U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
Air Traffic Organization Policy

ORDER JO 3900.68

Effective Date:
07/20/2016

SUBJ: Air Traffic Organization Radiation Safety Program

1. The purpose of this directive is to establish a Radiation Safety Program (RSP) for the Air Traffic Organization (ATO). This directive establishes the elements of an ATO RSP, including responsibilities, safety criteria, measurement and reporting standards, as well as procedures and guidelines for the recognition, evaluation, prevention, and control of potential health hazards from exposures to non-ionizing radiation and ionizing radiation in ATO workplaces.

2. Recognizing that program improvement is a vital element in the program's effectiveness and responsiveness to Federal Aviation Administration (FAA) personnel, users have the opportunity to offer suggestions to update and improve this directive through the use of FAA Form 1320-19, Directives Feedback Information.

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Chapter 1. General Requirements

1-1. Purpose of this Order. This order establishes the ATO policy, procedures, responsibilities, and implementation guidelines for the RSP. The purpose of this directive is to support NAS operations by anticipating, identifying, and seeking to control employee exposures to ionizing and non-ionizing radiation that may occur as part of the installation, operation, and/or maintenance of NAS facilities. This directive supports the attainment of safe workplaces for ATO employees in which all potential radiation hazards are identified and controlled in order to minimize employee exposures in accordance with applicable employee safety standards.

1-2. Audience. This order applies to all ATO employees whose work duties may expose them to ionizing radiation and/or non-ionizing radiation.

1-3. Where Can I Find This Order. You can find an electronic copy of this order on the Directives Management System (DMS) website: https://employees.faa.gov/tools_resources/orders_notices/, or go to the MyFAA Employee Website, select 'Tools and Resources', then select 'Orders and Notices'.

1-4. What this Order Cancels. This order cancels FAA Order 6340.28, Procedures for Conducting Radiation Hazard Surveys and Radiation Safety Training, dated February 3, 2006.

1-5. Scope.

a. This order addresses sources of ionizing and non-ionizing radiation related to ATO-owned or operated facilities, equipment, activities, and operations.

b. This order does not address:

(1) Commercial products that are unintentional sources of workplace radiation such as office computers and video display terminal units, cellular and satellite telephones, and microwave ovens. These are covered by other applicable public safety and health standards and regulations of the Federal Communications Commission and the Food and Drug Administration's (FDA) Center for Devices and Radiological Health.

(2) Implanted electronic medical devices (such as pacemakers), metal implants (such as orthopedic appliances), stents, shunts, or wires. FDA guidelines address the effects of electromagnetic fields on these devices.

(3) Exposure to radon gas.

1-6. Roles and Responsibilities.

a. Vice President, Technical Operations, AJW-0, must implement the requirements of this order into the planning, design, and deployment of new systems and facilities as well as the operation, maintenance, modernization and/or refurbishment of existing NAS facilities.

b. Vice President, Air Traffic Services, AJT-0, must implement the requirements of this order into the planning, design, and operation of air traffic systems and facilities.

c. Vice President, Program Management Office, AJM-0, must implement the requirements of this order into the planning, design, and deployment of systems and facilities.

d. Vice President, Mission Support Services, AJV-0, must provide sufficient resources to the Service Center to ensure that adequate support is provided to the field organizations in the implementation of this order.

e. Vice President, Safety and Technical Training, AJI-0, must:

(1) Implement the requirements of this order into training programs and other activities managed by the organization.

(2) Work with the FAA Academy to incorporate the radiation safety requirements of this order into the training courses offered by the Academy.

f. Director, Operations Support, AJW-1, must implement the requirements of this order into the planning, design, and deployment of systems and facilities.

g. Director, Air Traffic Control Facilities, AJW-2, must implement the requirements of this order into the planning, design, and deployment of systems and facilities.

h. ATO Technical Operations Services, Air Traffic Control (ATC) Facilities, Environmental and Occupational Safety and Health (EOSH) Services, AJW-23, must:

(1) Assign a National ATO Radiation Safety Officer (RSO) to manage the ATO RSP.

(2) Develop radiation safety guidance and policy, as needed, to implement and manage the requirements of this order.

(3) Serve as ATO's focal point for employee safety issues related to radiation for internal and external organizations, and provide radiation safety program liaison services for ATO.

(4) Provide technical assistance as needed to all ATO headquarters and field organizations on radiation risk management, exposure assessment, and dosimetry.

(5) Identify the training required to comply with all radiation safety requirements and provide a general definition of who should receive the training.

(6) Provide technical support to ensure that radiation safety considerations are included in the lifecycle management process.

(7) Request, allocate, and budget for all prioritized requirements necessary for ATO RSP implementation and management.

i. The National ATO RSO must:

(1) Provide technical assistance and oversight of the RSP to ensure all program elements are effective in identifying, measuring, evaluating, preventing, minimizing, controlling, mitigating, documenting, or assessing potential radiation hazards to employees at FAA facilities, or as a result of FAA activities.

(2) Provide RSP implementation guidance to ensure elements of the RSP are adequately addressed and implemented in a timely manner.

(3) Ensure that appropriate radiation safety training materials are developed in a timely manner, in coordination with current and documented RSP guidance and safety information.

(4) Oversee the program to monitor FAA employee exposure assessments.

(5) Evaluate sources of radiation that may expose employees to levels in excess of allowable limits or action levels.

(6) Identify and assess new operations, maintenance activities, and modifications to the work environment that may increase the potential for radiation exposure.

(7) Assist in the investigation and documentation of all alleged workplace overexposure incidents.

j. ATO Technical Operations, Spectrum Engineering Services must:

(1) Serve as the focal point for performing ionizing and non-ionizing radiation hazard measurements during the baselining or commissioning of FAA communication, navigation and surveillance facilities, or as otherwise required by FAA Order 6050.32, Spectrum Management Regulations and Procedures Manual.

(2) Perform radiation hazard measurements in response to public requests and inquiries from other Federal agencies, Congressional Offices, and other external parties.

(3) Coordinate with organizations external to the FAA on spectrum issues relating to radiation hazards.

(4) Maintain a centralized Spectrum Engineering database or management information system of official records to log and track representative hazard measurement data.

k. ATO Service Area Directors, Technical Operations must:

(1) Assign a RSO for their Service Area.

(2) Implement the RSP in their Service Area in accordance with this directive and other written guidance.

(3) Ensure that the request for resources for implementation of the RSP is addressed in the budgetary review process.

(4) Ensure that Service Area employees have clear procedures for requesting assistance in the identification and resolution of concerns of potential and alleged radiation hazards.

(5) Ensure all appropriate ATO personnel potentially exposed to radiation in excess of allowable limits are trained in safe work practices.

l. ATO Service Area RSOs must:

(1) Oversee the Service Area RSP to monitor FAA employee exposure assessments.

(2) Evaluate sources of radiation that may expose employees to levels in excess of allowable limits or action levels.

(3) Identify and assess new operations, maintenance activities, and modifications to the work environment that may increase the potential for radiation exposure.

(4) Assist in the investigation and documentation of all alleged workplace overexposure incidents.

m. ATO Engineering Services Managers must integrate the requirements of this order for all engineering projects for which they are responsible, including but not limited to:

(1) Ensuring new equipment is installed in accordance with all applicable radiation safety standards and guidelines.

(2) Reporting to the Service Area RSO the commissioning dates and modifications that may change baseline information or other activities that may require a new baseline assessment be performed on an ionizing radiation source.

(3) Comply with the radiation health hazard survey requirements as required by FAA Order 6010.7A, Joint Acceptance Inspection.

n. ATO Service Center Directors must:

(1) Assist the ATO Service Area Directors in implementing the requirements of this order at ATO facilities, including providing technical, planning, and requirements support.

(2) Ensure the Service Center Planning and Requirements staff receive training and adequate resources needed to identify, measure, evaluate, control and mitigate radiation hazard risks in the workplace.

o. ATO Service Center, Planning and Requirements Group Managers must manage requirements associated with radiation program implementation.

p. ATO Service Center, Quality Control Group Managers must manage requirements associated with radiation program implementation.

q. ATO District Office Managers are responsible for ensuring that the requirements of this directive are implemented at the facilities for which they are responsible, including but not limited to:

(1) Maintaining inventories of radiation sources under the control of the District Office or to which employees may be exposed above applicable maximum permissible exposure (MPEs) or as otherwise required under this order.

(2) Ensuring employees are adequately trained on radiation safety and informed about the potential radiation exposure hazards in their workplace.

(3) Ensuring workplace areas with potential for radiation exposures are properly posted with warning signs and placards.

(4) Conducting periodic monitoring to ensure the effectiveness of the engineering controls for equipment, as specified in paragraphs 2-4(c), 3-3(c), and 4-5(e) of this order.

(5) Coordinating with Service Area RSO regarding monitoring results that exceed applicable exposure standards and implementing corrective actions to address radiation exposure concerns.

(6) Providing employees with personal protective equipment (PPE) as required and ensure PPE is inspected in accordance with applicable regulations.

(7) Ensuring employees have access to exposure records and radiation survey records of radiation levels in their workplace, and are informed of excursions from applicable exposure standards.

(8) Ensuring that radiation survey reports are stored and maintained at the employees' work site in an accessible location, such as the Facility Reference Data (FRD) file.

r. Safety and Environmental Compliance Managers (SECMs) are responsible for providing support to the District Offices and System Support Centers for executing the requirements of this order, including but not limited to:

(1) Coordinating and assisting with corrective action on radiation anomalies reported during ionizing and non-ionizing radiation surveys.

(2) Assisting in the investigation and documentation of alleged workplace overexposure incidents.

(3) Evaluate the validity of radiation concerns expressed by employees and forward any unresolved concerns to the Service Area RSO.

(4) Provide guidance and/or training to FAA employees on activities that may cause them to be exposed to excessive levels of radiation.

(5) Provide guidance on appropriate signage to be posted to protect employees.

s. NAS Engineering Group (AJW-14) must:

(1) Ensure new equipment is installed in accordance with all applicable radiation safety standards and guidelines.

(2) Ensure radar maintenance handbooks and technical instruction books incorporate radiation safety policies and practices in accordance with this order.

t. Project Implementer. The Project Implementer (PI) is a representative from the FAA entity implementing the project regardless of which organization pays for it. Usually, the PI is Engineering Services. If not, the FAA organization that established the project provides the PI. The PI is required to comply with the radiation health hazard survey requirements as required by FAA Order 6010.7A, Joint Acceptance Inspection.

u. Front Line Managers and Supervisors must ensure that no FAA employee handles, maintains, tests, or operates radiation emitting components, or performs duties in areas where there is a potential radiation hazard, without first being made aware of the radiation hazard potential, and receiving information or appropriate training in radiation hazards prevention and control appropriate to his/her job tasks.

v. Employees are responsible for performing their jobs in accordance with established maintenance directives, standard operating procedures (SOPs), applicable laws and regulations, and the requirements of this order.

Chapter 2. Ionizing Radiation (X-ray)

2-1. Overview.

a. Ionizing radiation is any type of radiation possessing enough energy to eject an electron from a neutral atom, thus producing an ion. X-ray radiation is a type of ionizing radiation.

b. There are several sources of x-ray radiation in ATO workplaces. Any piece of equipment that uses an amplification tube (e.g., thyratron, magnetron, klystron) can potentially generate x-ray radiation. The amount of x-ray radiation generated by an amplification tube is related to the flow of current through the tube. If the shielding around the amplification tube is removed or misaligned, employees may be exposed to x-ray radiation. X-ray screening devices used for security purposes are another example of an ionizing radiation source in ATO.

2-2. Health Effects. Exposure to x-ray radiation can cause cancer. The risk of cancer is related to the duration and intensity of exposure to the x-ray radiation. Because effects of chronic doses of low levels of ionizing radiation are not precisely known, exposures to ionizing radiation should be kept as low as reasonable achievable (ALARA). Suspected overexposure incidents must be reported and investigated in accordance with the requirements of the latest version of FAA Order 3900.19, FAA Occupational Safety and Health Program.

2-3. Standards for Occupational Exposure. Occupational exposure limits are listed in Appendix C of this order. ATO has established an action level of 2.0 milliRoentgen/hour (mR/hr). This action level reflects the recommendations from the Nuclear Regulatory Commission (NRC). If the action level is exceeded, administrative actions (e.g., risk communication, demarcation of safe areas) and engineering controls (e.g., equipment repair) must be implemented.

2-4. Required Actions for Equipment Design and Deployment. ATO organizations managing the design and/or deployment of NAS equipment must take the following actions to minimize employee exposure to ionizing radiation:

a. Design. Equipment that generates x-ray radiation must be provided with engineering controls (e.g., lead shielding designed to attenuate x-rays).

b. Installation. Prior to deploying equipment that contains a source of x-ray radiation, the Program Office and/or Project Implementer must assess site-specific potential employee exposures and adjust equipment installation accordingly to minimize potential hazards. In addition, they must conduct a radiation survey on the equipment at the test site to verify the effectiveness of engineering controls. As part of the installation, the Program Office and/or Project Implementer must provide appropriate posting and signage for the x-ray source.

c. Maintenance. If the equipment will be maintained by the deploying Program Office via a contract or other mechanism, the maintenance contract must ensure compliance with applicable licensing and industry standards, and the contractor must provide to the FAA all related servicing records. If the equipment is to be maintained by ATO field staff, the Program Office will develop

technical instructions and/or maintenance procedures that minimize ATO employee exposure to radiation.

2-5. Required Actions for Equipment Operation. ATO organizations that have control over sources of x-ray radiation or have employees who may be exposed to sources of x-ray radiation must implement the following control measures:

a. Inventory. Maintain an inventory of all sources of x-ray radiation in ATO workplaces to which employees may be potentially exposed above the action level (e.g., radars).

b. Signage. Post appropriate warning signs for ATO workplaces that use equipment containing a source of x-ray radiation that may potentially expose employees to x-ray radiation above the action level. Required signage is illustrated in Appendix D.

c. Safe Work Practices. Establish and implement written safe work practices for using equipment containing a source of x-ray radiation. Instructions may be contained in FAA orders, maintenance handbooks, SOPs, or other documentation.

d. Training. Provide awareness training for employees: (1) who work with equipment containing a source of x-ray radiation that may potentially expose employees to x-ray radiation above the action level; or (2) provide support to radars and other surveillance systems that contain a source of x-ray radiation. The awareness training must comply with applicable training standards established by EOSH Services. At a minimum, awareness training must include: description of x-ray radiation; health effects from x-ray radiation; sources of x-ray radiation at radars and other facilities; description of how x-ray radiation is measured; regulations, standards, and policies applicable to x-ray radiation; exposure limits to x-ray radiation; description of ALARA (as low as reasonably achievable) principle; and description of control measures to minimize exposure (i.e., time, distance, shielding).

e. Periodic Monitoring. Conduct periodic monitoring on existing sources of x-ray radiation to ensure the effectiveness of the engineering controls.

(1) For NAS facilities with x-ray sources that are owned and operated by FAA, including but not limited to airport surveillance radars (ASR), Terminal Doppler Weather Radar (TDWR), and Next Generation Weather Radar (NXRAD), monitoring must be conducted at least every three years.

(2) A radiation survey is also required at NAS facilities with x-ray sources that are owned and operated by FAA within 14 days following major maintenance activities involving the amplification tube and/or shielding. For example, a survey is required if the amplification tube is replaced or if the shielding has been removed, re-assembled, or reconfigured. Surveys conducted to verify the efficacy of engineering controls must fulfill the requirements of the periodic monitoring in paragraph 2-5(e)(1).

(3) For purposes of the monitoring requirements in subparagraphs (1) and (2), the survey report will include, at a minimum, description of the facility type and radiation sources, operational parameters, description of the instrumentation (model number) and most recent calibration date,

measurement readings, criteria against which measurements are being compared, recommendations for action, report distribution list, and names of the survey team members.

(4) Monitoring results must be maintained in an accessible location at the worksite (such as the FRD) and in the Spectrum Engineering central database.

f. Dosimetry. The ATO organization that has control over sources of x-ray radiation or has employees who may be exposed to sources of x-ray radiation must establish dosimetry procedures in accordance with OSHA 29 CFR 1910.1096(d). Dosimetry is required when an employee's exposure to ionizing radiation exceeds 25% of the calendar quarter occupational limits presented in Table G-18 in the OSHA standard 29 CFR 1910.1096(d)(2). For measurement purposes, the calendar quarters consist of 13 weeks.

Chapter 3. Ionizing Radiation (Radionuclides)

3-1. Overview.

a. Radionuclides or radioisotopes are a type of ionizing radiation source that may emit alpha, beta, and gamma radiation. Radionuclides in ATO workplaces are generally found in electron tubes associated with the waveguides and cabinets of some radar facilities (tritium, Cobalt-60, and Promethium-147), exit signs (tritium), smoke detectors with Americium-241, instrument dials with radium, radiation detection meters with uranium or Cesium-137, and other portable instruments and devices (e.g., x-ray fluorescence analyzers).

b. The NRC regulates the handling of radionuclides. However, many of the types of equipment with radionuclides in ATO workplaces are exempt from NRC regulation due to their low quantities of radioactive material. NRC exemptions include:

(1) Each source containing no more than one exempt quantity set forth in 10 CFR §30.71, Schedule B and each instrument contains no more than 10 exempt quantities;

(2) 0.05 microcurie of Americium-241, often contained in smoke detectors, is considered an exempt quantity under 10 CFR §30.71.

(3) Electron tubes that do not contain more than the quantities of by-product material specified in 10 CFR §30.15.

3-2. Health Effects. Potential health damage from exposure to radionuclides depends on a number of factors, including the form of energy associated with radionuclides (alpha particles, beta particles, or gamma rays) and the exposure pathway (e.g., inhalation, ingestion, absorption). The most common health effect is an increased risk of cancer.

3-3. Standards for Occupational Exposure. Occupational exposure limits for ionizing radiation are listed in Appendix C of this order.

3-4. Required Actions for NRC Regulated Sources. ATO organizations that have control over radionuclide sources or have employees who may be exposed to radionuclide sources regulated by NRC under 10 CFR 31.5 must implement the following control measures:

a. Inventory. Maintain an inventory of all NRC regulated sources used in ATO workplaces or to which employees may be exposed. In the event that a regulated source goes missing, reporting is required to the Service Area RSO and SECM.

b. Safe Work Practices. Establish written safe work practices for using equipment containing radionuclide sources. Instructions may be contained in FAA orders, maintenance handbooks, SOPs, or other documentation.

c. Periodic Monitoring. Test devices for leakage of radioactive material and proper operation of the on-off mechanism and indicator, if any, at no longer than six-month intervals, and maintain records of tests for three years.

d. Dosimetry. Dosimetry is required when an employee's exposure to ionizing radiation exceeds 25% of the calendar quarter occupational limits presented in Table G-18 in the Occupational Safety and Health Administration (OSHA) standard 29 CFR 1910.1096(d)(2). For measurement purposes, the calendar quarters consist of 13 weeks. The ATO organization that has control over radionuclide sources must establish dosimetry procedures in accordance with OSHA 29 CFR 1910.1096(d).

e. Posting. Prominently post NRC Form 3, "Notice to Employees," referenced in 10 CFR 19.11(c).

f. Training. Provide awareness training for employees who work with NRC regulated sources. The awareness training must comply with applicable training standards established by EOSH Services. At a minimum, awareness training must include: description of radionuclides and radiation; health effects from radionuclides; description of the NRC regulated sources of radionuclides handled by the employee; description of how radionuclides are measured; regulations, standards, and policies applicable to radionuclides handled by the employee; description of ALARA (as low as reasonably achievable) principle; and description of control measures to minimize exposure (i.e., time, distance, shielding).

3-5. Required Actions for NRC-Exempt Sources. NRC-exempt sources have very low level radioactivity and are contained such that they do not generally pose an occupational hazard to employees. ATO organizations that have control over NRC-exempt radionuclide sources must implement the following control measures:

a. All sources must be properly managed, stored, packaged, and shipped, to prevent the breakage and release of radioactive isotopes.

b. Each District Office must maintain an inventory of all radioluminescent exit signs (i.e., exit signs containing tritium) in ATO facilities.

c. Disposal of equipment containing radioactive components must comply with the requirements in Chapter 8 of FAA Order JO 1050.17A, Environmental Compliance for Air Traffic Organization.

Chapter 4. Non-ionizing Radiation (Electromagnetic)

4-1. Overview. Electromagnetic fields cover a wide range of frequencies. This chapter addresses extremely low frequency electromagnetic fields (ELF), radiofrequencies, and microwaves, in accordance with C95.1-2005 "ANSI/IEEE Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 KHz to 300GHz".

a. ELF are associated with frequencies from 1 Hertz to 300 Hertz. ELF are usually associated with the generation, distribution and use of electricity at the frequency of 60 Hertz (Hz). Power lines, electrical wiring, and equipment (such as switchgear) may produce ELF electric and magnetic fields.

b. Radiofrequency (RF) and microwave (MW) radiation are electromagnetic radiation in the frequency ranges 3 kilohertz (kHz) to 300 Megahertz (MHz) and 300 MHz to 300 gigahertz (GHz), respectively. For the purposes of this chapter, electromagnetic radiation in the aforementioned frequency ranges will be referred to as RF radiation.

c. ATO operates thousands of facilities that produce RF radiation. ATO facilities and equipment that produce RF radiation includes surveillance facilities (i.e., radars), navigational aids, and communications equipment. Under normal operating conditions, the RF radiation at many of these facilities is either below the applicable health standard, or the RF radiation is virtually isolated from the workplace and its occupants.

4-2. Health Effects. Human body absorption of electromagnetic fields is dependent on frequency and intensity of the energy fields. The human body is most receptive to frequencies between 30 to 300 MHz. Exposure can result in heating of the body and cataract formation in the lens of the eye. According to the current health standards, if exposure is stopped before the damage threshold, the thermal effects are non-cumulative. Suspected overexposure incidents must be reported and investigated in accordance with the requirements of latest version of FAA Order 3900.19, FAA Occupational Safety and Health Program.

4-3. Standards for Occupational Exposure.

a. The ATO adopts the current American Conference of Governmental Industrial Hygienists (ACGIH) consensus occupational exposure safety guidelines for non-ionizing radiation. These levels are based on the American National Standards Institute (ANSI) and the Institute of Electrical and Electronic Engineers (IEEE) ANSI/IEEE C95.1-2005 MPEs limits. Appendix E contains more detailed information about applicable RF exposure limits.

b. In the ELF range from 1 Hz to 300 Hz, occupational exposures for electric fields should not exceed a field strength of 25 kilovolts per meter (kV/m). For ELF at 60 Hz, occupational exposures for magnetic fields should not exceed the ceiling value of 1 milli Tesla (mT) or 10 Gauss. The ACGIH limit for persons wearing cardiac pacemakers or similar medical electronic devices is 100 uT (0.1 mT).

c. For employees who have received training on electromagnetic field exposures in their workplace, the ANSI/IEEE C95.1-2005 MPEs for controlled (occupational) work environments

apply. For other employees who have not received training, such as office workers and general maintenance personnel, the more stringent ANSI/IEEE C95.1-2005 MPEs limits for uncontrolled (general public) environments apply.

d. The specific absorption rate (SAR) is the basis for most RF standards including the ANSI/IEEE MPE limits. The SAR defines heat absorbed into the body in units of watts per kilogram (W/kg) of tissue. Standards typically seek to limit whole body averaged SAR to less than 0.4 W/kg.

4-4. Required Actions for Equipment Design and Deployment.

a. Design. Provide RF emitting equipment with interlocks or other safety devices to prevent access to the equipment when it is transmitting.

b. Installation. Prior to deploying equipment that contains a source of RF radiation, the Program Office and/or Project Implementer must assess site-specific potential employee exposures and adjust equipment installation accordingly to minimize potential hazards. As part of the installation, the Program Office and/or Project Implementer must provide appropriate posting and signage for the RF source and must conduct a RF radiation survey on the equipment at the test site to verify the effectiveness of engineering controls.

c. Maintenance. If the equipment will be maintained by the deploying Program Office through a contract or other mechanism, the Program Office must ensure exposure to RF radiation for ATO employees is minimized. If the equipment is to be maintained by ATO field staff, the Program Office will develop technical instructions and/or maintenance procedures that minimize ATO employee exposure to radiation.

4-5. Required Actions for Equipment Operation. ATO organizations that have control over sources of non-ionizing radiation or have employees who may be exposed to sources of non-ionizing radiation must implement the following control measures:

a. Inventory. Maintain an inventory of FAA-owned or operated electromagnetic sources (e.g., RF emitting equipment, ELF sources) capable of exceeding the applicable MPE values.

b. Safe Work Practices. Establish written safe work practices for working near or using equipment containing electromagnetic sources that may expose employees to radiation above the applicable MPE. Instructions may be contained in FAA orders, maintenance handbooks, SOPs, or other documentation.

(1) RF emitting equipment must be de-energized prior to corrective maintenance activities that could potentially expose employees to RF radiation. For construction or renovation activities that occur immediately adjacent to an RF transmitter, an evaluation of potential exposure of construction personnel to non-ionizing radiation must be conducted.

(2) For FAA radars, the antenna deck of an operating radar tower is a restricted area. Interlocks are required at the door to the antenna platform. Personnel must not access the antenna platform or work on the antenna, waveguide, or feed horn structures while it is transmitting. Transmitter cabinet doors must be kept closed as much as possible.

(3) For employees who are working with or near electromagnetic sources above the MPE not owned by ATO (e.g., commercial cell phone towers), exposure must be characterized and/or measured.

c. Training.

(1) Awareness training must be provided to employees who work at a facility with a source of RF radiation that could potentially expose an employee above the applicable MPE, and/or provide support to radars and other facilities with a source of RF radiation that could potentially expose an employee above the applicable MPE.

(2) In addition, awareness training must be provided to employees who are working with or near electromagnetic sources above the MPE not owned by ATO.

(3) The awareness training must comply with applicable training standards established by EOSH Services. At a minimum, awareness training must include the following: description of RF radiation; health effects from RF radiation; description of the RF radiation sources in the employee's workplace with sufficient power to potentially expose employees above the applicable MPE; description of how RF radiation is measured; regulations, standards, and policies applicable to RF radiation; and description of control measures to minimize exposure (i.e., time, distance, shielding).

d. Signage.

(1) For FAA owned or operated sources of RF radiation that may exceed the applicable MPE, post and maintain appropriate signs and labels to assist site personnel in identifying the location of the radiation hazards at the site and any special requirements at that location. Signage must comply with the requirements of the OSHA regulations in 29 CFR 1910.97 or the requirements of ANSI/IEEE C95.2 and C95.7. Required RF signage and placement is illustrated in Appendix D.

(2) For FAA owned or operated sources of ELF that may exceed the applicable MPE, appropriate warning signs are recommended to warn employees with cardiac pacemakers or similar medical electronic devices. Recommended signage is illustrated in Appendix D.

e. Periodic Monitoring. Periodic surveys are required for electromagnetic sources in ATO workplaces in which employees may be exposed above the applicable MPE as follows:

(1) For the following facilities, surveys must be conducted at least every three years: ARSR, ASR, TDWR, and NXRAD. For all other sources of electromagnetic fields, periodic surveys are only required if there is evidence that employees may be exposed above the applicable MPE.

(2) An RF radiation survey is also required at ARSR, ASR, TDWR, and NXRAD facilities within 14 days following major maintenance activities such as:

(a) Replacement of directional coupler

(b) Replacement of waveguide switch

(c) Replacement of rotary joint

(d) Cases in which the waveguide has been dissembled and opened

(e) Maintenance activities in which waveguide flanges are modified.

(3) For purposes of the monitoring requirements in subparagraphs (1) and (2), the survey report will include, at a minimum, description of the facility type and radiation sources, operational parameters, description of the instrumentation (model number) and most recent calibration date, measurement readings, criteria against which measurements are being compared, recommendations for action, report distribution list, and names of the survey team members.

Chapter 5. Non-ionizing Radiation (Lasers)

5-1. Overview.

a. The term "laser" is an acronym for Light Amplification by Stimulated Emission of Radiation. Lasers are devices that produce an intense, coherent, directional beam of light by stimulating electronic or molecular transitions from higher to lower energy levels. The word "light" in the phrase from which the acronym "laser" was derived means electromagnetic radiation and may or may not be visible.

b. Lasers are used in a number of applications at ATO facilities. Examples of NAS systems that use lasers include the following: ceilometers; fiber optic transmission systems; and wind tracer systems.

5-2. Health Effects. Lasers are divided into a number of classes depending upon the power of the beam and the wavelength of the emitted radiation. Laser classification is based on the laser's potential for causing immediate injury to the eye or skin and/or potential for causing fires from direct exposure to the beam or from reflections from diffuse reflective surfaces. The laser classification for a piece of equipment can be determined by the manufacturer's labeling and/or the product's technical specification documentation.

a. Class 1 lasers are considered to be incapable of producing damaging radiation levels, and are therefore exempt from most control measures or other forms of surveillance.

b. Class 1M lasers are safe for all conditions of use except when passed through magnifying optics such as microscopes and telescopes. Class 1M lasers produce large-diameter beam or beams that are divergent.

c. Class 2 lasers are low-power visible lasers that emit above Class 1 levels but at a radiant power not above 1 milliwatt. These lasers emit radiation in the visible portion of the spectrum, and protection is normally afforded by the normal human aversion response (blink reflex) to bright radiant sources.

d. Class 3A lasers normally would not produce injury if viewed only momentarily with the unaided eye. They may present a hazard if viewed using collecting optics, e.g., telescopes, microscopes, or binoculars.

e. Class 3B lasers can cause severe eye injuries if the beam is viewed directly or specular reflections are viewed. A Class 3 laser is not normally a fire hazard.

f. Class 4 lasers include all lasers with beam power greater than class 3B. By definition, a Class 4 laser can burn the skin and cause permanent eye damage as a result of direct or diffuse beam viewing. These lasers may ignite combustible materials, and thus may pose a fire risk. Class 4 lasers must be equipped with a key switch and a safety interlock. Class 4 is the highest and most dangerous class of laser.

g. Suspected overexposure incidents must be reported and investigated in accordance with the requirements of the latest version of FAA Order 3900.19, FAA Occupational Safety and Health Program.

5-3. Standards. The FAA adopts ACGIH and ANSI technical standards for safe use of lasers in the workplace, as a function of wavelength, power, laser class, beam cross section, exposure type (both pulsed and continuous wave), duration of exposure, and body cross section exposed (ocular or skin).

5-4. Required Actions. ATO organizations that have control over laser devices or have employees who may be exposed to lasers must implement the following control measures:

a. Inventory. Maintain an inventory of all FAA-owned Class 3B and Class 4 lasers used by ATO employees or to which employees may be exposed.

b. Inspection of New Equipment. Inspect newly purchased laser products to ensure that they contain all required labels and otherwise comply with the Federal Laser Product Performance Standard (FLPPS). All laser products must be certified per the requirements in 21 CFR 1040.10 or ANSI/IEC Z136.1, Safe Use of Lasers.

c. Signage. Ensure laser equipment is provided with appropriate laser warning signs in accordance with OSHA and ANSI Z136.1. Required signage is illustrated in Appendix D of this order.

d. Safe Work Practices. Implement recognized safe work practices for Class 3B and Class 4 lasers such as those contained in the ANSI Z136.1-2007, Safe Use of Lasers, and ANSI Z136.2, Safe Use of Optical Fiber Communication Systems Utilizing Laser Diodes. Examples of safe work practices include the following:

(1) De-energizing components and follow proper lockout-tagout procedures before working on the laser system. Use an optical power meter to confirm the laser system is de-energized.

(2) Using eye protection appropriate to the maximum power density or intensity of the laser used.

e. Training. Provide awareness training for all employees who work with equipment containing a Class 3B or a Class 4 laser. The awareness training must comply with applicable training standards established by EOSH Services. At a minimum, awareness training must include the following: description of lasers and laser classification systems; health effects from lasers; description of the Class 3B or Class 4 laser source in the employee's workplace; regulations, standards, and policies applicable to lasers; and description of control measures to minimize exposure.

Chapter 6. Pregnancy

6-1. Overview. Exposure to ionizing radiation can affect a fetus. Rapidly dividing embryonic cells are more sensitive to ionizing radiation than normal cells. Consequently, the allowable ionizing radiation exposure for the embryo-fetus is much lower than the allowable dose for workers. Pregnant employees and their employer must ensure they are not subjected to levels of radiation that could harm the fetus. The most effective way of protecting the unborn fetus from excess radiation is by protecting the mother. NRC recommends limiting the dose to the embryo/fetus to no more than 500 millirem during the entire pregnancy.

6-2. Employee Written Pregnancy Declaration to Supervisor. An employee may voluntarily notify her supervisor of her pregnancy using the ATO Voluntary Pregnancy Declaration template found in Appendix F. A declaration of pregnancy may be withdrawn at any time by the employee in writing.

6-3. Required Actions.

a. Upon receiving the ATO Voluntary Pregnancy Declaration, the supervisor must coordinate with the Service Area RSO regarding appropriate administrative controls to minimize the radiation exposure to the unborn fetus. The Service Area RSO and supervisor must review the exposure history and the present job duties of the declared pregnant woman and require any adjustments in working conditions so as to avoid a monthly exposure of more than 50 millirem. It may be necessary in some cases to reassign job duties for the declared pregnant employee. If the pregnant employee is not reassigned to another workplace, then dosimetry to measure employee exposure to ionizing radiation is recommended.

b. The declared pregnant employee must be given a copy of NRC Regulatory Guide 8.29, be provided an explanation of the contents of the guide by the Service Area RSO, and be given an opportunity to ask questions and request additional information.

c. Suspected overexposure incidents must be reported and investigated in accordance with the requirements of the latest version of FAA Order 3900.19, FAA Occupational Safety and Health Program.

Chapter 7. Administrative Information

7-1. Distribution. This order will be distributed electronically.

7-2. Background. ATO uses many different systems in support of NAS operations. These systems may contain sources of ionizing and non-ionizing radiation. The goal of this directive is to establish a comprehensive radiation safety program in ATO to identify and control employee exposures to ionizing and non-ionizing radiation during the installation, operation, and/or maintenance of NAS facilities.

7-3. Related Resources.

a. FAA Orders. You can find an electronic copy of FAA orders on the DMS website: https://employees.faa.gov/tools_resources/orders_notices/. The FAA orders referenced in this order are listed below.

(1) FAA Order 3900.19B, FAA Occupational Safety and Health Program, Chapter 14, Radiation Safety Program.

(2) FAA Order 6050.32B, Spectrum Management Regulations and Procedures Manual.

b. Standards and References. The regulatory standards and guidelines that apply include:

(1) 29 CFR 1910.97, Non-ionizing Radiation

(2) 29 CFR 1910.1096, Ionizing Radiation

(3) 29 CFR 1910.1020, Access to Employee Exposure and Medical Records

(4) 29 CFR 1910.1200, Hazard Communication Program

(5) 21 CFR 1040.10, Federal Laser Product Performance Standard

(6) ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (current revision). ISBN: 1-882417-36-4

(7) ANSI/IEEE C95.1-2005, IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz

(8) ANSI/IEEE C95.2-1999, IEEE Standard for Radio Frequency Energy and Current Flow Symbols

(9) ANSI/IEEE C95.3-2005, IEEE Recommended Practice for the Measurement of Potentially Hazardous Electromagnetic Fields – RF Microwave

(10) ANSI/IEEE C95.7, IEEE Recommended Practice for Radio Frequency Safety Programs, 3 kHz to 300 GHz

(11) ANSI Z136.1-2007, Safe Use of Lasers

(12) ANSI Z136.2-2012, Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources

(13) National Fire Protection Association 30 Flammable and Combustible Code

(14) NRC Regulatory Guide 8.13, Instruction Concerning Prenatal Radiation Exposure.

7-4. Recordkeeping. The following records generated from implementation of this order will be considered occupational medicine records and will be included in the employee's medical file per the latest version of FAA Order 3900.19: (1) pregnancy declaration, (2) employee's dosimetry data, and (3) results from investigation of exposure incidents.

Appendix A. Acronym List

ACGIH	American Conference of Governmental Industrial Hygienists
ALARA	As low as reasonably achievable
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
BEI	Biological exposure indices
CFR	Code of Federal Regulations
DMS	Directives Management System
ELF	Extremely low frequency
EOSH	Environmental and Occupational Safety and Health
FLPPS	Federal Laser Product Performance Standard
FRD	Facility Reference Data
IEEE	Institute of Electrical and Electronic Engineers
IR	Ionizing radiation
MPE	Maximum permissible exposure
NIR	Non-ionizing radiation
PEL	Permissible exposure level
QCG	Quality Control Group
REM	Roentgen equivalent man
RF	Radio frequency
RSO	Radiation Safety Officer
RSP	Radiation Safety Program
SECM	Safety and Environmental Compliance Manager
TLV	Threshold limit value

Appendix B. Definitions

Definitions. Definitions provided in this appendix are largely limited to nontechnical or frequently used terms in this document. Please consult the ACGIH and ANSI/IEEE publications referenced above for definitions and explanations of specialized radiation terminology.

a. Action levels. Action levels are employee exposure levels that trigger implementation of certain actions. When these levels are exceeded, protective steps will be initiated to ensure the safety of employees, such as: increased employee awareness of radiation hazards (through improved communications or updated training), additional radiation measurements, labeling and signage, and/or initiation of controls to reduce exposure to below the action levels.

b. ALARA. The acronym for "as low as reasonably achievable" means making every reasonable effort to maintain exposures to ionizing radiation as far below the limits in this program as is practical.

c. Controlled Environment. Locations where access is restricted and that are occupied only by individuals who are aware of the potential for exposure as a concomitant to employment. Training and safe work practices to prevent and control exposures are assumed, and posted warnings or access restrictions (e.g., fences, enclosures, and physical barriers) apply to controlled areas.

d. Electromagnetic (EM) radiation. The radiant electromagnetic energy characterized by its power density (energy radiated per unit area per second), and frequency (or wavelength). The EM spectrum ranges from nonionizing radiation (NIR) that includes sub-radiofrequency, RF and MW radiation through infrared, visible and ultraviolet frequencies, and extends into the ionizing radiation range (including x-rays and gamma rays).

e. ELF electromagnetic radiation. Electromagnetic radiation with a frequency between 1 Hz and 300 Hz. At such low frequencies and very long wavelengths, electric and magnetic fields may be considered separately.

f. Hertz (Hz). Unit of EMF denoting 1 cycle per second. Common units for spectral range designation for NIR are KHz, MHz for RF radiation and GHz for MW radiation.

g. Ionizing radiation. Ionizing radiation is either particulate or electromagnetic radiation that is sufficiently energetic (more than 12.4 electron-volts) to ionize the matter absorbing it. It includes subatomic particles (such as electrons, protons, neutrons, or energetic alpha particles and heavier ions), and electromagnetic radiation (x-rays and gamma rays). Electromagnetic radiation (gamma rays or X-rays) or particulate radiation (alpha particles, beta particles, neutrons, etc.) capable of producing ions, directly or indirectly, in its passage through matter.

h. Laser. A device which produces an intense, coherent, directional beam of light by stimulating electronic or molecular transitions from higher to lower energy levels. The word "laser" is an acronym for Light Amplification by Stimulated Emission of Radiation. The word "light" in the acronym is used to mean electromagnetic radiation; that radiation may or may not be visible to the human eye.

i. Magnetic Field (H). Magnetic fields are produced by direct current or alternating current, and also represent one of the components of an electromagnetic field. Common units of magnetic flux density are: Gauss, milli-Gauss, or fractions of Tesla (1 T = 10,000G). Another unit used for H strength measurements related to EM radiation is Amperes per meter (A/m).

j. MPE. MPE is the ANSI/IEEE designation for a human safety exposure limit to RF radiation. This term, defined in IEEE Standard C95.1-2005, denotes the recommended levels of power density, or equivalent electric or magnetic field strengths, for radiated NIR energy, as a function of frequency range. MPEs are provided in ANSI/IEEE C95.1-2005 for both controlled and uncontrolled (general public) environments. When ACGIH adopted the controlled environment MPEs, the MPEs were designated as threshold limit values (TLVs). Because ACGIH did not adopt the uncontrolled environment MPEs, these standards should continue to be called MPEs.

k. NIR. NIR applies to electromagnetic radiation with photon energies less than 12.4 eV, which cannot ionize atoms and molecules. It includes all frequencies at and below the ultraviolet portion of the spectrum, namely:

(1) ELF electromagnetic fields (EMF) 1 Hz to 300 Hz. ELF/EMF includes magnetic fields at power frequency (60 Hz) and its harmonics (up to 300 Hz).

(2) Static magnetic and static electric fields, which may pose electromagnetic interference hazards to medical device wearers.

(3) RF radiation (30 kHz – 300 MHz) and MW radiation (300 MHz – 300 GHz) where the specified TLVs limit either the radiation power density or the corresponding electric or magnetic field components. Radiation might be emitted as periodic pulse trains (pulsed) or as continuous waves. The quantity of interest to exposure safety is the time-averaged power density, or corresponding magnetic and /or electric field strengths, as specified in the standards as a function of frequency.

(4) Optical radiation, with wavelengths longer than 100 nm and shorter than 1 mm, including infrared, visible, and ultraviolet ranges.

l. Radionuclides. Materials that release ionizing radiation over time through nuclear decomposition, and may be a potential source of exposure through intake into the body (e.g., through inhalation) or, for some radionuclides, through proximity.

m. SAR. This quantity is the time rate for absorption of non-ionizing EMF radiation energy by a unit of biological tissue of body mass. It is expressed in units of watt/kilogram (i.e., W/kg). Average whole body SAR represents the energy transferred per unit time, or the total EMF energy per total body mass.

n. Uncontrolled environment. Locations where individuals may be exposed to radiation who have no knowledge, control, or expectation of potential for radiation exposure. In the FAA, this would include any location with high power emitters where there is a possibility of access by persons unaware of the radiation hazard. ANSI/IEEE C95.1-2005 provides MPEs for uncontrolled (general

public) environments and states that individuals may be exposed to these levels without harmful effect and with an acceptably high safety factor. See definition for action level.

o. X-rays. A type of electromagnetic radiation of higher frequency (e.g., shorter wavelength) than visible light but lower frequency (e.g., longer wavelength) than gamma rays.

Appendix C. Ionizing Radiation Exposure Limits

Type of Exposure	Dose Limit*
Effective Dose:	
In a single year	5,000 mRem/yr whole body
Averaged over 5 years	2,000 mRem/yr whole body/yr
Annual Equivalent Dose:	
Lens of eye	15,000 mRem
Skin, hands, and feet	50,000 mRem
Embryo-Fetus exposure once the pregnancy is known:	
Monthly equivalent dose**	50 mRem

*Dose limits in this table are presented in millirem (1 millirem = 10 micro Sieverts)

**Sum of internal and external exposure but excluding doses from natural sources as recommended by the National Council on Radiation Protection & Measurements

Source: American Conference of Governmental Industrial Hygienists, "2002 Threshold Limit Values and Biological Exposure Indices, Guidelines for Exposure to Ionizing Radiation". Adapted and reprinted with permission from ACGIH.

Appendix D. Radiation Signage

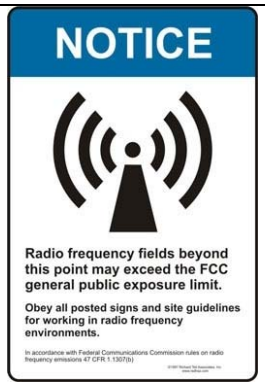
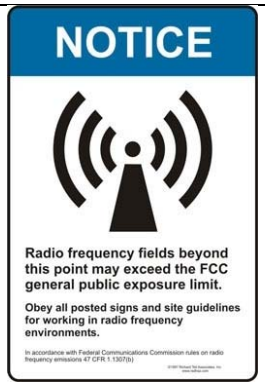
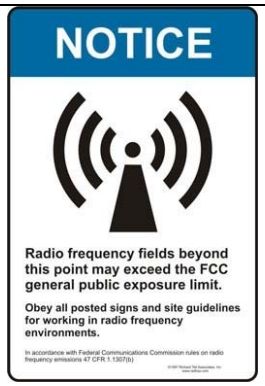
1. Ionizing Radiation. Signs are required for ionizing radiation in a radiation area. "Radiation Area" means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any one hour a dose in excess of 5 millirem, or in any five consecutive days a dose in excess of 100 millirem (OSHA 29 CFR 1910.1096(d)(3)). All sources of ionizing radiation should be marked with either a sign or a label. The marking should be placed on the exterior of the cabinet or source of x-ray radiation in order to alert employees to the presence of the source inside the equipment. The marking should be yellow, with the following design:

2. ELF Radiation. The following sign is recommended to warn employees in areas where ELF exceed the MPE levels shown in Table 7 of Appendix E. Elevated ELF levels may pose risks for personnel with cardiac pacemakers or similar medical electronic devices.

3. RF Radiation. The following radiation signs are required at the NAS facilities specified in the table below. For appropriate signage at other facilities not specified in the table, consult your RSO.

A blue "Notice" sign indicates RF radiation levels may exceed the action level at times due to possibility of RF leaks and temporary spiking. The FAA uses the uncontrolled or general public MPE level as its action level. The yellow "Caution" signs are used where the RF levels may exceed occupational exposure levels by no more the 10 times. You must be trained to work in an area designated caution. The orange "Warning" sign indicates that RF radiation levels may exceed the Federal Communications Commission (FCC) (or OSHA) MPE for human exposure. These are restricted areas. Unauthorized personnel are not permitted to enter or loiter near this area. Access to these areas are controlled by locks.

Facility Type	**Sign required at the gate or entrance to the facility grounds**	**Sign required at the front door of the facility**	**Sign required at the door leading to the transmission point or the area directly adjacent to the transmission point (i.e., radar sail, antenna)**
ARSR			
ASR			

Facility Type	Sign required at the gate or entrance to the facility grounds	Sign required at the front door of the facility	Sign required at the door leading to the transmission point or the area directly adjacent to the transmission point (i.e., radar sail, antenna)
Non Directional Beacon (NDB) (signage requirement only applies to Class C which includes NDB Class HH facilities that transmit more than 2000 watts for long-range over water navigation)			
NXRAD (signage requirement only applies to NXRAD facilities owned and operated by FAA)			
National Radio Communications System (signage requirement only applies only to Digital High Power Base Stations operating at 125 watts or higher)			
TDWR			

4. Lasers. Workplaces that have lasers must be posted with a warning sign that indicates the nature of the hazard. An area with a Class 1M laser should be posted with this sign:

An area with a Class 3B laser should be posted with this sign:

An area with a Class 4 laser should be posted with this sign:

Appendix E. RF Radiation Exposure Limits

Table 1. Maximum Permissible Exposure to Electromagnetic Fields for Uncontrolled Environments

Frequency range (MHz)	RMS electric field strength (E)[a] (V/m)	Magnetic field strength (H)[a] (A/m)	RMS power density(S) E-Field, H-field (W/m^2)	Averaging time[b] $[E]^2$,$[H]^2$ or S (min)	
0.1-1.34	614	$16.3/f_M$	$1000,100,000/ f_M^2$)	6	6
1.34-3	$823.8/f_M$	$16.3/f_M$	($1800/ f_M^2$,$100,000/f_M^2$)	$f_M^2/0.3$	6
3-30	$823.8/f_M$	$16.3/f_M$	($1800/ f_M^2$,$100,000/f_M^2$)	30	6
30-100	27.5	$158.3/f_M^{1.668}$	($2,9\ 400000/f_M^{3.336}$)	30	$0.0636f_M^{1.3}$ 37
100-400	27.5	0.0729	2	30	30
400-2000	-	-	$f_M/200$	30	
2000-5000	-	-	10	30	
5000-30000	-	-	10	$150/f_G$	
30000-100000	-	-	10	$25.24/f_G^{0.476}$	
100000-300000	-	-	$(90f_G-7000)/200$	$5048/[9f_G-700)f_G^{0.476}]$	

NOTE -- f_M is the frequency in MHz, f_G is the frequency in GHz

[a] For exposures that are uniform over the dimensions of the body, such as certain far-field plane-wave exposures, the exposure field strengths and power densities are compared with the MPEs in the table. For non-uniform exposures, the mean values of the exposure fields, as obtained by spatially averaging the squares of the field strengths or averaging the power densities over an area equivalent to the vertical cross section of the human body (projected area) or smaller area depending on the frequency are compared with the MPEs in the table.

[b] The left column is the averaging time for $[E]^2$, the right column is the averaging time for $[H]^2$. For frequencies greater than 400 MHz. the averaging time is for power density S.

Source: C95.1-2005 "ANSI/IEEE Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 KHz to 300GHz", IEEE 2030-2011. Adapted and reprinted with permission from IEEE.

Table 2. Maximum Permissible Exposure to Electromagnetic Fields for Controlled Environments

Frequency range (MHz)	RMS electric field strength (E)[a] (V/m)	Magnetic field strength (H)[a] (A/m)	RMS power density(S) E-Field, H-field (W/m^2)	Averaging time[b] $[E]^2$,$[H]^2$ or S (min)
0.1-1.0	1842	$16.3/f_M$	$9000{,}100{,}000/ f_M^2$)[b]	6
1.0-30	$1842/f_M$	$16.3/f_M$	$(9000/ f_M^2, 100{,}000/f_M^2)$	6
30-100	61.4	$16.3/f_M$	$(10{,}100000/f_M^2)$	6
100-300	61.4	0.0163	10	6
300-3000	-	-	$f_M/30$	6
3000-30000	-	-	100	$19.63/f_G^{1.079}$
30000-300000	-	-	100	$2.524/f_G^{0.476}$

NOTE -- f_M is the frequency in MHz, f_G is the frequency in GHz

[a] For exposures that are uniform over the dimensions of the body, such as certain far-field plane-wave exposures, the exposure field strengths and power densities are compared with the MPEs in the table. For non-uniform exposures, the mean values of the exposure fields, as obtained by spatially averaging the squares of the field strengths or averaging the power densities over an area equivalent to the vertical cross section of the human body (projected area) or smaller area depending on the frequency are compared with the MPEs in the table.

[b] These plane-wave equivalent power density values are commonly used as a convenient comparison with MPEs at higher frequencies and are displayed on some instruments in use.

Source: C95.1-2005 "ANSI/IEEE Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 KHz to 300GHz", IEEE 2030-2011.

Table 3. Maximum Permissible Exposure to Induced and Contact Radio Frequency Currents for Controlled Environments

RMS induced and contact current limits for continuous sinusoidal waveforms
F = 100 kHz to 110 MHz

Condition	Action level[a] (mA)	Persons in controlled Environments (mA)
Both feet	90	200
Each foot	45	100
Contact, grasp[b]	-	100
Contact, touch	16.7	50
NOTE 1—Limits apply to current flowing between the body and a grounded object that may be contacted by the person.		
NOTE 2—The averaging time for determination of compliance is 6 minutes.		
[a] MPE for the general public in absence of an RF safety program.		
[b] The grasping contact limit pertains to controlled environments where personnel are trained to make grasping contact and to avoid touch contacts with conductive objects that present the possibility of painful contact.		

Source: C95.1-2005 "ANSI/IEEE Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 KHz to 300GHz", IEEE 2030-2011. Copyright (c) 2005 IEEE. All rights reserved. Adapted and reprinted with permission from IEEE.

Table 4. Maximum Permissible Exposure to Pulsed RF Fields for Uncontrolled Environments

Frequency Range (MHz)	Peak Electric Field (kV/m)	Peak Power Density per Pulse (mW/cm^2) for Pulse Duration < 100 msec
0.1 – 300,000	100	MPE x T_{avg}/5 x pulse width

Source: C95.1-2005 "ANSI/IEEE Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 KHz to 300GHz", IEEE 2030-2011. Copyright (c) 2005 IEEE. All rights reserved. Adapted and reprinted with permission from IEEE.

Table 5. Maximum Permissible Exposure to Pulsed RF Fields for Controlled Environments

Frequency Range (MHz)	Peak Electric Field (kV/m)	Peak Power Density per Pulse (mW/cm^2) for Pulse Duration < 100 msec
0.1 – 300,000	100	MPE x T_{avg}/5 x pulse width

Source: C95.1-2005 "ANSI/IEEE Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 KHz to 300GHz", IEEE 2030-2011. Copyright (c) 2005 IEEE. All rights reserved. Adapted and reprinted with permission from IEEE.

Table 6. Maximum Permissible Exposure to RF Radiation

Frequency Range (MHz)	E (V/m)	H (A/m)	Power Density (S) E-Field : H-Field (mW/cm^2)	Averaging Time $\|E\|^2$, $\|H\|^2$ or S (minutes)
0.003 to 0.1	614	163	(100 : 1,000,000)[c]	6
0.1 to 3	614	16.3/f	(100 : 10,000/f^2)[c]	6
3 to 30	1842/f[a]	16.3/f	(900/f^2 : 10,000/f^2)[c]	6
30 to 100	61.4	16.3/f	(1.0 : 10,000/f^2)[c]	6
100 to 300	61.4	0.163	1.0	6
300 to 3000			f/300	6
3,000 to 15,000			10	6
15,000 to 300,000			10	616,000/$f^{1.2}$

a f = frequency in MHz

b The exposure values in terms of electric and magnetic field strengths are the values obtained by spatially averaging values over an area equivalent to the vertical cross-section of the human body (projected area).

c These plane-wave equivalent power density values, although not appropriate for near-field conditions, are commonly used as a convenient comparison with MPEs at higher frequencies and are displayed on some instruments in use.

Source: C95.1-2005 "ANSI/IEEE Standard for Safety Levels with Respect to Human Exposure to Radiofrequency Electromagnetic Fields, 3 KHz to 300GHz", IEEE 2030-2011. Copyright (c) 2005 IEEE. All rights reserved. Adapted and reprinted with permission from IEEE.

Table 7. Maximum Permissible Exposure to Sub-Radiofrequency (30 kHz and Below) Magnetic and Static Electric Fields

ACGIH Occupational Threshold Limit Values for 60 Hertz EMF	
Electric Field (E field)	**Magnetic Field (H field)**
Occupational exposures should not exceed 25,000 V/m (from 0 Hz to 100 Hz).	Occupational exposure should not exceed 1 mT millitesla (from 1Hz to 300 Hz). Occupational exposure should not exceed 0.2 mT millitesla (from 300 Hz to 30 kHz).
* For workers with cardiac pacemakers, maintain exposure at or below 1,000 V/m.	* For workers with cardiac pacemakers, the field should not exceed 1 Gauss (1,000 milligauss, or 0.1 millitesla)
* For those persons with cardiac pacemakers or other implanted electronic medical devices, always refer to manufacturer specific EMF interference information.	

Source: ACGIH 2002 TLVs and BEIs

Appendix F. ATO Voluntary Pregnancy Declaration

Name of Employee: _____

Estimated Date of Conception (Month/Year): _____

I am submitting this Pregnancy Declaration to inform my supervisor that I am pregnant as of the date shown above. Under the provisions of the latest version of FAA Order JO 3900.19 and 10 CFR Part 20.1208 as applicable, I understand:

- My exposure will not be allowed to exceed 5 mSv (500 mrem) during my entire pregnancy from occupational exposure to radiation;
- This limit includes exposure I have already received; and
- I may revoke this declaration at any time without explanation by submitting a signed and dated statement requesting the revocation.

Signature of Person Declaring Pregnancy: _____

Date: _____

Name of Supervisor: _____

I acknowledge that the above individual has submitted to me a Pregnancy Declaration. I understand it is my responsibility to forward this declaration to the Radiation Safety Officer (RSO) to ensure that this individual is properly trained about potential exposure risks to their unborn child.

Signature of Supervisor: _____

Date: _____

This record should be protected from public disclosure because of its personal privacy nature. These records are protected by most State privacy laws and by the Privacy Act of 1974, Public Law 93-579, 5 U.S.C. 552a.