

Title: Non-Ionizing Radiation Procedure
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Issuing Authority: VP, Facilities and Construction Management
Responsible Officer: Director Environmental Health and Safety

PURPOSE OF THE PROCEDURE

This document describes the University's non-ionizing radiation safety procedure and will not describe the theory behind the sources. It is intended to protect personnel, visitors and property from the hazards associated with non-ionizing radiation sources or equipment and to fulfill the requirements set under OSHA's Non-ionizing radiation standard [29CFR1910.97]. Non-ionizing radiation included in this program is all sources of electromagnetic radiation with wavelengths greater than 0.16 micrometers.

SCOPE OF THIS PROCEDURE

NYU's non-ionizing radiation program is structured to inform and train employees on safety procedures and regulations for these types of radiation sources.

WHO NEEDS TO KNOW THIS PROCEDURE

This program applies to all New York University [NYU].

PROCEDURES FOR IMPLEMENTATION

Responsibilities:

Department of Environmental Health and Safety

1. Developing the program
2. Assisting in defining hazardous operations
3. Designating safe practices and selecting protective equipment
4. Reviewing and approving written procedures for the use of non-ionizing radiation sources, before the work is to begin.
5. Obtaining an inventory of all potentially hazardous sources of non-ionizing radiation

Directors or Department Chairs

1. Compliance to the program
2. Notifying EH&S prior to ordering non-ionizing radiation sources that may emit potentially harmful radiation [i.e., lasers or microwaves]
3. Training employees in the procedures necessary for safe operation
4. Submitting written procedures [SOPs] for using the sources and equipment
5. Furnishing proper eye and body protection
6. Notifying EH&S when an accidental exposure occurs

7. Ensuring that the sources or equipment are used safely.

Employees or lab personnel using a non-ionizing radiation source will be responsible for the following:

1. Compliance to the program and SOPs
2. Using good safe laboratory practices
3. Alerting supervisor or EH&S of any potentially hazardous sources of non-ionizing radiation or hazardous aspects of their operation
4. Providing for the repair of malfunctioning equipment that represents potential and immediate hazards or contacting a specialist from the outside if required

Facilities Manager, Department Manager, Construction Manager and Supervisors

Facility Managers (FM) must be made aware of the various hazards within their respective buildings. All FMs with active laser and other non-ionizing radiation sources must be aware of the science departments utilizing such equipment.

UNVIERTIY PROCEDURES

RESPONSIBILITIES

Personal Protective Equipment:

1. Proper eye protection must be worn when working with sources such as ultraviolet, laser and high intensity visible light that may be capable of producing eye damage.
2. Protective clothing must be worn with sources such as ultraviolet that are capable of producing skin burns.

General Laboratory Procedures

1. Interlocks are to be used whenever possible on chambers containing hazardous sources of non-ionizing radiation. Opening a door to a chamber must de-energize the source. The source must be re-energized only through a specific action such as pressing a switch. Whenever a procedure calls for overriding the interlocks, the experimental procedure must be approved by EH&S.
2. Warning signs must be approved by EH&S and prominently displayed where hazardous sources of non-ionizing radiation exist at NYU. Administrative procedures are to be prominently displayed where interlocks do not exist or where they can be overridden.

Electromagnetic/ Microwave Radiation

1. Sources not confined in a shielded chamber must be operated in a manner where exposure intensities to anyone near the apparatus are less than the guidelines listed by the American Conference of Governmental Industrial Hygienists [ACGIH].
2. The latest edition of ACGIH Threshold Limit Values [TLVs] will be used. The TLVs are based on maintaining a whole body thermal load of specific absorption rate [SAR] to 0.4 W/Kg or less in any six-minute [0.1 Hr] period for 3 MHz to 300 GHz. The following table is an adaptation from the guidelines presenting exposure as a function of frequency.

Table 1: Guidelines for Electromagnetic/ Microwave Radiation

Frequency (f)	Power Density, S (mW/cm ²)	E = (V/m)	H = (A/m)	Averaging Time E ² , H ² or S (min)
30 kHz-100kHz		614	163	6
100 kHz-3 MHz		614	16.3/f	6
3 MHz-30 MHz		1842/f	16.3/f	6
30 MHz-100 MHz		61.4	16.3/f	6

100 MHz- 300 MHz	1	61.4	0.163	6
300 MHz- 3 GHz	f/300			6
3 GHz- 15 GHz	10			6
15 GHz- 300 GHz	10			616,000/f

3. Operation at higher exposure intensities than given should be in a shielded interlock chamber with administrative procedures and warnings clearly posted.
4. Clearly visible warning signs approved by EH&S must be posted in areas where electromagnetic sources exist that could possibly interfere with pacemakers that are susceptible to this type of radiation.

Ultraviolet Radiation [UV]

1. All UV sources capable of causing eye or skin burns should be interlocked so that direct viewing or bodily exposure is not possible.
2. The total intensity of UV light from lamps and reflecting surfaces should not exceed the levels specified in the latest edition of the TLVs for Chemical Substances and Physical Agents and Biological Exposure.
3. The following table is a general guideline based on the TLVs; however, these are not a function of wavelength and do not apply to laser generated sources of UV, photosensitive individuals or employees who are constantly exposed to photosensitizing agents.

Table 2: Guidelines for UV Radiation

Duration of Exposure / Day	Effective Irradiance [uW/cm2]
8 hours	0.1
4 hours	0.2
2 hours	0.4
1 hour	0.8
30 minutes	1.7
15 minutes	3.3
10 minutes	5
5 minutes	10
1 minute	50
30 seconds	100
10 seconds	300
1 second	3000
0.5 second	6000
0.1 second	30,000

4. UV sources must be placed out of the direct line of sight. Highly reflective surfaces should be painted with low reflectance paint.

Laser Radiation

1. Laser sources exist with outputs from the infrared to the UV. The eye is generally the most sensitive organ and must be protected.
2. Eyes are transparent to radiation from 400 to 1,400 nm. This range is termed the ocular-hazard region because the radiation incident on the cornea is focused on the retina.
3. Ultraviolet and higher power lasers may cause skin burns upon exposure and can become a fire hazard.
4. Lasers are classified by the American National Standards Institute (ANSI) in numbered classes where the higher the number the greater the potential hazard.
 - a. Class I – Denotes exempt lasers or laser systems that cannot under normal operating conditions produce a hazard. This includes lasers that are completely enclosed and interlocked or so low in power where no hazard exists. No warning label is required.
 - b. Class II – Denotes low power visible lasers or laser systems that because of the normal human aversion responses [$<0.25s$], doesn't normally present a hazard but may have some potential for hazard if viewed directly for extended periods of time. This is similar to many conventional light sources.
 - c. Class IIM – Class IIM lasers pose the same ocular hazards to the unaided eye as Class II lasers. However, Class IIM lasers are potentially hazardous when viewed with optical aids.
 - i. If manufactured after 1976, this type of system will normally have a sign attached stating the following: **“Caution – Laser Radiation – Do Not Stare Into Beam.”**
 - ii. This label must be clearly visible.
 - d. Class IIIR – Denotes lasers or laser systems that normally would not produce a hazard if viewed for only momentary periods with the unshielded eye. These systems may present a hazard if viewed using collecting optics.
 - i. This type of laser system will have a sign attached stating the following: **“Caution – Laser Radiation – Do Not Stare Into The Beam Or View Directly With Optical Instruments.”**
 - ii. This label must be clearly visible.
 - iii. The laser operator(s) of the system as well as anyone in the area during operation

must wear eye protection.

- e. Class IIIB – Denotes lasers or laser systems that can produce a hazard if viewed directly. This includes viewing of reflections from various smooth reflective surfaces. Diffuse reflections are not a potential hazard.
 - i. All signage must be in compliance to state and federal regulations.
 - ii. This type of laser system will have a sign attached stating the following: “Danger – Laser Radiation Avoid Direct Exposure To Beam.”
 - iii. This label must be clearly visible.
 - iv. The laser operator(s) and anyone in the area must wear eye protection.
 - v. Access to the area must be controlled while the laser is in use.
 - vi. Removing highly reflective surfaces, enclosing the beam path, operating in a closed room with shielding and permitting only trained personnel to operate the laser, can reduce hazards.
 - vii. Safe operating procedures [SOPs] must be visibly posted and approved by EH&S.
- f. Class IV – Denotes lasers or laser systems that can produce a hazard not only from direct or specular reflections but also from diffuse reflections. Such systems may produce fire and skin hazards.
 - i. All Signage must be in compliance to state and federal regulations.
 - ii. This type of laser system will have a sign attached stating the following: **“Danger – Laser Radiation – Avoid Eye Or Skin Exposure To Direct Or Scattered Radiation”**.
 - iii. This label must be clearly visible.
 - iv. Lasers in this class are capable of producing serious eye injury.
 - v. If enclosure is not feasible, the operator(s) and anyone in the area require eye protection.
 - vi. Access must be controlled while the laser is in use.
 - vii. Skin must be protected.
 - viii. Laser should be operated remotely if possible.
 - ix. Highly reflective surfaces must be painted or removed.
 - x. Only trained and qualified personnel should operate the laser system.
 - xi. SOPs must be visibly posted and approved by EH&S.
- g. EH&S will assist in determining the classification of any laser not already classified. All Class IIIB and IV lasers will be registered with EH&S using the Laser User Registration Form [Attachment A]

RELATED POLICIES

NYU Environmental Health and Safety Policy

RELEVANT RESOURCES