

A REVIEW OF THE PHYSICAL AGENTS (ELECTROMAGNETIC FIELDS) DIRECTIVE

Howard Venning

Aspen Electronics Ltd

Abstract - *The First directive on “Physical Agents” (Electromagnetic fields) was published in April 2004 with a transposition date of April 2008. Its publication resulted in a major lobbying effort from “interested parties” resulting in the transposition date being amended to April 2012. This was extended again without a firm transposition date being set.*

In June 2013 the latest version of the directive was published with a transposition date of 1st July 2016. It would appear that this directive takes into account the concerns of all “interested parties” and at the time of writing, will not be postponed further. Therefore from the middle of 2016 it will become law for employers to ensure employees are protected from electromagnetic fields. Whilst the majority of ARMMS attendees will already have a good understanding of electromagnetic fields (EMF) and the steps needed to protect themselves from potentially harmful effects; this new directive means a wide range employers will have the responsibility of dealing with a situation that, when viewed in basic RF/Microwave terms, is as complex as any. This paper explores the subject in more detail.

INTRODUCTION

The full title of the directive is as follows:- DIRECTIVE 2013/35/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 June 2013 on the minimum health and safety requirements regarding the exposure of workers to the risks arising from physical agents (electromagnetic fields) (20th individual Directive within the meaning of Article 16 (1) of Directive 89/391/EEC and repealing Directive 2004/40/EC.

Note the reference to Directive 89/391/EEC, which is the overriding EU directive on health & safety and since its introduction has been considered by many to be the start of the “Health & Safety Culture” that is responsible for much written on the subject in the popular press.

However, the Physical Agents directive points in paragraph (1) that its main purpose is, “... to guarantee a better level of protection of the health and safety of workers...” and so we will review its content accordingly.

THE DIRECTIVE – an overview

The Directive consists of:-

Chapter 1, an introductory section plus General Provisions chapter, which provide background to the requirements, which the directive states, are based upon the International Commission on Non-Ionizing Radiation Protection (ICNIRP) recommendations. Note the reference to non-ionizing radiation, in contrast to ionizing radiation typically associated with the “nuclear” industry.

Chapter II outlines the obligations of Employers. Chapter III, miscellaneous Provisions and finally Chapter IV, entitled Final Provisions, which detail the need for Practical Guides, plus some “housekeeping” notes. There then follows a number of Annexes detailing Exposure Limit Values and Action Levels for Non-Thermal and Thermal effects.

THE DIRECTIVE – Introductory details

This Directive introduces, “...more appropriate and proportionate measures to protect workers from the risks associated with (EMF)...” and is intended to “...address all known direct biophysical effects and indirect effects caused by (EMF)...”. “...The Directive does not address suggested long term effects of exposure... since there is currently no well-established scientific evidence of a causal relationship.” Minimum requirements are laid down with the option of fixing lower values for “...action levels or the exposure limit values...”. In addition “...The system of protection should be limited to a definition which should be free from excessive detail,...”.

“In order to protect workers...it is necessary to carry out an effective and efficient risk assessment...proportional to the situation encountered...”.

“...There is ... a need to avoid duplication of assessments where work equipment meets the requirements of relevant Union law on products ...”.

Employers should be required to ensure risks arising ...are eliminated or reduced to a minimum. But levels can be “temporarily exceeded”.

Annex II & III specify exposure limit values and action levels for Non-Thermal and Thermal effects. Looking at the levels specified in the Annexes, the Directive is a direct read across from the ICNIRP standards that everyone should already be aware of.

THE DIRECTIVE – Employers Obligations

“...employers shall assess all risks ... and if necessary measure or calculate the levels... to which workers are exposed...”. These calculations or measurements shall be carried out by competent persons at suitable intervals and results preserved to permit later consultation.

Health and Safety Executive (HSE) uses the following definition to define a competent person: *Someone who has sufficient training and experience or knowledge and other qualities that allow them to assist you properly. The level of competence required will depend on the complexity of the situation and the particular help you need.*

Key elements of any risk assessment include defining the scope of your responsibility. This would typically include:-

- Definition of the physical space(s) under your control
- Types of workers and their roles / activities
- Processes undertaken
- Equipment installed / used on site
- Potential sources of EMFs outside your control
- Any other important factors.

An initial assessment will tend to identify a number of risks groups. These include, fields around equipment emitting high magnetic fields; equipment emitting fields due to high electrical voltages or currents, typically at low frequencies; and fields associated with Radio Frequency (RF) transmission, typically in the range 100kHz to 300GHz.

The Directive advises that when carrying out a risk assessment you should pay particular attention to, the exposure limit values, the frequency duration and type of exposure, any biophysical effects, any effects on workers at particular risk (i.e. those fitted with cardiac pacemakers, insulin pumps, or other implants), multiple sources of exposure, simultaneous exposure of multiple frequency fields, to name some of the requirements. Lastly, ensure you record the assessment process, calculations, measurements and results of any findings.

When completed the employer shall review the assessment and identify which measures must be taken to reduce risks. Standard health & safety procedures typically state that any risk assessment should be proportional to the situation encountered. Therefore in relatively benign environments the risk assessment could be a relatively simple statement with reasons as to why a further detailed risk assessment is not necessary. Alternatively it may outline the start of a more detailed assessment process.

As with most health & Safety legislation, once a risk has been identified Employers should “...devise & implement an action plan ...” to reduce or minimise said risk. If you are in control of EMFs or the environment in which they operate, this may be a relatively simple process of introducing safe working practices, signs, “safe zones”, operating interlocks, shielding and most importantly employee training. Unfortunately there is little you can do about EMFs from sources outside your control other than report this occurrences to the authorities.

The Directive states that “the employer shall ensure that workers who are likely to be exposed ... and/or their representatives receive ... necessary information and training...”. In addition there is a requirement for worker consultation and participation.

The Directive also specifies that appropriate health surveillance shall be carried out.

Lastly, you will need a procedure for monitoring changes and deciding upon review periodicity. For benign environments this would be relatively simple. However, for a facility involved in multiple projects involving development test, trials etc., a formal reporting procedure may need to be introduced and managed.

CONDUCTING AN EMF AUDIT

So, your risk assessment recommends an EMF audit. If you or your organisation has a competent person, you are fortunate and they can undertake the calculations and/or measurements required. The alternative is to hire this resource.

Initially the audit should be an information gathering exercise using the risk assessment as a reference. Chapter IV of the Directive makes reference to “Practical Guides” which, once they are published in early 2016, should provide a definitive audit methodology and give guidance on demonstrating compliance, with information on calculation methods, measurement procedures and techniques.

It is worth noting the EU already has a similar “EuroNorm” or standard covering this subject, which is “EN 50499 – Procedures for the assessment of the exposure of workers to electromagnetic fields. However, whilst this normative is currently being rewritten its methodology brings up an interesting observation.

EN 50499, in effect, outlines a procedure whereby, if you have a number of sources of EMF that individually have all been certified as being CE compliant, then by default you don't; have to worry. Table 1 includes items such as, Mobile & cordless phones, Two-way radios Base Station Antennas etc. etc.

It will be interesting to see if the Directive Practical Guides follows this path, as if it does, the vast majority of employers will find compliance relatively simple. An “asset” audit followed by a paperwork assessment, leading to a compliance statement, should do the job. Whilst this may be suitable for some, the only way to really know what is happening is to take some measurements.

MAKING MEASUREMENTS

Whilst the directive does make reference to performing calculations, the best course of action will be to make measurements. In doing so it is important that you select the correct equipment. Whilst many may have access to Spectrum Analysers, some of which may be fitted with sophisticated “signal strength” measurement routines, these will not be suitable for conducting a full EMF survey.

This is especially true when you consider the range of measurements that will need to be taken in large multi process facilities where RF equipment is co-located with welding and other electrical process equipment, high voltages & current, plus the possibility of magnetic fields.

Ideally one should use a Field Strength meter / probe. Suitable meters will typically have a selection of probes for electrical (E) field strength and magnetic (H) field strength, plus cover the wide frequency range needed for a thorough assessment.

In addition dedicated field strength equipment will have the required 6 minute “time averaging period” as required by ICNIRP, embedded in the measurement routines and provide measurement results in T, Vm^{-1} , Wm^{-2} etc. Plus, associated accessories, such as a wooden tripod on which to mount the probe and/or a fibre optic link to download results.

Based upon measurements you may determine that no further action is necessary. However, if further assessments are necessary you might need to install a continuous monitoring system that will give you a 24/7 reading of field strength. An alternative might be to fit vulnerable workers with body worn monitors.

Typical results of such a monitoring system demonstrate another aspect of measurement procedures. In the example shown, a school is concerned about EMFs from a local base station. Notice the difference in levels measured during the working day and you will notice the peak and troughs occurring at different times of day. Peaks during the working day, and troughs at night, when most people are asleep. Weekends also show a drop in levels, as do holiday periods. (Figures 1.1 – 1.3) Using the average level functions, variations range from $1.43Vm^{-1}$ for the period Monday to Friday 16th – 20th March; $1.36Vm^{-1}$ for the period Saturday – Sunday 21st – 22nd March and $1.34Vm^{-1}$ for the period 30th – 31st March 2015.

Again, looking at these results you will see that they are well within the ICNIRP recommendations. However, as previously mentioned the Directive does allow for the fixing of lower values for “action levels”.

Whilst ICNIRP has a level (for frequencies between 10MHz and 300GHz) of between $28Vm^{-1}$ & $61Vm^{-1}$, as an example, Cambridge City Council has set an action level of $3Vm^{-1}$. Taking all of this into account, the standard ICNIRP compliance statement you get from cellular operators that give a “blanket” statement along the lines that “our measurements demonstrate that levels are hundreds or thousands of times lower than the ICNIRP general public guidelines” is, based upon these findings, no longer fit for purpose.

COMPLIANCE

As with all EU directives, member nations are responsible for transposition into domestic law and determining penalties in the event of “infringements”. Both the UK Health & Safety Executive and Public Health England have posted information regarding this directive on their websites, but it is still too early to tell exactly how this legislation will be transposed and policed.

As it is primarily health & safety legislation focusing on worker wellbeing, it may be the case that employers have to demonstrate compliance in order to ensure they meet the requirements of their employee liability insurance.

CONCLUSION

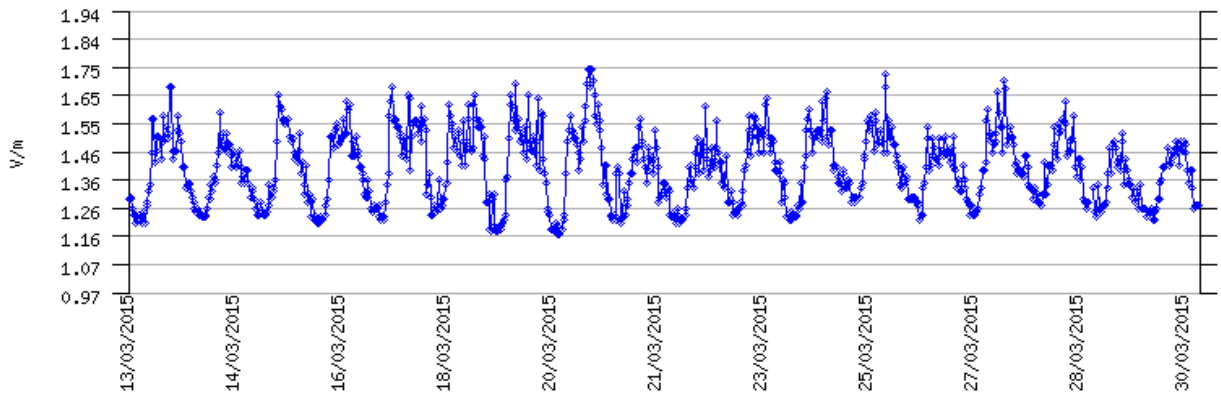
As with many EU directives, initial review tends to raise far more questions than answers. However, when viewed pragmatically, demonstrating compliance with this directive is relatively easy and followed a well-trodden path. Initial investigation of both internal and external sources will highlight the need for formal measurements and these will determine the need for new or amended procedures and training, plus possible long term monitoring. Regular review of internal process and external developments will ensure continued compliance.

FURTHER READING

I would recommend that anyone interested in the latest opinions on the subject of the possible health effects of EMF read the Scientific Committee on Emerging and Newly Identified Health Risks (SCENIHR) Opinion on Potential health effects of exposure to electromagnetic fields (EMF) published 20-01-2015.

REFERENCES

1. Directives; 2004/40/EC published – 30th April 2008, 2008/46/EC published 23rd April 2008, 2012/11/EU published 19th April 2012, Directive 2013/35/EU published 26th June 2013
2. EN50499 – Procedures for the assessment of the exposure of workers to electromagnetic fields



MAXIMUM registered value in the period: 1.74 V/m
Date: 20/03/2015 Time: 17:00

AVERAGE of the period: 1.40 V/m

Fig 1.1 - 18 day period

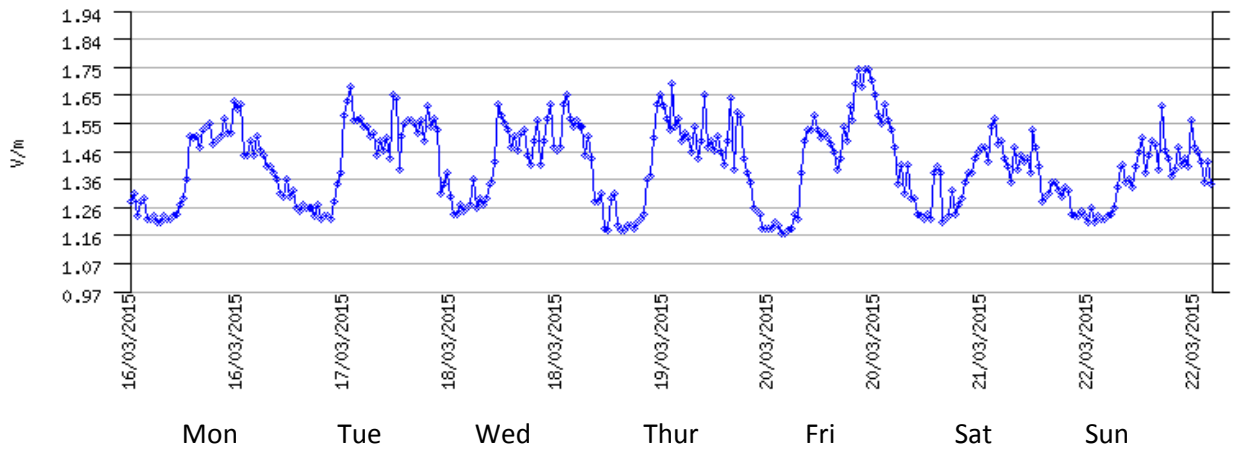


Fig 1.2 - 7 day period

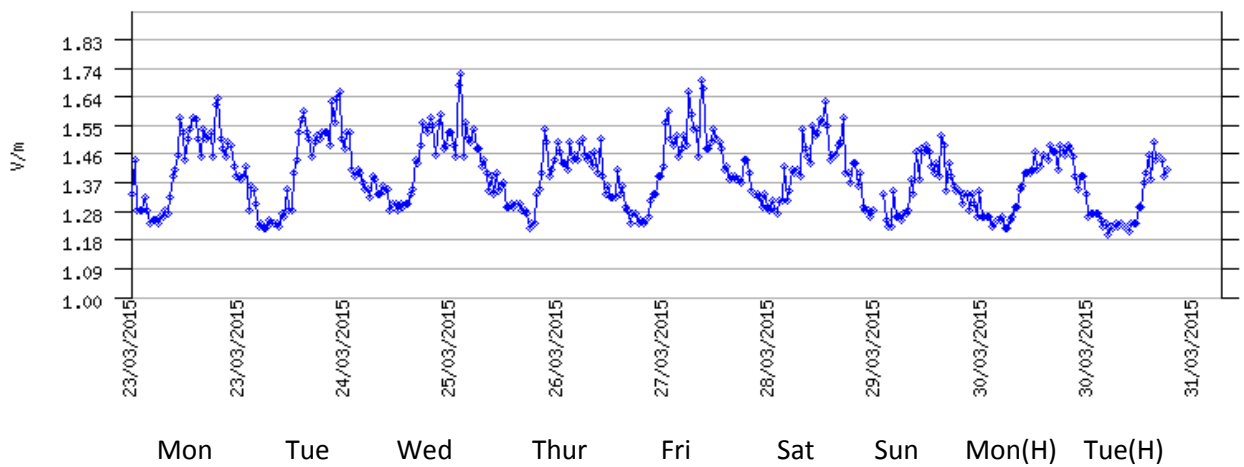


Fig 1.3 - 9 day period - last 2 days "holiday days"