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Occupational Health Programs Manual – Chapter 10

Non-ionizing Radiation Safety w/Change 2 (9/30/2015)

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Change Record

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***Include all information for each revision. Do not remove old revision data. Add new rows to table when space runs out by pressing the tab key in the last row, far right column.*

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Contents

1.0 PURPOSE 4
2.0 APPLICABILITY 4
3.0 BACKGROUND 4
4.0 POLICY 4
5.0 RESPONSIBILITIES 4
5.1 Health Physicist and Radiation Safety Officer 4
5.2 Safety Committee Chairperson 4
5.3 Safety Permit Requester 5
5.4 Equipment User (Operator) 5
5.5 Equipment User's (Operator's) Supervisor 5
5.6 Chief, Human Capital Development Division 5
5.7 Chief, Safety and Health Division 5
6.0 REQUIREMENTS 5
6.1 Training 5
6.2 Evaluation of Activities Involving Non-ionizing Radiation Sources 5
6.2.1 Radiofrequency (RF) Sources (*IEEE C95.7*) 5
6.2.2 Other Non-ionizing Sources (*ACGIH Threshold Limit Values*) 6
6.3 Exposure Condition (*ANSI C95.1, IEEE C95.7, and ACGIH Threshold Limit Values*) 6
6.3.1 Occupational Exposure Limits 6
6.3.2 Action Levels 6
6.3.3 Non-occupational Exposure Limit 6
6.4 Field Evaluations or Surveys (*ANSI C95.1, IEEE C95.7, and ACGIH Threshold Limit Values*) 6
6.5 Safety Permit Process (*GLM–QS–1700.1*) 7
6.6 Construction Contractor Use of Radiofrequency Emitters (*GLM–QS–1700.1*) 7
6.6.1 Health and Safety Plan 7
6.6.2 Operating Considerations 7
7.0 RECORDS 7
8.0 REFERENCES 7
APPENDIX A .—DEFINITIONS AND ACRONYMS 9
APPENDIX B .—CATEGORIES OF NON-IONIZING RADIATION 11
APPENDIX C .—SUMMARY OF EXPOSURE LIMITS 14

List of Tables

TABLE I.—SUMMARY OF RFSP CATEGORIES BASED ON RF EXPOSURE CONDITIONS (*Reproduced from reference IEEE C95.7*) 6
TABLE B.1.—BANDS OF RADIOFREQUENCY AND SUBRADIOFREQUENCY FIELDS AND RADIATION 11
TABLE B.2.—BANDS OF LIGHT RADIATION 13
TABLE C.1.—STATIC MAGNETIC FIELDS 14
TABLE C.2.—SUBRADIOFREQUENCY MAGNETIC FIELDS (f in Hz) 14
TABLE C.3.—STATIC AND SUBRADIOFREQUENCY ELECTRIC FIELDS (f in Hz) 14
TABLE C.4.—RADIOFREQUENCY AND MICROWAVE MAXIMUM PERMISSIBLE EXPOSURE (MPE) IN A CONTROLLED ENVIRONMENT 14

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Chapter 10—Non-ionizing Radiation

Note: *The current version of this chapter is maintained and approved by the Safety and Health Division (SHeD). The last revision date of this chapter was March 2012. The current version is located on the Glenn Research Center intranet within the BMS Library. Approved by Chief of Safety and Health Division*

1.0 PURPOSE

This chapter provides a summary of suitable criteria for human exposure to non-ionizing radiation, including bands of light radiation (except for lasers). The standards and guidelines for measurements and biophysical interaction apply to non-ionizing radiation sources except lasers. (Refer to Chapter **13**, Laser Safety Program, for laser safety controls and requirements.)

2.0 APPLICABILITY

The provisions of this chapter apply to civil servants, support service contractors (SSC), and construction contractors at NASA Glenn Research Center (GRC) Lewis Field and Plum Brook Station.

3.0 BACKGROUND

The Glenn Radiation Protection Program for Non-ionizing Radiation establishes the policies and procedures necessary for protection against exposure to high-intensity non-ionizing sources of radiation. Non-ionizing radiation sources are electromagnetic fields, radiofrequency (RF) fields and microwaves, visible and non-visible light, and lasers. (Laser use policies and procedures are specified in Chapter **13**, Laser Safety Program, of the Occupational Health Programs Manual.)

Definition of terms and acronyms are found in Appendix A. Typical bands of non-ionizing radiation and fields are categorized in Appendix B. The adverse health effects associated with, or, suspected for this broad category of energy emitters is quite varied. Some of the potential health hazards are summarized in the rightmost columns of the tables of Appendix B.

4.0 POLICY

GRC applies applicable use and exposure guidelines specified by the American Conference of Governmental Industrial Hygienists (ACGIH) (primary resource) and the Institute of Electrical and Electronics Engineers (IEEE) (secondary resource) to protect employees against a variety of known health effects associated with exposure to non-ionizing, high-power-density fields. GRC's policy is to ensure that non-ionizing radiation sources are identified, work areas are posted (if needed), users are properly trained to work with and around these sources, measurements are taken (if needed) to evaluate worker exposures, and controls to mitigate hazards are implemented, as needed, when surveys indicate that exposures can exceed acceptable limits.

5.0 RESPONSIBILITIES

5.1 Health Physicist and Radiation Safety Officer

The health physicist and radiation safety officer (RSO) shall ensure that activities involving non-ionizing radiation are conducted in accordance with appropriate industry standards, NASA policy, and Occupational Safety and Health Administration (OSHA) requirements. If the health physicist is not also GRC's RSO, then the health physicist shall work under the direction of the RSO.

5.2 Safety Committee Chairperson

The Area Safety Committee Chairperson (ASCC) leads safety permit evaluations and provides guidance to the safety permit requester on how to satisfy permit conditions. In cases involving non-ionizing radiation sources, the safety committee chairperson shall include the health physicist or the RSO as an ad hoc member of their evaluation committee. In addition the ASCC shall, in accordance with the Center's current safety permit process, maintain the documentation package (paperwork, procedures, drawings, etc.) that was used in evaluating the permitted activity.

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5.3 Safety Permit Requester

The safety permit requester shall follow the Safety and Health Division (SHeD) process for obtaining a safety permit and shall work with the safety committee and the health physicist or the RSO in satisfying conditions for the permit.

5.4 Equipment User (Operator)

The equipment user (operator) shall satisfy training and other requirements of this chapter in addition to working in a safe manner in accordance with established procedures for their particular non-ionizing radiation-generating equipment. Equipment users should express their concerns or questions regarding potential non-ionizing radiation safety issues to their management or to the RSO.

5.5 Equipment User's (Operator's) Supervisor

The equipment user's (operator's) supervisor shall ensure that operators of non-ionizing radiation-generating equipment follow established procedures and meet requirements specified in this chapter and any applicable safety permits. Also, for Support Service Contractors (SSC), supervisors may be required to maintain training records.

5.6 Chief, Human Capital Development Division

The Human Capital Development Division Chief shall maintain records for employee completion of non-ionizing radiation safety courses and any associated examinations.

5.7 Chief, Safety and Health Division

The SHED Chief shall provide support to the health physicist, RSO, and safety committee chairperson in the performance of their duties. In addition, the SHeD Chief shall satisfy applicable safety permit process requirements identified in accordance with the Center's current safety permit program.

6.0 REQUIREMENTS

Note: *Implementation of administrative and engineering controls along with other program elements is triggered by the potential for worker exposure to levels that exceed the "action level" for the subject type of non-ionizing radiation. The assessment of the exposure scenario is conducted by the health physicist or the RSO typically in support of a safety permit resview or when otherwise contacted by GRC staff regarding the use of such systems.*

6.1 Training

The need for formal safety training or, less formal, informational safety guidance, shall be assessed during the safety permit review process using the standards of practice identified in the following section, which are based upon exposure potential. The RSO/health physicist will determine if safety training is required for a set of operators and what that training will entail.

6.1 - Employee completion of formal safety training associated with the use of a non-ionizing radiation source will be documented in SATERN, which is accessible by the reporting function of an administrative SATERN session.

6.2 Evaluation of Activities Involving Non-ionizing Radiation Sources

6.2 – Controls associated with using the NIR source are identified within the "Safety Committee Conditions for Conducting Activity" as found in the relevant safety permit.

6.2.1 Radiofrequency (RF) Sources (*IEEE C95.7*)

Implementation of RF safety program (RFSP) elements is based upon the potential risk associated with such sources. First, the RF sources shall be categorized according to its potential for producing RF exposure above action levels or exposure limits, and then appropriate controls shall be specified for each category. The term "controls" refers to both engineering and administrative controls for eliminating or reducing the potential exposure above the applicable RF exposure limits or action level. Table I, which summarizes these categories, is reproduced from the IEEE guidance

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document on RFSPs. That document, IEEE C95.7, is used as general guidance for parts of this chapter.

TABLE I.—SUMMARY OF RFSP CATEGORIES BASED ON RF EXPOSURE CONDITIONS
[Reproduced from reference IEEE C95.7]

RFSP category	Exposure condition	Control actions required
1	Operational characteristics of source(s) would not cause the action level to be exceeded.	None, unless maintenance or other conditions alter category
2	Operational characteristics of source(s) could cause the action level to be exceeded, but would not cause the exposure limit to be exceeded in accessible areas.	See Clause 4 and Table 3 *(of reference IEEE C95.7)*
3	Potential to exceed the exposure limit in accessible areas, if mitigating controls are not applied.	See Clause 4 and Table 3 *(of reference IEEE C95.7)*
4	Exposure will exceed exposure limit in accessible areas.	Restrict source output to achieve Category 3, 2, or 1 conditions, or prevent personnel access (see Clause 4 and Table 3 *of reference IEEE C95.7)*

6.2.2 Other Non-ionizing Sources (*ACGIH Threshold Limit Values*)

Other than RF emitters and lasers, non-ionizing radiation sources include, but are not limited to, high-intensity visible light sources, ultraviolet (UV) light emissions, and static or low-frequency electromagnetic fields. Activities involving these sources shall be evaluated to assess the potential for delivering worker exposures that could exceed action levels or exposure limits. Appropriate controls measures shall be implemented based upon the assessment and could, again, include both administrative controls (training, qualification, standard operating procedures, postings, labeling, etc.) and engineering controls (barricades, enclosures, shielding, interlocked entryways, etc.)

6.3 Exposure Condition (*ANSI C95.1, IEEE C95.7, and ACGIH Threshold Limit Values*)

6.3 – The exposure scenario is evaluated by the Health Physicist/RSO during the safety permit review process and is the basis for any controls and other specified conditions.

6.3.1 Occupational Exposure Limits

Worker exposure (i.e., occupational exposure) to non-ionizing radiation sources shall be controlled and limited so that applicable maximum permissible exposure (MPE) levels are not exceeded. Those subjected to such limits are referred to as being “people in a controlled environment.” A summary of these limits, which are identified as either MPEs or threshold limit values (TLVs) depending on the source reference, is provided in Appendix C as a quick reference. When evaluating an exposure scenario, the actual reference document shall be reviewed to ensure that the breadth and scope of the limit are being properly considered. The referenced exposure guidelines typically have multiple footnotes or amplifying criteria that should be taken into account.

6.3.2 Action Levels

Action levels are threshold exposure conditions which trigger the need for implementation of RFSP control elements for occupationally exposure workers (i.e., does not apply to general public or “uncontrolled exposure” population). For the purposes of RF exposures, action levels shall be established using the methodology in IEEE C95.7. For other non-ionizing radiation sources, the RSO shall establish this threshold as needed, which will typically be a fraction of the accepted exposure limit. A fraction value of one-half will be the default adjustment to the relevant exposure limit unless other guidance is available.

6.3.3 Non-occupational Exposure Limit

Non-operators of equipment, individuals unaware of sources of ionizing radiation, or those workers not trained on non-ionizing radiation hazards and safety are considered members of the general public or the “uncontrolled exposure” population. These people should not be exposed to non-ionizing radiation fields that exceed the action level guidelines, which can be thought of as the uncontrolled exposure MPE.

6.4 Field Evaluations or Surveys (*ANSI C95.1, IEEE C95.7, and ACGIH Threshold Limit Values*)

6.4 – Any field measurements performed around Non-ionizing Radiation sources will be documented using a “Radiological Survey Form,” which is maintained by the Health Physicist/RSO.

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Non-ionizing radiation emitters are evaluated to ensure that exposures to workers and the general public do not exceed specified guidelines and recommendations. Because of the variety of parameters needing to be measured for surveys of non-ionizing radiation sources and the wide range of frequencies involved, it is impractical to own and maintain instruments to make every type of possible measurement. The health physics staff maintains, or has access to, certain survey and monitoring instruments to "cover" the bulk of devices used at GRC. Other survey meters or equipment shall be procured or rented as needed. Surveys shall be documented using a GRC Radiological Survey Form. (This form is used by the health physics staff and can be found in the SHeD Health Physics Procedures.) Equipment specifications and numerical calculations may also be used in lieu of direct field measurements.

6.5 Safety Permit Process (*GLM–QS–1700.1*)

6.5 – Safety permit documentation is maintained by the chairperson of the committee issuing the permit.

Research activities that involve the use of non-ionizing radiation sources shall be required to have a safety permit based upon the criteria outlined in Chapter 1A of the Glenn Safety Manual (GSM). The safety permit process described in GSM Chapter 1A is used to assess and address potential health and safety hazards associated with activities at GRC. GRC's health physicist or RSO will assist area safety committees in determining requirements, controls, and conditions for a safety permit involving the use of sources of non-ionizing radiation, except for lasers. The process shall involve a hazard assessment of the subject activity by the health physicist or the RSO. Typical permit conditions could include training, qualification requirements, posting of signs, labeling of equipment or systems, the use of engineering controls or shielding, field surveys, and written standard operating procedures.

6.6 Construction Contractor Use of Radiofrequency Emitters (*GLM–QS–1700.1*)

6.6 – The use of a Ground Penetrating Radar System or other Non-ionizing Radiation Source by a Construction Contractor is to be reviewed during the HASP evaluation process.

6.6.1 Health and Safety Plan

Ground-penetrating radar technology, which utilizes an RF signal emission, can be used to provide information concerning materials or structures that lie below the surface. A ground-penetrating radar system (GPRS) can be used for a variety of scanning purposes, including locating underground utilities, rebar, post-tension cables, electrical conduit, and other impediments embedded in concrete. Contractors who wish to utilize this technology onsite shall address the potential hazards of GPRSs, as they would any other activity, as they go through GRC's Health and Safety Plan (HASP) process described in Chapter 17 (Construction Safety) of the Glenn Safety Manual. As needed, the health physicist/RSO will be incorporated into the HASP evaluation process.

6.6.2 Operating Considerations

Workers shall be trained on how to use the equipment and be aware of the potential health effects of this type of radiation. Additionally, the equipment shall be used in such a way that non-operators would not be unknowingly exposed to non-ionizing radiation exceeding the applicable action level criteria. As an example, for a frequency of 1500 Megahertz (MHz) the maximum permissible exposure to a non-operator would be 1 milliwatt per square centimeter (mW/cm^2) or 10 W/m^2, for any 30-min period (see IEEE C95.1, Table 9—Action level (MPE for the general public when an RF safety program is unavailable)).

7.0 RECORDS

- GRC Radiological Survey Form.—Maintained by RSO or health physics staff.
- Standard operating procedures.—Maintained by the facility researcher, engineer, or safety permit requester.
- GRC safety permit package.—Maintained by the Safety Committee Chairperson.

8.0 REFERENCES

Document Number	Document Name
29 CFR 1926.54	Occupational Safety and Health Administration, "Construction Health and Safety Standards," Section 1926.54, Nonionizing Radiation

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GLM–QS-1700.1	NASA Glenn Safety Manual, Chapter 1A, Safety Permit System
GLM–QS–1700.1	NASA Glenn Safety Manual, Chapter 17, Construction Safety
GLM–QS–1700.1	NASA Glenn Safety Manual, Chapter 21, Mishap and Close Call Reporting, Investigating and Record Keeping
GLM–QS–1800.1	NASA Occupational Health Programs Manual, Chapter 13, Laser Safety Program
NPR 1800.1	NASA Procedural Requirement NASA Occupational Health Program Procedures
	American Conference of Governmental Industrial Hygienists, TLVs and BEIs, 2009
	American Conference of Governmental Industrial Hygienists, Documentation of the Threshold Limit Values and Biological Exposure Indices, 2002
C95.1	American National Standards Institute, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz: C95.1-1999
C95.7	Institute of Electrical and Electronics Engineers, IEEE Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz: C95.7–2005
29 CFR 1910.97	Occupational Safety and Health Administration, “Nonionizing Radiation,” Section 1910.97-Nonionizing Radiation

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APPENDIX A.—DEFINITIONS AND ACRONYMS

Action level.—The values of the electric and magnetic field strength, the incident power density, contact and induced current, and contact voltages above which steps should be initiated to protect against exposures that exceed the upper tier, specifically, implementation of a radiofrequency safety program.

> ***Note:*** *For the purposes of this chapter, the action level for a particular exposure scenario will be established using the criteria specified in IEEE Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz: C95.7. Action level determination varies on the reference document; action levels can be a fraction of the allowable MPE for a controlled environment or simply the exposure limit for an uncontrolled environment.*

Adverse health effect.—A biological effect characterized by a harmful change in health.

American Conference of Governmental Industrial Hygienists (ACGIH)

Averaging time (*T*avg).—The appropriate time period over which exposure is averaged for purposes of determining compliance with a maximum permissible exposure or reference level.

American National Standards Institute (ANSI)

Attenuation.—The decrease in the radiant flux as it passes through an absorbing or scattering medium.

Biological effect.—A biological effect is an established effect caused by, or in response to, exposure to a biological, chemical, or physical agent, including electromagnetic energy. Biological effects are alterations of the structure, metabolism, or functions of a whole organism, its organs, tissues, and cells. Biological effects can occur without harming health and can be beneficial. Biological effects also can include sensation phenomena and adaptive responses.

Code of Federal Regulations (CFR)

Controlled environment.—Location where there is exposure that may be incurred by persons who are aware of the potential for exposure as a concomitant of employment, by other cognizant persons, or as the incidental result of transient passage through areas where exposure levels may be above the action level (or "uncontrolled environment" maximum permissible exposures (MPEs)) but less than "controlled environment" MPEs. An area where the occupancy and activity of those within is subject to control and accountability as established by a radiofrequency (RF) safety program for the purpose of protection from RF exposure hazards.

Electromagnetic radiation.—Natural or generated energy that moves through space.

Electromagnetic force (EMF).—Measurable field of energy that is produced by all devices and equipment that use or carry an electric current.

Extremely high frequency (EHF)

Far infrared (FIR)

Gauss (G).—Unit of magnetic field strength.

General public.—Individuals of all ages and varying health status, some of whom may be subject to requirements of the controlled environment.

> NOTE 1—Generally, unless specifically provided for as part of a radiofrequency safety program (RFSP), the general public includes, but is not limited to, children, pregnant women, individuals with impaired thermoregulatory systems, individuals equipped with electronic medical devices, and persons using medications that may result in poor thermoregulatory system performance.
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> NOTE 2—Unless specifically provided as part of an RFSP, individual members of the public may not be aware of their exposure.

NASA Glenn Research Center (GRC)

Glenn Safety Manual (GSM)

Ground-penetrating radar system (GPRS)

Health and Safety Plan (HASP)

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Institute of Electrical and Electronic Engineers (IEEE)

Infrared (IR).—Electromagnetic radiation with wavelengths that lie within the range of 0.7 to 1000 μm. This region is often broken into three spectral banks by wavelength: IR–A, or near–IR (0.7–0.78 to 1.4 μm), IR-B (1.4 to 3 μm), IR–C (3 to 1000 μm).

Ionization.—The process of adding one or more electrons to, or removing one or more electrons from, atoms or molecules, thereby creating ions.

Maximum permissible exposure (MPE).—The highest root mean square (rms) or peak electric or magnetic field strengths, their squares, or the plane-wave equivalent power densities associated with these fields, or the induced and contact currents to which a person may be exposed without incurring an established adverse health effect and with an acceptable margin of safety.

Microwave.—Electromagnetic radiation with frequencies in the range 300 MHz to 300 GHz.

National Aeronautics and Space Administration (NASA)

NASA Procedural Requirement (NPR)

Near field.—The area around an electromagnetic force source, such as an antenna, where the electric and magnetic fields do not exhibit a substantially wave-plane character, but vary considerably from point to point.

Near infrared (NIR)

Occupational Safety and Health Administration (OSHA)

Non-ionizing radiation.—Electromagnetic radiations that have long wavelengths and lack enough energy to produce ionizations

Power density.—Measurable quantity of an electromagnetic field.

Radiation safety officer (RSO)

Radiofrequency (RF) radiation.—Generally, electromagnetic energy with frequencies in the range 10 kHz to 300 GHz. Sometimes the term is used to refer more narrowly to the frequency range below 300 MHz.

Radiofrequency safety program (RFSP)

Root mean square (rms)

Safety and Health Division (SHeD)

Superhigh frequency (SHF)

Tesla (T).—Unit of magnetic field strength.

Threshold limit value (TLV).—Guidance on the level of exposure and conditions under which it is believed that nearly all healthy workers may be repeated exposed, day after day, without adverse health effects.

Ultraviolet (UV) radiation.—Electromagnetic radiation with wavelengths between soft x-rays and visible, violet light. The region is often broken down into three spectral bands by wavelength: UV–A (315 to 400 nm), UV–B (280 to 315 nm), and UV-C (200 to 280 nm).

Uncontrolled environment.—Locations where there is the exposure of individuals who have no knowledge or control of their exposure.

Visible radiation (light).—Electromagnetic radiation that can be detected by the human eye. It is commonly used to describe wavelengths that are in the range between 400 nm and 700 to 780 nm.

Waveguide.—A (usually) hollow metal duct used to contain and direct RF energy along a desired path.

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APPENDIX B.—CATEGORIES OF NON-IONIZING RADIATION

TABLE B.1.—BANDS OF RADIOFREQUENCY AND SUBRADIOFREQUENCY FIELDS AND RADIATION

Frequency range			Wavelength range	Name	Potential adverse health effects from overexposure, (M) = magnetic field effect and (E) = electric field effect
>300 GHz			<1 mm	Infrared	
30 to 300 GHz	Radiofrequencies	Microwaves	10 to 1 mm	Extremely high frequency (EHF)	Biological effects are dependent upon both the quantity of energy absorbed and its distribution in the body. Possible cataract production in lens at excessive exposure levels. Possible effects (sterility production or genetic damage) due to testes exposure to excessive field strengths. Possible immunological effects due to excessive exposures. Some behavioral effects possible at high exposures in the microwave range.
>3 to 30 GHz			10 to 1 cm	Superhigh frequency (SHF)	
300 MHz to 3 GHz			1 m to 10 cm	Ultrahigh frequency (UHF)	
30 to 300 MHz			10 to 1 m	Very high frequency (VHF)	
3 to 30 MHz			100 to 10 m	High frequency (HF)	
300 kHz to 3 MHz			1 km to 100 m	Medium frequency (MF)	
30 to 300 kHz			10 to 1 km	Low frequency (LF)	
3 to 30 kHz	Subradiofrequencies		100 to 10 km	Very low frequency (VLF)	(M) When induced currents in body are high enough, various effects are observed at the cellular, tissue, and animal levels with unclear outcomes. Magnetic field limited to keep induced currents low. (M) Possible effects on embryo; unclear results. (M) Possible impact on miscarriages due to video display terminal use; unclear results (10 kHz). (E) Little evidence of specific health effects. Electric field limits are based on keeping induced current densities in the body close to that which occurs naturally. While biological effects due to electric fields may be observed, they are not readily associated with an adverse health effect. (M) Possible elevated risk to leukemia and brain cancer (50/60 Hz); no causal link established. (M) Interference with medical electronic devices (<6 Hz).
300 Hz to 3 kHz			1000 to 100 km	Voice frequency	
>0 to 300 Hz			>1000 km	Extremely low frequency (ELF)	
0 Hz				Static	(M) Interference with medical electronic devices. (M) Cardiovascular stress effects (change in blood pressure and heart rate) due to high exposure. (M) Possible impact on thermoregulatory

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					function due to high exposure.

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TABLE B.2.—BANDS OF LIGHT RADIATION

	Wavelength range	Name	Potential adverse health effects from overexposure
INFRARED	100 to 280 nm	UV–C	Damage (photochemical) to skin; erythema (reddening of skin) Damage to cornea and conjunctiva; photokeratitis (welder's flash) and conjunctivitis
	280 to 315 nm	UV–B	Damage (photochemical) to skin; erythema (reddening of skin), aging of skin, and skin cancer Damage to cornea and conjunctiva; photokeratitis (welder's flash) and conjunctivitis Damage to the lens; opacities and/or cataracts
	315 to 400 nm	UV–A	Damage (photochemical) to skin; erythema (reddening of skin), aging of skin, and skin cancer (lower hazard than UV-B or UV-C) Damage to cornea (lower hazard than UV-B or UV-C)
VISIBLE	400 to 700/780 nm		Damage (thermal and photochemical) to retina
ULTRAVIOLET	700/780 nm to 1.4 μm	Near infrared (NIR), IR–A	Damage (thermal) to retina
	1.4 to 3 μm	IR–B	Damage (thermal) to cornea and lens
	3 μm to 1 mm	Far infrared (FIR), IR–C	

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APPENDIX C.—SUMMARY OF EXPOSURE LIMITS

TABLE C.1.—STATIC MAGNETIC FIELDS

Frequency, Hz	Category	Ceiling TLV
0	Whole body (general workplace)	2 T
	Whole body (special worker training and controlled workplace environment)	8 T
	Limbs	20 T
	Medical electronic device wearers	0.5 mT

TABLE C.2.—SUBRADIOFREQUENCY MAGNETIC FIELDS (f in Hz)

Frequency	Category	Ceiling TLV
1 to 300 Hz	Whole body	60/f mT
	Hands and feet	Whole body limit × 10
	Arms and legs	Whole body limit × 5
300 Hz to 30 kHz	Whole body and partial body	0.2 mT
50 Hz/60 Hz	Medical electronic device wearers	0.1 mT

TABLE C.3.—STATIC AND SUBRADIOFREQUENCY ELECTRIC FIELDS (f in Hz)

Frequency	Category	Ceiling TLV
0 to 100 Hz	Whole and partial body	25 kV/m
100 Hz to 4 kHz	Whole and partial body	2.5×10^6/f V/m
4 kHz to 30 kHz	Whole and partial body	625 kV/m
50 Hz/60 Hz	Medical electronic device wearers	1 kV/m

TABLE C.4.—RADIOFREQUENCY AND MICROWAVE MAXIMUM PERMISSIBLE EXPOSURE (MPE) IN A CONTROLLED ENVIRONMENT

Part A: Electromagnetic Fields (f in MHz)				
Frequency (f), MHz	Power density (S), mW/cm^2	Electric field (E), V/m	Magnetic field (H), A/m	Averaging time (E^2, H^2, or S), min
0.03 to 0.1		614	163	6
0.1 to 3.0		614	16.3/f	6
3 to 30		1842/f	16.3/f	6
30 to 100		61.4	16.3/f	6
100 to 300	1	61.4	0.163	6
300 to 3000	f/300			6
3000 to 15 000	10			6
15 000 to 300 000	10			616 000/f $^{1.2}$

Part B: Induced and Contact Currents (f in MHz)				
Frequency (f), MHz	Induced current through both feet, mA	Induced current through either foot, mA	Contact current, mA	Averaging time
0.03 to 0.1	2000 × f	1000 × f	1000 × f	1 s
0.1 to 100	200	100	100	6 min

MPEs for radiofrequency and microwave exposures in an uncontrolled environment can be found in ANSI/IEEE C95.1–2005.

For exposure limits to visible, near-infrared, and ultraviolet light, see the ACGIH documents listed as “References” in Section 8.