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Federal Administration admin.ch

Federal Department of Home Affairs DHA

Federal Office of Public Health FOPH

Effets des rayonnements non ionisants sur la santé

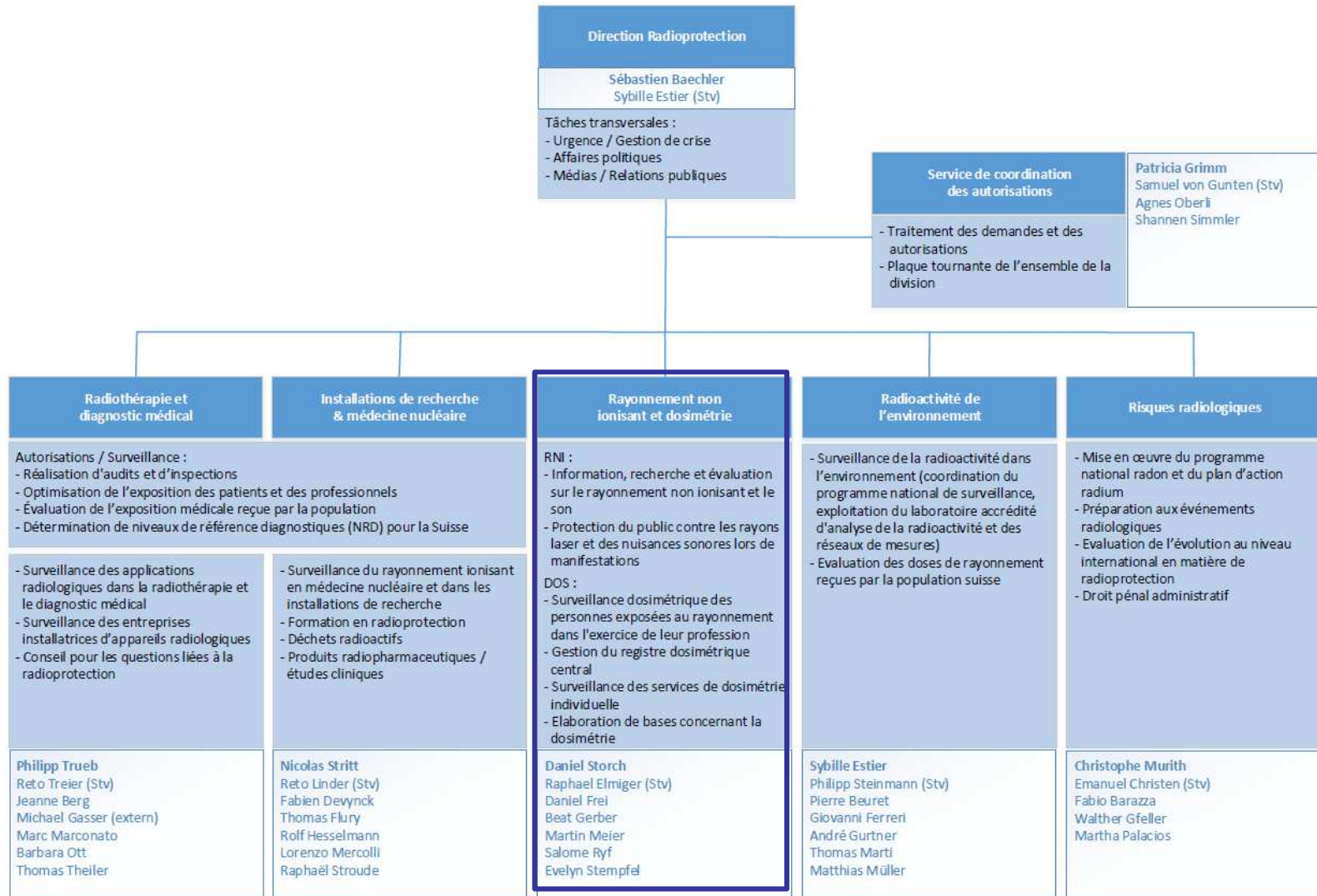
11.03.2016, BH08-1 Alexandre Yersin, CHUV

Daniel Storch - Federal Office of Public Health





FOPH – Département of Radioprotection





Topics

- Electromagnetic Spectrum
- International Commission on Non-Ionizing Radiation Protection ICNIRP
- Factsheets FOPH – Risk Communication
- Federal Law on Protection against NIR and Sound



General Remarks

Non-ionizing Radiation is everywhere

... Sunlight – natural source

... Communication technologies (Internet, WLAN, Smartphones, Bluetooth, ...)

... Energy sector – Powerlines

... Light, Lamps – LED (light-emitting diodes)

Omnipresence – Visibility – (baseless) fears ?



WHO



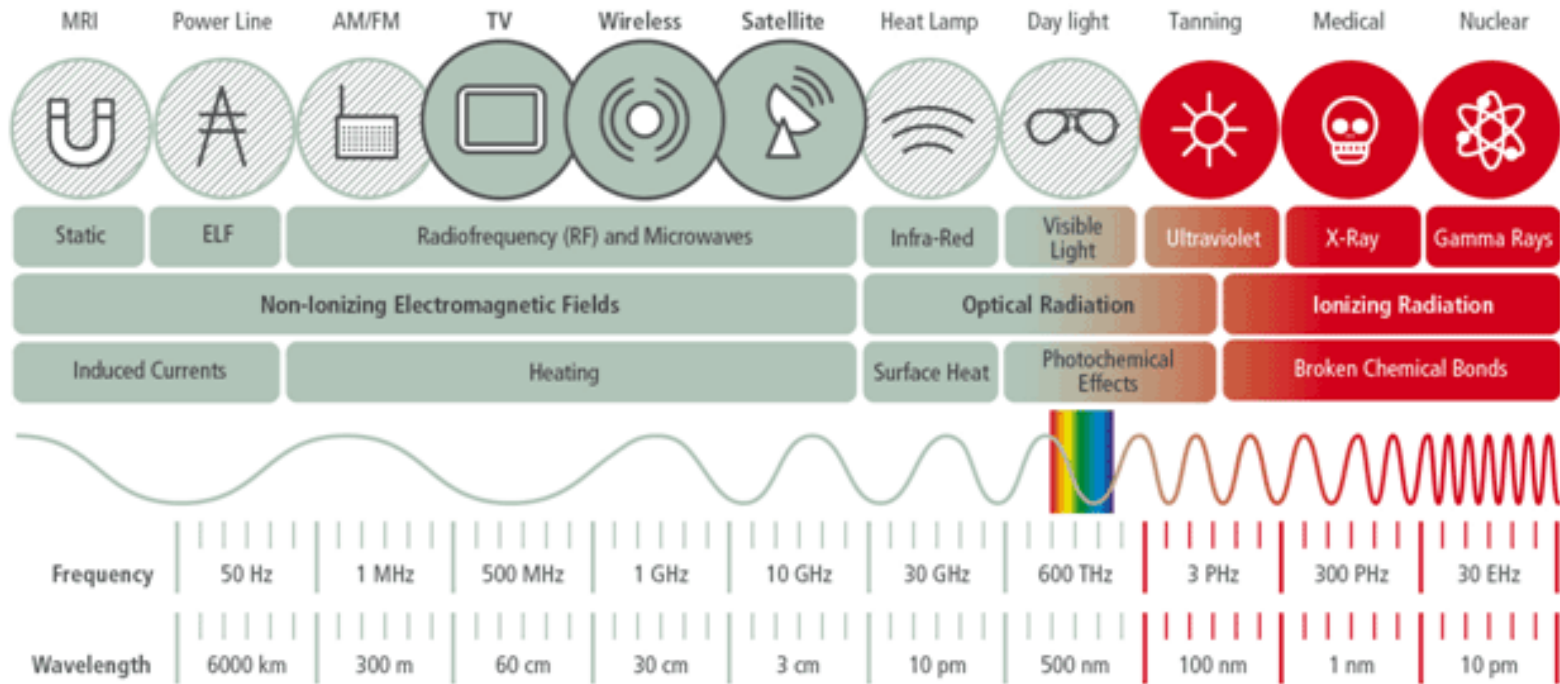
«Definition» Radiation, Non-ionizing:

Non-ionizing radiation is the term given to radiation in the part of the electromagnetic spectrum where there is insufficient energy to cause ionization. It includes electric and magnetic fields, radio waves, microwaves, infrared, ultraviolet, and visible radiation.





Electromagnetic Spectrum





ICNIRP

As an independent organization, the International Commission on Non-ionizing Radiation Protection (ICNIRP) provides scientific advice and guidance on the health and environmental effects of non-ionizing radiation (NIR) to protect people and the environment from detrimental NIR exposure.

NIR refers to electromagnetic radiation such as ultraviolet, light, infrared, and radiowaves, and mechanical waves such as infra- and ultrasound. In daily life, common sources of NIR include the sun, household electrical appliances, mobile phones, Wi-Fi, and microwave ovens.

[READ MORE](#)

FREQUENCIES

Non-ionizing radiation (NIR) is a generic term used to describe electromagnetic radiation that does not carry enough photon energy to ionize atoms or molecules and, as per its definition, also includes mechanical waves (infra- and ultrasound).

Non-ionizing radiation is sub-grouped into frequencies (number of oscillation per second) or wavelength bands (distance between two peaks of an oscillation). This classification is not always used strictly and might differ depending on the information source. ICNIRP uses subcategories of NIR, which group frequencies or wavelength bands together, and treats these groupings separately in terms of protection.

Static Magnetic Fields (0 Hz)

Static Electric Fields (0 Hz)

LF (1 Hz-100 kHz)

HF (100 kHz-300 GHz)

UV (100-400 nm)

Visible (380-780 nm)

Infrared (780 nm-1mm)

NEWS [View all](#)

DEC 2015

International NIR Workshop 2016
The International NIR Workshop takes place from 9-11 May 2016 in Cape Town, South Africa. All information available now.

DEC 2015

Commission 2016-2020
ICNIRP Commission members 2016-2020 elected.

JUN 2015

ICNIRP elections
ICNIRP Membership 2016-2020. Call open until 14.09.2015.

TOOLS & TOPICS

[UVI](#)
[CER](#)
[SUN](#)

APPLICATIONS

People are exposed to NIR in naturally occurring situations, for example to the magnetic field of the earth and to radiation from the sun. Within the last century individual's NIR exposure has increased through the use of a wide array of technological applications that utilise NIR, such as electric appliances and communication devices.

ICNIRP expresses its protection recommendation primarily through the ICNIRP guidelines related to a specific frequency or wavelength band independently from the source. Read here how these recommendations translate for some common NIR applications.

MRI

Power Lines

Mobile Phones

Base Stations

WI-FI

DECT

UV Index

Sunbeds

Infrared Warming Cabins



Static Magnetic Fields (0 Hz)

Characteristics of the field and its use

Static magnetic fields are ***constant fields***, which do not change in intensity or direction over time, in contrast to low and high frequency alternating fields. The strength of a static magnetic flux density is expressed in tesla (T) or in some countries in gauss (G).

Effects of static magnetic fields on the body and health implications

There are several known mechanisms by which magnetic static fields can influence biological systems.

- The magnetic force can accelerate or reduce the movement of susceptible particles (reduction in the velocity of blood cells)
- Exposed to strong fields (2-3T or higher) → vertigo and nausea because of small electrical currents in the ear's balance organ.
→ ***not adverse health effects***

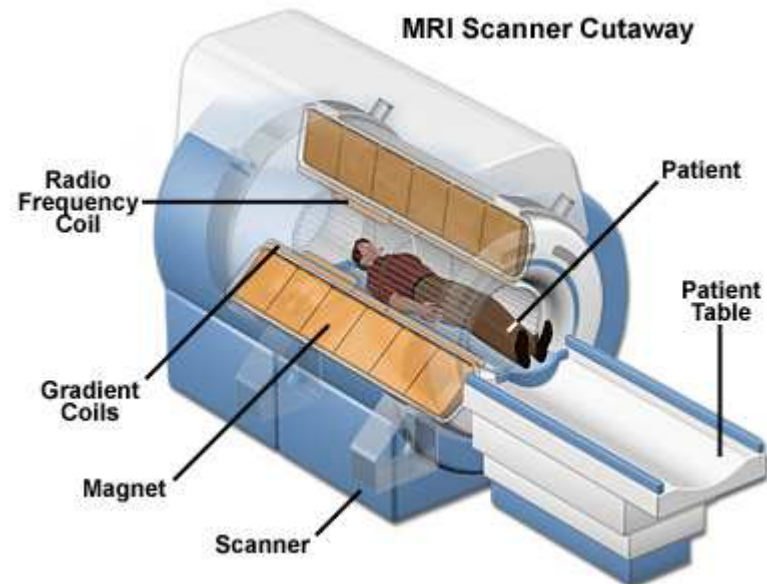


Static Magnetic Fields (0 Hz)

Protection

In situations involving exposure to very high fields (2-3T), **specific working procedures** should be developed to minimize symptoms such as vertigo and nausea. → reduction of speed of movement through the field

Provisions to protect individuals who are wearing implanted ferromagnetic or electronic medical devices sensitive to magnetic fields.





New aspects from legislation, guidelines and safety standards for MRI

Many aspects of magnetic resonance (MR) operation are not directly regulated by law but in standards, guidelines and the operating instructions of the MR scanner.

The mandatory contents of the operating instructions are regulated in a ***central standard*** of the International Electrotechnical Commission (***IEC) 60601-2-33***. In this standard, the application of static magnetic fields in MRI up to 8 Tesla (T) in the clinical routine (first level controlled mode) has recently been approved.

The employment of pregnant workers in an MRI environment is still not generally regulated in Europe. In parts of Germany and Austria pregnant and lactating employees were prohibited from working in the MR control zone (0.5 mT) in 2014. This is based on the mostly unresolved question of the applicability of limits for employees.

Radiologe 2015 · 55:691–696

Radiologe 2015 · 55:638–648

www.mrisafety.com

...



Regulations in Switzerland

SUVA (workers)

2015: 200 mT

2016: 2'000 / 8'000 mT

MuSchV

(Ordonnance sur la protection de la maternité, SR 822.111.52)

2015: 40 mT

2016: 400 mT (ICNIRP 2009)



→ Factsheet (SECO) about MRI → mid 2016



Static Electric Fields (0Hz)

Characteristics of the field and its use

Static electric fields are constant fields, which do not change in intensity or direction over time, in contrast to low and high frequency alternating fields. The strength of a static electric field is expressed in volts per meter (V/m).

Effects of static electric fields on the body and health implications

Static electric fields do not penetrate the human body because of its high conductivity. The electric field induces a surface electric charge, which, if sufficiently large, may be perceived through its interaction with body hair and through other phenomena such as spark discharges (microshocks).

Very high electric fields, such as from ***HVDC lines***, can charge particles in the air, including polluted particles.

...



Static Electric Fields (0Hz)

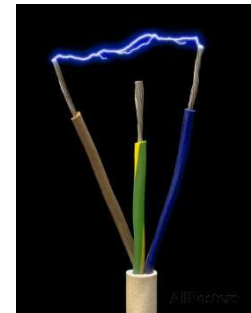
Effects of static electric fields on the body and health implications

There was a hypothesis that charged particles might be better absorbed by the lung than uncharged ones and so, raise people's exposure to air pollution. Current knowledge, however, suggests that an ***increased health risk from such charging of particles is very unlikely.***

Overall, the limited number of animal and human laboratory studies that have investigated the effects of exposure to static electric fields, have not provided evidence of adverse health effects.

Protection

The only established health effect is possible stress resulting from prolonged exposure to spark discharges (microshocks)





Low Frequency - LF (1Hz – 100 kHz)

Frequency range and LF use

LF fields have two components: an electric field due to an electric charge, and a related magnetic field. Magnetic fields only occur when an electric current is flowing. The electric component is measured in volts per meter (V/m).

LF fields are mainly related to the electric power supply, through the generation, ***distribution and use of alternating current*** (AC). The frequency used for this purpose is usually 50 or 60 Hz. Power lines are also a source of LF fields.

LF effects on the body and health implications

When people are exposed to LF fields, electric fields and currents are generated inside the body and they can interfere with the body's own electric fields and current flows related to normal biological functioning.



Low Frequency (1Hz – 100 kHz)

LF effects on the body and health implications

Potential health effects associated with long-term low-level exposure have been extensively studied over the last few decades.

Epidemiological studies have suggested that long-term low-level exposure to 50-60 Hz magnetic fields might be associated with an increased risk of childhood leukemia.

No biophysical mechanism has been identified that exposure to 50-60 Hz magnetic fields is a cause of childhood leukemia. Therefore, the currently existing scientific evidence does not lead to the conclusion that a prolonged exposure to LF is a cause of childhood leukemia.

There is no substantial scientific evidence for an association between LF exposure and Parkinson's disease, multiple sclerosis, cardiovascular diseases, ...

Overall research has not shown to date that long-term low-level LF exposure has detrimental effects on health.



Low Frequency (1Hz – 100 kHz)

Protection

To prevent health-relevant interactions with LF fields, ICNIRP recommends limiting exposure to LF fields so that the threshold at which the interactions between the body and the external electric and magnetic field causes adverse effects is never reached inside the body.

In Switzerland:

Ordonnance sur la protection contre le rayonnement non ionisant

(ORNI, SR 814.710)

→ FOEP





High Frequency (100 kHz – 300 GHz)

Frequency range and use

HF field exposure is usually measured in watts per square meter (W/m^2).

HF fields are used in a variety of technologies, most widely for communication purposes (e.g. mobile phones, base stations, Wi-Fi, radio, TV, security devices), and also in medicine (e.g. Magnetic Resonance Imaging (MRI) equipment) and for heating purposes (e.g. microwave ovens).





High Frequency (100 kHz – 300 GHz)

HF effects on the body and health implications

The critical effect of HF exposure relevant to human health and safety *is heating of exposed tissue*. HF fields can penetrate into the body (the higher the frequency, the lower the penetration depth) and cause vibration of charged or polar molecules inside.

Acute and long-term effects of HF exposure below the thermal threshold have been studied extensively without showing any conclusive evidence of adverse health effects.

Extensive research (>2'500) has been undertaken in relation to exposure to HF fields used specifically in mobile telephony. Among all of this research, the risk of tumors in close proximity to the ear where the phone is held, e.g. brain tumors, has been the focus of numerous epidemiological studies. A few of these *epidemiological studies have reported a slight statistical increase in risk* of some brain tumours for the small group of long-term and heavy mobile phone users.



IARC – International Agency for Research on Cancer (WHO)

Lyon, France, May 31, 2011 -- The WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as **possibly carcinogenic to humans (Group 2B)**.



"the evidence, while still accumulating, is strong enough to support a conclusion and the **2B classification**. The conclusion means that there could be some risk, and therefore we need to keep a close watch for a link between cell phones and cancer risk."

Group 1: The agent is *carcinogenic to humans*.

Group 2A: The agent is *probably carcinogenic to humans*.

Group 2B: The agent is *possibly carcinogenic to humans*.

Group 3: The agent is *not classifiable as to its carcinogenicity to humans*.

Group 4: The agent is probably not carcinogenic to humans.



High Frequency (100 kHz – 300 GHz)

Protection

The basic restrictions are generally expressed in terms of the specific absorption rate (SAR). Distinct **SAR values are recommended** for sources operated close to the body and those operating at a remote distance. (...but not mandatory)

Recommandation: SAR - 2 W/kg

<http://www.handystrahlung.ch/sar.php>



Apple A1457 iPhone 5S	0.80
Apple A1687 iPhone 6S Plus	0.87
Apple A1429 iPhone 5	0.90
Apple A1522 iPhone 6 Plus	0.91
Apple A1524 iPhone 6 Plus	0.91
Apple A1241 iPhone 3G	0.93
Apple A1332 iPhone 4G	0.93
Apple A1549 iPhone 6	0.93
Apple A1688 iPhone 6S	0.93
Apple A1507 iPhone 5C	0.96
Apple A1203 iPhone	0.97
Apple A1586 iPhone 6	0.97
Apple A1387 iPhone 4S	0.99
Apple A1303 iPhone 3GS	1.10



Ultraviolet (100 – 400nm)



Characteristics of UV and sources

Ultraviolet (UV) radiation is the band of non-ionizing radiation that lies next to ionizing radiation in the electromagnetic spectrum. UV radiation is categorized as UVA (400–315 nm), UVB (315–280 nm) and UVC (280–100 nm). The sun is the major source of UV but all of the sun's UVC and much of the UVB are absorbed by the earth's atmosphere so that at the earth's surface the highest proportion of UV is ***UVA (over 90%)***.

Several sources of artificial UV are found in occupational and medical settings. Sunbeds used for cosmetic tanning have become a more prevalent source of UV exposure in many countries in the last two decades.





Ultraviolet (100 – 400nm)

UV effects on the body and health implications

In humans, exposure of the skin to UVB in small amounts is responsible for synthesis of Vitamin D, which is essential for bone health.

However, exposure of skin cells to high levels of UV radiation has harmful health effects. In the short-term, intense exposure of pale skin to UVB causes inflammation or sunburn and local immunosuppression. **Long-term UV** exposure of the deeper skin over many years causes skin wrinkling and premature **skin ageing**, as well as causing **skin cancers** such as basal cell cancer, squamous cell cancer and malignant melanoma.

Protection

The main ways to protect the skin and eyes are to **avoid sun exposure** during the middle of the day, **seek shade** and **wear protective clothing** including a broad-brimmed hat **and sunglasses** with side panels.



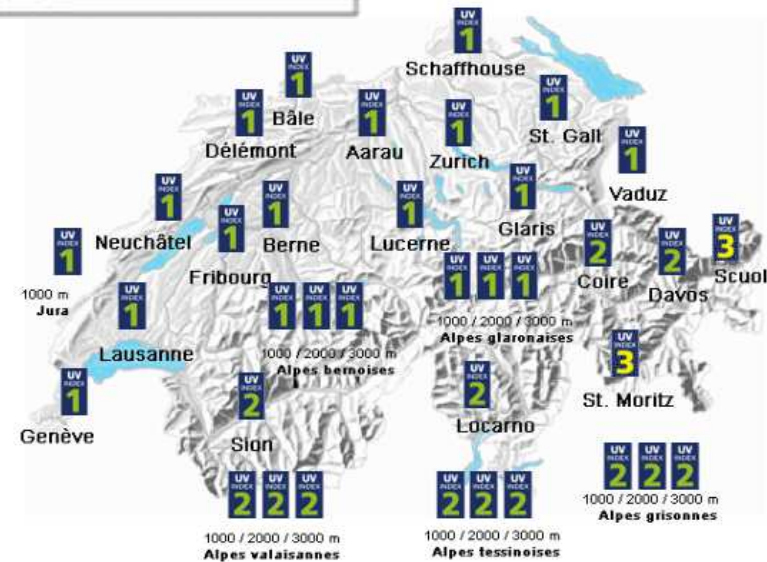
UV Index

Représentation	Intensité du rayonnement	Protection
	faible	Protection non nécessaire
	modérée	Protection nécessaire : chapeau, t-shirt, lunettes de soleil, crème solaire
	élevée	Protection nécessaire : chapeau, t-shirt, lunettes de soleil, crème solaire
	très élevée	Protection supplémentaire nécessaire : éviter, si possible, tout séjour en plein air
	extrême	Protection supplémentaire nécessaire : éviter, si possible, tout séjour en plein air

maximale journalière)

(jour à 8 heures du matin)

www.uv-index.ch





Visible Radiation (380 – 780nm)



Wavelength range and sources

Common natural sources that produce visible radiation are the sun and fire. Common artificial sources include lamps for lighting, projectors, displays, indicator lights, welding arcs and lasers.

Effects of visible light on the body and health implications

Looking into the sun or another bright source for a brief moment can lead to the transient occurrence of after-images. Additionally, “flash blindness” can also occur.

With regard to shorter-wavelength (i.e. **blue light**) visible radiation, there are some ongoing discussions that this might **accelerate retinal aging**.

Blue light also suppresses the secretion of melatonin, which contributes to the **regulation of sleep and wake cycles**. The health implications of de-regulation of the day and night (circadian) rhythm remain unclear and continue to be the subject of research.



Visible Radiation (380 – 780nm)



Protection

Protection recommendations are aimed especially at the skin and relevant parts of the eye, which are at risk from excessive exposure to bright and intense light sources.

For some lasers, damage can occur in an extremely short time, within a fraction of a second. Of particular concern for public health are laser pointers of powers **exceeding 5 mW**, which may be purchased by private individuals and used by children who are unaware of the severe hazard that they present.

Etiquetage européen	Etiquetage américain	Puissance typique en milliwatt (mW)	Exemples d'applications
Classe 1	Classe I	< 0.4 mW	scanners de caisse, lecteurs DVD
Classe 2 Classe 3R	Classe II Classe IIIa	< 1 mW < 5 mW	Pointeurs laser Lasers de spectacles et de projections
Classe 3B	Classe IIIb	< 500 mW	Lasers de spectacles et de projections
Classe 4	Classe IV	> 500 mW	Lasers de spectacles et de projections



Factsheets from FOPH



Regulations

IEC - International Electrotechnical Commission

International Standards and Conformity Assessment for all electrical, electronic and related technologies

CENELEC is the European Committee for Electrotechnical Standardization and is responsible for standardization in the electrotechnical engineering field.

Swiss Association for Standardization (**SNV**)
- direct representative of global and European standardization efforts (ISO, CEN)

→ **Technical Specifications which should be fulfilled by “bringing on the market”.**
(Product Safety Regulation)





Factsheets of FOPH

In the context of uncertainty in the field of EMF, information of the public is an important issue. A well informed public is able to act in a **self-responsible** way and apply precautionary measures.

The internet has been chosen by the FOPH as the main medium for the direct information of the general public about EMF.

The access to the internet is widely-spread in Switzerland; already in 2005 70% of the population older than 14 years used the internet as a medium for information.

2014 Factsheet about induction hobs had more than 1'000'000 clics

Factsheets in 3 country specific languages (German, French, Italian) and English.



NEW, since 9.2.2016

Diseases and medicine

Health insurance

Nutrition and Physical Activity

Alcohol, tobacco, drugs

Radiation, radioactivity and sound

General information

Therapy and Diagnostics

Research facilities and nuclear medicine

Occupational radiation exposure

Education and training in radiation protection

Radioactive substances

Environmental Radioactivity

Release of radioactivity

Radon

Electromagnetic Fields EMF

UV Radiation

Laser / Light

LED lamps

Homepage > Topics > Radiation, radioact... > Laser / Light > LED lamps

[Print version](#)

LED lamps

LED lamps or LED lighting systems are suitable for energy-efficient interior and exterior lighting. They are an alternative to energy-saving and halogen lamps.

For technical reasons LED lamps cannot produce white light, but rather emit yellow and blue light components that when mixed together result in white light. As blue light, above a certain intensity and irradiation time, represents a risk to the retina of the eye, the lamps have to meet the limit value for blue light exposure. This limit value is attained after a longer or shorter irradiation time depending on the intensity of the blue light component.

Commercial LED lamps represent no health risk when used correctly. This is also true for vulnerable population groups, such as children or persons, who have very clear, synthetic eye lenses or none at all.

Lamps are classified into the following risk groups. Lamps in the "exempt group" are risk-free even with unlimited use. Lamps in the risk groups 1 and 2 are risk-free for a limited period of use, whereas lamps of risk group 3 exhibit a high risk even for very short periods of use.

The following information helps you to employ LED lamps correctly:

- In general, use LED lamps at a distance of at least 20 cm.
- Use LED lamps of the "exempt group" if your eyes are exposed to direct light for very long periods. The exempt group primarily includes light bulb shaped LED lamps with a mat surface and a screw thread, as well as tubular LEDs.

Kontakt

■ Non ionizing Radiation Competence and Information Centre

Tel. 058 462 96 14

Fax 058 462 83 83

emf@bag.admin.ch

Documentation

- [LED Fact sheet pdf](#)
09.02.2016 | 6518 kb | PDF

Further information

- [ICNIRP guidelines on limits of exposure to incoherent visible and infrared radiation](#)

Legal framework






- [SR 734.26 Ordinance of 9 April 1997 on low-voltage electrical equipment \(LVEO\)](#)

Links

- [Swiss federal office of energy SFOE](#)



Factsheets

Household	
	Energy-saving lamps (68'681 clicks/yr)
	Induction hobs (1'039'253 clicks/yr)
	Microwave ovens
	Waterbeds
Household	
	Magnetic mattress pads



Factsheets II

Telecommunication



Mobile phones (141'256 clicks/yr)



Cordless (DECT) phone



WLAN (138'002 clicks/yr)



Bluetooth



Baby monitors



Factsheets III

Traffic



Cars, hybrid cars

Toys



Magnets

Heating



Electric floor heating system



Electric water heater



Electrical radiators

...



Layout of the factsheets

- Part 1** - Summary of relevant health aspects
- Risk assessment
 - (Simple) **advices**

- Part 2** - detailed information
- technical aspects
 - health aspects
 - limits (law, technical, ...)
 - health assessment
 - regulatory framework
 - references



Advices

- → **Verwenden Sie NIE ein Mobiltelefon, während Sie ein Fahrzeug lenken.** Dies gilt auch für Gespräche über eine Freisprecheinrichtung, die ebenfalls ablenken können! ¶
- → **Verwenden Sie NIE ein Mobiltelefon zu Fuss oder auf dem Fahrrad, wenn Sie Verkehrswege überqueren oder benutzen.** ☐
- → Verwenden Sie Kopfhörer oder eine drahtlose **Freisprecheinrichtung** (Head-Set) mit einem schwachen Bluetoothsender (Leistungsklasse 2 oder 3), um die Strahlung am Kopf zu reduzieren. ☐
- → Nutzen Sie bevorzugt moderne Mobilfunknetze wie LTE (4G) oder UMTS (3G), die strahlungsärmer als die ältere Technologie GSM arbeiten. Überprüfen Sie diesbezüglich die Einstellungen Ihres Mobiltelefons oder wenden Sie sich an Ihre Verkaufsstelle. ¶
- → Verwenden Sie im Innern von Gebäuden oder im Zug wenn möglich WLAN zum Telefonieren und zur Datenübertragung. Überprüfen Sie die Einstellungen ihres Mobiltelefons. ☐
- → Vorsicht bei Schutz- und Abschirmprodukten, welche die Strahlenbelastung reduzieren sollen. Wenn die Verbindungsqualität verschlechtert wird, ist das Mobiltelefon gezwungen, stärker zu strahlen. ☐
- → Personen, die ein elektronisches medizinisches **Implantat** tragen, sollten einen Abstand von 30 cm zwischen dem Mobiltelefon und dem Implantat einhalten. ☐



Federal Law for the Protection against NIR and Sound



Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of Home Affairs FDHA
Federal Office of Public Health FOPH
Radiological Protection



Federal law for the protection against NIR and sound (draft)

- Protection of humans against non-ionising radiation and sound
- NIR: electromagnetic fields longer than 100 nm
- Sound: Infrasound, sound, ultrasound



Mandate and framework

Mandate:

- April 2012: Federal council gave the mandate to elaborate a federal law for the protection against NIR and sound
- Public consultation spring 2014
- 11.12.2015: Federal Council transmit the federal law to the parliament

Framework:

- Short law
- To close gaps
- Regulations only if it is necessary



Regulations in the future law

- ***Compliance with safety regulations*** of the distributor/manufacturer
 - e.g. sun bed: sun bed owner is not allowed to serve children
- ***Training for using specific products*** which emit NIR or sound (e.g. application of cosmetic devices)
- ***Regulations for events*** with sound and laser shows
- ***Ban of products with significant health hazard potential*** (e.g. laserpointer)





Conclusion

- *NIR: wide field in spectrum but also in health effects interpretation*
- *Overall research has not shown to date that long-term low-level LF exposure has detrimental effects on health.*
- *Acute and long-term effects of HF exposure below the thermal threshold have been studied extensively without showing any conclusive evidence of adverse health effects.*
- *The WHO/International Agency for Research on Cancer (IARC) has classified radiofrequency electromagnetic fields as possibly carcinogenic to humans (Group 2B).*
- *Factsheets on the website of FOPH – “self responsible acting”*
- *New federal law on protection against NIR and sound*



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