

Do Electromagnetic fields in chlor-alkali production pose a health problem?

Electromagnetic fields (EMFs) are generated by electrical equipment, including those used to make chlorine and caustic soda. Some people link health problems to exposure to EMFs (for example from mobile telephone masts and sun-beds). In chlorine plants, workers are exposed to static, extremely low-frequency (ELF) electromagnetic fields of relatively low strength. Based on the currently available science and on decades of Euro Chlor experts' experience with chlorine and caustic soda industry workers, no EMF-related health effects are expected. Despite this, the chlor-alkali industry remains vigilant and the Euro Chlor Health Working Group have written some advice for two specific groups of workers...

What are electromagnetic fields?

An electromagnetic field (EMF) is a form of radiation that results from the combination of magnetic and electric fields. In electrolysis units, an electric current runs through a salt solution to transform common ('kitchen') salt (NaCl) into chlorine gas (Cl₂) and caustic soda (NaOH). The flow of electricity through the cells induces a magnetic field and together they generate an electromagnetic field.

Many people have heard of EMFs associated with everyday items such as power lines, household appliances, computer screens, communication masts, and mobile telephones. As shown in Figure 1, those fields generated during chlorine production have extremely low frequencies which do not interact with the body as much. Not only the frequency, but also the field strength is important. A higher field strength may be encountered around some electrical equipment, but overall it remains weak in the major areas of the plant.

Why are people worried about EMFs?

For several years now, there has been rising concern about health effects associated with electromagnetic fields (e.g. from mobile phones and power cables). Living close to power lines has been linked to the development of specific types of cancer and to a multitude of additional health effects. Even though completely different frequencies and field strengths are encountered in chlor-alkali plants, many questions are raised by chlorine and caustic soda industry workers.

As a general rule, it must be understood that any health effect due to exposure to an EMF depends mostly on the frequency of the field the person is in.

This is because different frequencies interact with the body in various ways. Generally lower frequency fields cause stimulation of nerves and muscles, whilst higher frequency fields cause heating and even tissue damage. As said before, next to the frequency, the field strength will also play a role. Therefore it is important to consider both parameters.

European legislation

Directive 2013/35/EU aims to introduce appropriate and proportionate measures to protect workers from the risks associated with electromagnetic fields. It covers all industries, including medical applications (such as MRI imaging) where nurses are typically exposed to high frequency EMFs. The Directive defines so-called 'Exposure Limit Values (ELVs)' for different types of health effects. Above these values, workers might experience (e.g.) stimulation of nerve and muscle tissue, altered sensory perceptions, minor changes in brain functions without health effects etc. As the internal EMF in the human body cannot be measured, external 'Action Levels (ALs)' have been established to know when specific prevention and/ or protection measures are needed.

As the subject of EMFs is very technical, the Directive was accompanied by a non-binding guide that aims to assist companies in carrying out a first assessment on the risks of EMFs in their workplace and to provide some practical advice on the tailored measures to be taken. The guide contains a specific annex describing the situation in the chlor-alkali industry.

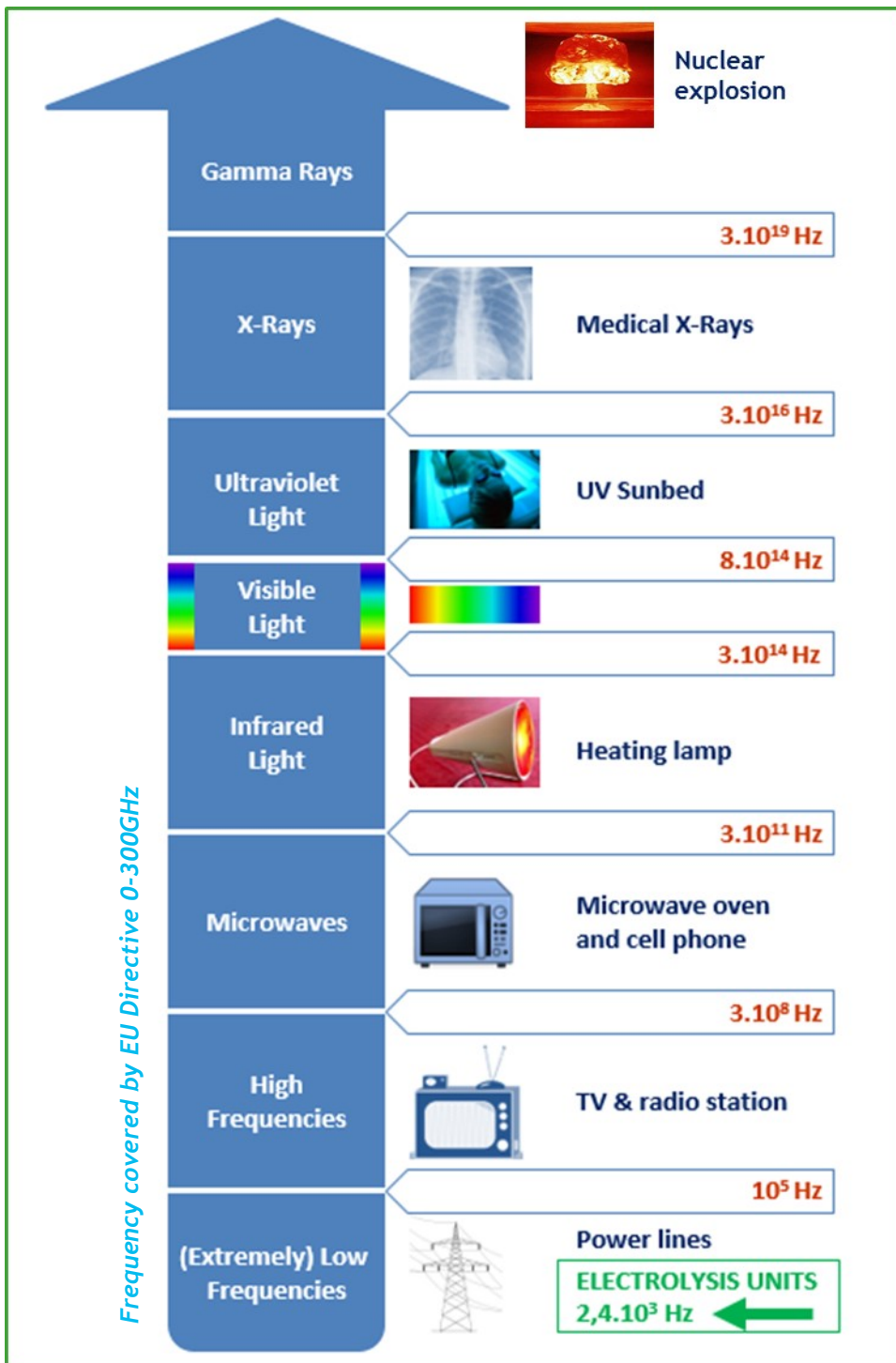


Figure 1. The EMF spectrum

Health effects related to extremely low frequency (ELF) electromagnetic fields

Health effects after short-term exposure

Low frequency magnetic fields, such as those found in chlor-alkali plants, have, under laboratory conditions, shown to cause stimulation of sense organs and stimulation of nerves and muscles (particularly in the arms and legs). The eyes appear to be the most sensitive to the effects of magnetic fields. People experienced 'phosphenes', which are elusive, flickering, visual sensations at the edge of vision. They are similar to the effect that can be seen upon gently massaging closed eyes.

These effects only occur when the field strength is sufficiently high. In addition, they are not harmful but may be irritating or distracting to workers. Nevertheless, in over 25 years of checks, the occupational physicians in the Euro Chlor network have not encountered any of the above complaints or symptoms.

Health effects after long-term exposure

The EU EMF Directive does not address the issue because there is currently no conclusive scientific evidence linking exposure to ELF EMFs to things like Alzheimer's, stress, suicide or depression. Therefore, the European Commission continues to monitor the science and, should it be appropriate, the necessary means for addressing potential adverse effects will be considered.

Regarding the link between ELF fields and cancer, only one type of cancer is still debated, childhood leukaemia. As children do not form part of the workers' population, this scientific discussion is not of relevance here.

Indirect effects via conducting objects

Any metallic (conducting) object, such as a vehicle or a fence that is not electrically grounded, can be charged by an electric field. Anyone who then touches these objects may receive a small electric shock.

Whilst one shock might be simply surprising, repeatedly receiving shocks may become annoying or worse. In order to provide the necessary protection, specific training is given and grounding of objects and workers is of benefit. Insulating shoes, gloves and protective clothing are useful here too.

Important worker specific information

Pregnant women

In over 25 years of study, Euro Chlor occupational physicians have found no literature on the effects of EMF on pregnancy. Nevertheless, European Directives require a detailed assessment of the exposure risk to pregnant workers, as well to chemicals and non-ionizing radiation (including electromagnetic fields). As such, as a precautionary measure, pregnant women should not be allowed to go where the limit for the general public may be exceeded.

Implanted materials and devices

Metallic materials cannot be moved by those EMFs found in chlor-alkali electrolysis units as the field strength is not strong enough.

The functioning of certain devices, such as pacemakers, may be affected in areas where frequency and field strength are highest. The manufacturer of such devices may certify that the device will not be affected by those fields, but especially older models may be more susceptible. Therefore, before entering the plant, all workers should be informed of the potential risk posed by exposure of medical devices to EMFs and requested to inform and consult their employer and/or medical doctor. Adequate information should be given to visitors too.

Both of these scenarios are summarized overleaf.

Euro Chlor initiatives

Euro Chlor document *Health 10: Electromagnetic Fields in the Chlorine Electrolysis Units - What an Occupational physician should know?* provides a concise explanation on this subject for those who deal with potential health effects of electromagnetic fields. This distills nearly 300 pages of EU EMF Guideline and is available on the Euro Chlor website.

References

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. Official Journal of the European Union L179 (29/06/2013):1-21, available via <https://osha.europa.eu/fr/legislation/directives/directive-2013-35-eu-electromagnetic-fields>

Non-binding guide to good practice for implementing Directive 2013/35/EU 'Electromagnetic Fields', volume 1 and volume 2, both of them available via <https://osha.europa.eu/en/oshnews/eu-non-binding-guide-good-practice-implementing-directive-201335eu-electromagnetic-fields>

This Focus on Chlorine Science (FOCS) is part of a series of leaflets aiming to clarify and consolidate scientific research in the field of chlorine industry. With the FOCS series, we want to facilitate the knowledge gathering of scientists, regulators and key decision makers. For further Euro Chlor science publications, please consult <https://www.eurochlor.org/resources/publications/>

Euro Chlor

Euro Chlor provides a focal point for the chlor-alkali industry's drive to achieve a sustainable future through economically and environmentally-sound manufacture and use of its products. Based in Brussels, at the heart of the European Union, this business association works with national, European and international authorities to ensure that legislation affecting the industry is workable, efficient and effective. Chlorine and its co-product caustic soda (sodium hydroxide) are two key chemical building blocks that underpin 55% of European chemical industry turnover.

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