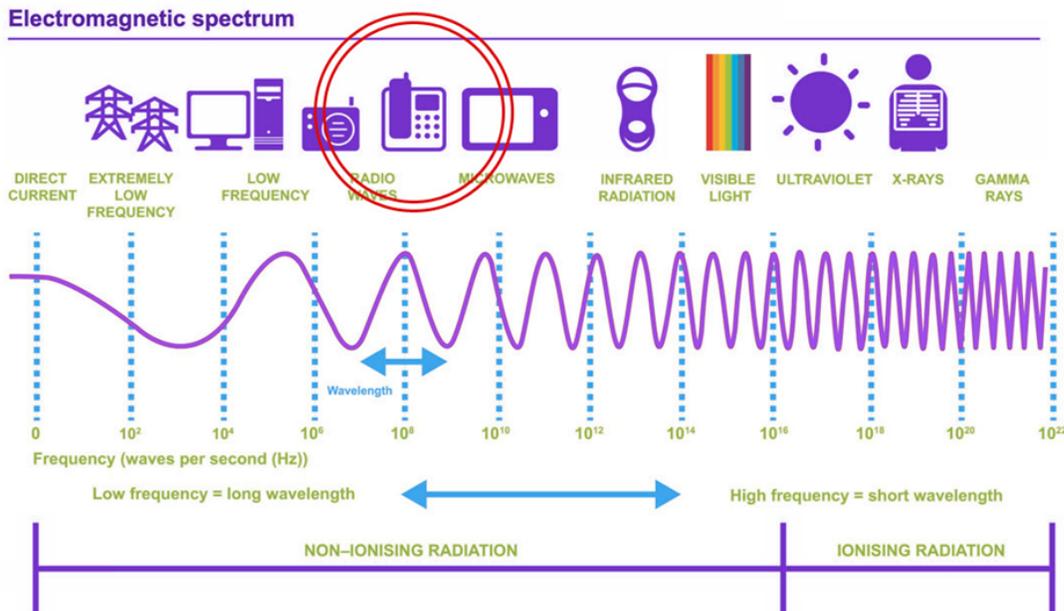
### Personal Factors

The risk assessment should also consider whether individuals are deemed to be at 'particular risk' from RF. Special consideration needs to be given towards females of a child bearing age and persons with active medical devices such as pacemakers or passive implants like joint prosthetics.

If in doubt, ask or cease work until you know RF sources have been depowered or have been made safe for you to enter the area of work, **remember RF is invisible!**

## Appendix A-

The diagram below shows the electromagnetic spectrum from extremely low frequency (non-ionising) to gamma rays (ionising). There are different types of non-ionising radiation. At one end of the non-ionising radiation spectrum is extremely low frequency or ELF radiation, which can be emitted through electric currents from overhead power lines and equipment powered by electricity and at the other end is radiofrequency (RF) radiation (indicated by the red circles). RF radiation is much higher frequency than ELF radiation and therefore potentially more harmful.



RF radiation collectively refers to radio waves and microwaves and is characterized by wavelength and frequency. The frequency of each wave is measured in Hertz (Hz) – cycles per second. Kilohertz (KHz) are low frequency – 1,000 cycles per second. Megahertz (MHz) are 1 million cycles per second, and gigahertz (GHz) are at the high end – 1 billion cycles per second.

The RF and microwave parts of the electromagnetic spectrum are generally defined as that part of the spectrum where electromagnetic waves have frequencies in the range of about 3 kilohertz (3 kHz) to 300 gigahertz (300 GHz). As shown in Figure 1, microwave radiation has higher frequencies than radiofrequency, but the two are often grouped together.

In general, signals with longer wavelengths travel a greater distance and penetrate through and around objects better than signals with shorter wavelengths. Low frequencies have longer wavelengths. Higher frequencies have shorter wavelengths.

Frequency matters because, when it comes to the health effects, different frequencies affect humans differently.

Frequencies between 30 and 300 mega hertz appear to be the most harmful to humans because it is the range where humans absorb RF radiation most efficiently. Distance is also important because the power density decreases farther away from the source.

The amount of RF power generated is measured in watts and a common measure of RF radiation power density is milliwatts per square centimeter (mW/cm<sup>2</sup>).

## Appendix B- Photographic Examples of RF Sources

Below are some pictures to demonstrate what workers need to look for. Sites are designed so that areas readily accessible to members of the public and workers are safe, however the risk increases when specialist equipment is used to put people in an elevated position:



RF Source  
Close to building 1<sup>st</sup>  
Floor



When working  
adjacent to  
rooftops you  
need to consider  
RF Sources  
around you



Some RF sources may not be immediately obvious



RF Source near street furniture. This needs to be included in the risk assessment. Assume all RF sources are live until you have evidence to prove otherwise

\*\*\*\*\*

*The information in this document does not absolve contractors or suppliers from their responsibility to identify and comply with all relevant legislation, regulations and legal standards nor does it take precedence over laws, regulations and external standards.*

GN-020	Issued	Review date
Version 1.0	December 2019	November 2021
Version 1.1 images added	January 2020	November 2021