BY THE ORDER OF THE COMMANDER
HQ 62 AIRLIFT WING

62 AIRLIFT WING INSTRUCTION 48-05

17 SEPTEMBER 2002

Aerospace Medicine

RADIATION SAFETY PROGRAM

COMPLIANCE WITH THIS PUBLICATION IS MANDATORY

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This instruction establishes the McChord Air Force Base Radiation Safety Program. The Radiation safety program incorporates all radiation related Air Force Occupational Safety and Health Standards (AFOSH), Air Force Instructions, Technical Orders (T.O.), and Nuclear Regulatory Commission Regulations. This instruction applies to all organizations assigned or attached to McChord AFB, including tenant units, where radiation sources or radiation generation devices exist.

SUMMARY OF REVISIONS

The subparagraphs of paragraph **3.** were rearranged to emulate AFI 48-148. Paragraph 3.9.1 changed to only apply to contractors and only for permitted sources. Paragraph 4.1.10 changed from restricting pregnant workers from occupational radiation exposure to monthly monitoring with restriction based on exposure potential. This change is in line with Air Force policy. **Attachment 2** now includes the Base Information Transfer Center (BITC), 62 CS/SCSA, for recently purchased x-ray machine. **A bar (|) indicates a change since the last revision.**

1. Background. Potentially harmful sources of radiation exist at McChord AFB. These may present hazards to personnel who are unaware, unfamiliar, or untrained in radiation safety. Strict control of radiation sources is necessary to protect workers from exposure. Controls of the sources include operator training, periodic monitoring of the workplace, or operating instructions, as designated by applicable references in **Attachment 1**.

2. Responsibilities:

2.1. Squadron Commanders with Ionizing or Non-Ionizing Radiation Sources:

2.1.1. Designate, in writing, a unit Radiation Safety Officer (RSO) to act as the single focal point for the unit on radiation protection matters.

2.1.2. Ensure personnel receive education and training in ionizing, non-ionizing and laser radiation protection as appropriate.

2.1.3. Provide adequate facilities, equipment and resources for radiation protection and safety commensurate with the radiation hazards of the workplace.

2.1.4. Ensure that personnel comply with appropriate directives.

2.1.5. Ensure implementation of radiation dosimetry and/or bioassay for personnel identified by base RSO.

2.1.6. Ensure the Base RSO is provided all the information necessary to evaluate the radiating devices, for example, laser, or RF system's operating characteristics.

2.1.7. Provide the Base RSO access to the necessary classified information pertaining to the radiating system's operating characteristics if the Base RSO has the proper security clearances.

2.1.8. Ensure that users of electronic equipment capable of producing biologically hazardous levels of radiation implement procedures for control of these hazards.

2.1.9. Ensure all personnel working in areas where hazardous levels of radiation produced are familiar with the sources and types of radiation. Make sure those personnel are familiar with the operating procedures and any precautions which have been recommended in radiation hazard survey reports.

2.2. 62d Medical Group Commander (62 MDG/CC):

2.2.1. Ensures initiation, supervision, and execution of the Base Radiation Safety Program.

2.2.2. Ensures complete records are maintained of either measured or estimated radiation dose received by personnel during occupational practices or contingency operations in member's medical records.

2.2.3. Ensures medical staff knows how to properly manage patients alleging overexposure to ionizing or non-ionizing radiation.

2.3. The Base Bioenvironmental Engineer (62 MDOS/SGOAB) will:

2.3.1. Serve as the Base RSO and Permit RSO.

2.3.2. Provide consultation and advice on the degree of hazards associated with radiation and the effectiveness of measures to control these hazards.

2.3.3. Ensure that all radiation producing devices beyond the survey capacity of the base are surveyed by appropriate United States Air Force agencies.

2.3.4. Investigate suspected cases of personnel overexposure, document the investigation and ensure a copy is maintained in the appropriate industrial case file and/or the patients' respective medical records.

2.3.5. Maintain an inventory of ionizing, non-ionizing, and hazardous LASER sources.

2.3.6. Provide appropriate personnel monitoring devices, Thermo Luminescent Dosimeter (TLD), to individuals likely to receive an accumulated dose of ionizing radiation in excess of the monitoring criteria outlined in AFI 48-125.

2.3.7. Periodically survey radiation sources with a frequency determined by this and other applicable directives.

2.3.7.1. Quarterly: Radio frequency (RF) sources in the maintenance shops, repair and test facilities, and flight-line activities as specified in AFOSH Standard 48-9.

2.3.7.2. Annually:

2.3.7.2.1. RF ground based radiation sources.

2.3.7.2.2. Medical, Dental, and Industrial X-Ray Machines.

2.3.7.2.3. Low-level radioactive waste burial sites.

2.3.8. Acts as the point of contact for base activities requiring radioactive material permits (issues, maintenance, etc.), by coordinating with MAJCOM Bioenvironmental Engineering (62 MDOS/SGOAB) and the United States Air Force Radioisotope Committee.

2.3.9. Consults with base activities requiring disposal of radioactive wastes in accordance with special instructions issued by the AFIERA/SDRH (AFRMWO) and/or the Wright-Patterson AFB Radiation Safety Office (88 ABW/EMO).

2.3.10. Updates the Base Fire Department and Environmental Coordinator on the locations of all permitted radioactive sources and a listing of personnel to notify should an incident occur with any of these sources.

2.3.11. Provides initial and annual ALARA training for all personnel working in or frequenting any portion of an area where radioactive material or ionizing radiation-producing devices are used.

2.3.12. Approves all radioactive storage areas prior to use.

2.3.13. Approves all facilities for industrial X-ray inspections (NDI) prior to use.

2.4. Unit RSO will:

2.4.1. Forward all requests for As Low As Reasonably Achievable (ALARA) training certification to Bioenvironmental Engineering (62 MDOS/SGOAB).

2.4.2. Forward requests for RF safety training to Public Health (62 MDOS/SGOAM).

2.4.3. Notify the Base RSO in writing of all changes in radiation sources assigned to the unit.

2.4.4. Assist the Base RSO, when needed, to obtain radiation source operating parameters.

2.4.5. Verify the accuracy of the unit radiation emissions inventory when received from the Base RSO.

2.4.6. Coordinate radiation survey or hazard evaluation activities with the Base RSO.

2.4.7. Assist in investigations of suspected or actual overexposures.

2.4.8. Ensure corrective action has been initiated within the unit on all radiation protection program deficiencies identified by the Base RSO.

2.4.9. Read AFI 40-201 and implement all of the requirements of this instruction when the Unit RSO maintains licensed radioactive materials.

2.4.10. Ensure areas containing biologically hazardous levels of radiation as recommended by the Base RSO are permanently posted.

2.4.11. Notify the Base RSO immediately of any suspected personnel overexposure to radiation, assist in the evaluation of the incident, and help in the preparation of the investigation report.

2.4.12. Notify the Base RSO of each new operation, change in equipment, procedures, or modification of radiation sources.

2.5. Section Supervisors with Radiation Sources will:

2.5.1. Notify the Base RSO of all suspected or actual radiation overexposures.

2.5.2. Provide the unit radiation monitor with information on all changes of radiation sources in the section.

2.5.3. Provide the Base RSO with radiation source operating parameters.

2.5.4. Develop radiation protection operating instructions as recommended by the Base RSO.

2.5.5. Assist the unit radiation monitor with updating the unit radiation emissions inventory.

2.5.6. Notify each employee of his or her radiation exposure when this information is received from the Base RSO.

2.5.7. Ensure personnel obtain a copy of their AF Form 1527, **History of Occupational Exposure to Ionizing Radiation**, annually from the Bioenvironmental Engineering office as applicable.

2.5.8. Submit a radioactive material permit application to the Base Radiation Safety Officer IAW AFI 40-201, as applicable.

2.5.9. Ensure radiation operator exposures are ALARA.

2.5.10. Refer all pregnant active duty members and all pregnant civilians to Public Health (62 MDOS/SGOAM) as soon as possible after pregnancy is reported.

2.5.11. When subordinates lose or fail to turn in a Thermo Luminescent Dosimeter (TLD), provides the Base RSO with a letter explaining how the badge was lost and actions taken to recover the badge.

2.6. Military Public Health (62 MDOS/SGOAM) will:

2.6.1. Annually provide safety training for McChord AFB workers in areas generating RF radiation.

2.6.2. Start actions to investigate alleged or suspected RF radiation overexposures. Where required, prepare and distribute AF Form 190, **Occupational Illness/Injury Report**.

2.6.3. Ensure copies of each investigation are placed in the involved individuals' medical records.

2.7. The 62d Supply Squadron Inspection Section (62 SUPS/LGSDI) will comply with provisions of AFI 40-201 concerning the requisition, receiving, and storage of radioactive materials, and applicable federal codes for transit storage and shipment of radioactive materials. This section will also serve as a temporary storage area for radioactive waste material prior to shipment for disposal.

2.8. Base Contracting (62 CONS/LGC) will:

2.8.1. Ensure contractors using permit required radiation sources on McChord AFB provide the following information to the base RSO prior to bring the source on base:

2.8.1.1. A written request (30 days in advance) for permission to bring any radioactive material on base.

2.8.1.2. Evidence of a valid Nuclear Regulatory Commission (NRC) or Agreement State Radioactive Materials License.

2.8.1.3. A copy of an NRC Form 241, **Report of Proposed Activities In Non-Agreement States**, or a similar document (such as a letter), listing the specific licensable items the contractor wishes to use on the base (in the case of an Agreement State License, the original must be forwarded by the contractor to the appropriate NRC region).

2.8.1.4. Report of last leak tests, if testing is required by the NRC license.

2.8.1.5. Proof of a valid Air Force contract.

2.8.2. Contractors and non-Air Force organizations will follow applicable Air Force directives, technical orders, and AFOSH standards when conducting operations on McChord AFB.

2.9. The 62d Aerial Port Squadron Transportation Surface Freight (62 APS/TRTF) will:

2.9.1. Notify the Base RSO within 3 hours upon receipt of packages containing radioactive materials so that the RSO can check the parcel for contamination. If 62 APS receives a package containing radioactive materials after normal duty hours, 62 APS will notify the Base RSO within 3 hours of the start of the next duty day.

2.9.2. Not release packages containing radioactive materials to the user until the RSO accomplishes this survey.

2.10. The 62d Aerial Port Squadron Packing and Crating (62 APS/TRTC) section will:

2.10.1. Prepare packages for shipment containing radioactive materials in accordance with 49 CFR Part 173 and other applicable directives depending on the mode of transportation.

2.10.2. Contact the Base RSO prior to shipment of radioactive materials so that the RSO can check the package for contamination and aid in determining the appropriate package labels.

2.11. 62d Civil Engineering Squadron (62 CES/CE) will coordinate designs for construction of new facilities housing radiation sources with the Base RSO.

3. Precautionary Measures:

3.1. Precautionary Measures For Ionizing Radiation.

3.1.1. Gamma and x-rays are high-energy electromagnetic waves that can cause biological damage due to ionization of cell material. The damage from X-rays depends upon the energy of the waves and the total dose. Even very low amounts of radiation can cause some type of biological damage. Therefore, even very small exposures are unacceptable. The concept of ALARA (as low as reasonably achievable) shall be practiced at all times. Exposure limits for ionizing radiation are based upon experimental evidence that ionizing radiation can cause cancer.

3.1.2. The peacetime acceptable dose for radiation workers is 5 REM in any one year after the 18th birthday.

3.1.3. Occupation exposure for minors 16-18 years of age is 500 mREM in any one year; no person under 16 shall be subjected to occupational exposure. No person under 18 shall work in a restricted area except if being supervised for purposes of training.

3.1.4. The exposure limit for the general public is 100 mREM in 1 year, or 2 mREM in any 1 hour.

3.1.5. Under the ALARA concept, the Base RSO will review the current Occupational Radiation Exposure Report that contains monthly and quarterly radiation dosimetry information. The Base Radiation Safety Officer has established 50 mREM as the ALARA action level for McChord AFB. Exposure in excess of these levels will be investigated by the Base RSO to determine the cause of the exposure. Based on findings, the Base Radiation Safety Officer will recommend engineering or administrative controls to reduce or eliminate future exposures.

3.1.6. Radiation producing equipment must be operated for the absolute minimum length of time.

3.1.7. Personnel will not remain in the room where they will receive direct rays from equipment.

3.1.8. Personnel will stand behind a protective barrier whenever possible. Protective barrier requirements for industrial X-ray operations in "unshielded areas" are outlined in T.O.33B-1-1, paragraph 5-594.

3.1.9. Access to radiation must be strictly controlled.

3.1.10. Women suspected of being pregnant shall be placed on monthly TLD. Exposure limit is 500 mREM for the remainder of pregnancy. Any pregnant worker expected to exceed this limit shall be restricted from occupational exposure.

3.1.11. TLDs or other monitoring devices must be worn when operating the radiation producing equipment or handling a source.

3.1.12. TLDs will be stored with the unit's control TLD when individuals are not participating in a procedure that will result in X-ray or gamma rays being generated.

3.1.13. Eating, drinking, or smoking is not permitted while handling radioactive materials.

3.2. Precautionary Measures for Non-ionizing Radiation.

3.2.1. Radio Frequency (RF) energy consists of electromagnetic waves in the region of 3 kHz to 300 GHz, which can cause biological damage due to physical effects. This is considered non-ionizing radiation and primarily causes biological damage due to thermal effects. The most significant areas of the human body affected are the lens of the eye and the testicles. These two areas can only withstand small increases in internal temperature before biological damage occurs.

3.2.1.1. The operating frequency of the emitter determines the exposure limit to personnel. These limits can be found in AFOSH Standard 48-9.

3.2.1.2. Dummy loads, water loads, or other absorbing devices will be used to attenuate energy emitted into confined spaces.

3.2.1.3. Where dummy loads cannot be utilized, RF exposure must be controlled through the use of hazard distances where the boundary identified by the PEL for the specific frequency of the emissions.

3.2.2. Operation of mobile RF equipment, such as aircraft, requires special precautions. Safe occupancy distances are strictly enforced and may be found in applicable technical orders, the

base RF inventory, or can be determined by the Base RSO. Permanent structures (non-mobile units) that emit RF energy must be surveyed and the areas of limited occupancy adequately marked.

3.2.3. Personnel are prohibited from performing work on antennae, wave-guides, or feed horns while the set is energized at hazardous levels.

4. Storage and Disposal of Radioactive Materials:

4.1. Storage. All items that contain radioactive materials shall be labeled IAW MIL-STAD-129. Sealed sources may be stored in unrestricted areas where containers are properly labeled and radiation levels do not exceed 2 mREM/hr, one meter from any container in the storage configuration. Areas where radiation levels potentially exceed 2 mREM/hr will be designated a restricted area, and will be surveyed at least once every 90 days to ensure that the area's perimeter does not exceed 2mREM/hr.

4.2. Disposal. Personnel requiring the disposal of radioactive materials (i.e. compasses, exit signs, DU rods) will deliver them to the 62d Supply Squadron Inspection Section for storage in the radioactive materials storage area. 62d Supply will then process a letter requesting disposal instructions from the San Antonio Air Logistics Center or the Wright-Patterson AFB Radiation Safety Office through the Base RSO. After receiving instructions, the 62d Supply Squadron, with the assistance of the Base RSO, will dispose of the material accordingly.

ROBERT R. ALLARDICE, Colonel, USAF
Commander

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFI 40-201, *Managing Radioactive Materials in the USAF.*

AFPD 40-2, *Radioactive Materials (Non-Nuclear Weapons).*

AFI 48-125, *The U.S. Air Force Personnel Dosimetry Program.*

AFI 48-148, *Ionizing Radiation Protection*

AFOSH Standard 48-9, *Radio Frequency Radiation (RFR) Safety Program.*

AFOSH Standard 48-139, *Laser Radiation Protection Program.*

10 CFR Part 20, *Standards for Protection Against Radiation.*

10 CFR Part 30, *Rules of General Applicability to Domestic Licensing of Byproduct Material.*

10 CFR Part 40, *Domestic Licensing of Source Material.*

49 CFR Part 173, *Shippers General Requirements for Shipments and Packaging.*

T.O. 31Z-10-4, *Electromagnetic Radiation Hazards.*

T.O. 33B-1-1, *Non-Destructive Inspection Methods.*

AMC Policy Letter (95-0009), *USAF Adoption of New ANSI/IEEE Personnel Radio frequency Standard.*

Abbreviations and Acronyms

AF—Air Force (as used on forms)

AFIERA—Air Force Intitute for Environmental, Safety and Occupational Health Risk and Analysis

AFOSH—Air Force Occupational Safety and Health

ALARA—As Low as Reasonably Achievable

gHz—Gigahertz

IAW—In Accordance With

kHz—Kilohertz

LASER—Light Amplification by Stimulated Emission of Radiation

MAJCOM—Major Command

mREM—MilliRoentgen

NDI—Non-Destructive Inspection

NRC—Nuclear Regulatory Commission

OPR—Office of Primary Responsibility

PEL—Permissible Exposure Limit

REM—Roentgen Equivalent Man

RF—Radiofrequency

RSO—Radiation Safety Officer

TLD—Thermo Luminescent Dosimeter

T.O.—Technical Order

Terms

ALARA—"As low as Reasonable Achievable" is a principle of ionizing radiation protection mandated by the U.S. Nuclear Regulatory Commission (10 CFR 20.1003) for its licenses to make every reasonable effort to maintain radiation exposures as far as below the limits as is reasonably achievable. Establishes maximum PELs that are conservative and offer a low risk of hazardous health effects, when compared to other hazards of life and occupation. Every effort should be made to reduce exposures to ALARA levels. This regulation implements ALARA by establishing a comprehensive, coordinated, base-wide radiation protection program that incorporates all of the current radiation protection requirements. It also provides additional management concepts and controls specifically designed to keep exposure period constitutes an overexposure, and will automatically require an investigation by the Base Radiation Safety Officer in coordination with the unit radiation safety officer. Implemented for practice by the Air Force on 10 December 1984.

Dosimeter—A device that detects and measures accumulated radiation exposures over a given period of time.

Health Physics—Application of the principles of physics to determine the health involved with exposure to EMR or particulate radiation. Health physics is a branch of Industrial Hygiene.

Ionizing Radiation—Radiation of sufficient energy to ionize matter, causing the disruption or alteration of the functions of biological cells. This includes alpha, beta, x-ray, and gamma radiation.

LASER—Acronym for Light Amplification by Stimulated Emission of Radiation. Intense, coherent light beam used in precision measurement, materials cutting/welding, computer printing, bar code scanning, range finding, etc. Protection concerns primarily the eye and thermal burns, and is dependent upon the LASER wavelength.

Non-Ionizing Radiation—For the purposes of this regulation, EMR to include radio frequency radiation (RF) at frequencies between 10 kHz and 300 GHz. Biologic effects of RF relate to thermal damage caused by energy absorbency from exposure to radiation. This includes radar, radio, microwave, LASER, infrared, ultraviolet and visible light.

Permissible Exposure Limit (PEL)—Level of radiation to which a worker can be exposed, throughout a working lifetime, without experiencing adverse health effects. Specific levels are defined in the appropriate references listed in **Attachment 1**.

Personnel Dosimetry—The use of thermo luminescent dosimeters (TLD) to monitor personnel exposure to ionizing radiation.

Radiation Areas—Area accessible to personnel where the level of ionizing radiation to major portion of the body could receive a dose of more than 5 mREM in any 1 hour at 30 centimeters (1 foot) from the radiation source.

Radiation Emission Inventory—Three binders maintained by the Bioenvironmental Engineering Element that incorporate the ionizing radiation inventory, RF inventory, and LASER inventory for McChord. These binders describe all radiation sources used on McChord AFB, potential radiation hazards, training requirements, and assigned unit radiation safety officers.

Radiation Generating Devices—Devices or equipment that produce either ionizing or non-ionizing radiation. Examples: x-ray machines, radar, and radio transmitters.

Radiation Hazards—Any equipment or substance capable of producing electromagnetic radiation (EMR) or particulate radiation (alpha, beta, gamma, X-ray) exposures above the permissible exposure limits (PEL) outlined in the applicable publications listed in **Attachment 1**.

Radiation Source—Naturally occurring or man-made isotopes that continually decay, emitting ionizing radiation. Examples: Cesium 137, Plutonium 239, Strontium 90 and Krypton 85.

RF system—Any radio frequency (RF) emitter with operating frequencies between 3 kHz and 300 GHz. A survey by the Base RSO is required before placing any RF emitter into operation.

Roentgen Equivalent Man (REM)—Quantity of ionizing radiation which, when absorbed by man, produces an effect equivalent to the energy absorption by man of the one roentgen of x-ray or gamma radiation. Relates exposures in air to absorbed dose. One millirem equals 1/1000 REM.

Thermo luminescent Dosimeter (TLD)—A type of dosimeter that uses crystalline materials to record radiations doses. Armstrong laboratory (AL/OEBD) at Brooks AFB, Texas, analyzes the TLDs for McChord AFB.

Unit RSO—The single local point of contact for the unit on radiation protection matters.

Attachment 2

IDENTIFICATION OF ORGANIZATIONS WITH RADIATION SOURCES SUBJECT TO CONTROL MEASURES

A2.1. Ionizing Radiation:

A2.1.1. Radioactive Materials:

A2.1.1.1. 62d Maintenance Squadron, Precision Measurement Equipment Lab, Test Diagnostic Maintenance Equipment Branch (62 MXS/MAET).

A2.1.1.2. 62d Supply Squadron (62 SUPS).

A2.1.1.3. 62d Civil Engineer Squadron, Emergency Services Flight (62 CES/CEX).

A2.1.1.4. Low-level radioactive waste burial sites located at the Golf Course Maintenance Shop and the Munitions Management compound.

A2.1.1.5. 446th Civil Engineer Squadron, Disaster Preparedness (446 CES/CEB).

A2.1.1.6. 62d Medical Operations Squadron, Bioenvironmental Engineering Element (62 MDOS/SGOAB).

A2.1.1.7. 62d Civil Engineer Squadron, Fire Department (62 CES/CEF).

A2.1.1.8. Det 35 Mukilteo Aerospace Fuels Laboratory (SA-ALC/SFTLD).

A2.1.1.9. 62d Communications Squadron, Base Information Transfer Center (62 CS/SCSA).

A2.1.2. X-Ray Machines (Used in the following locations):

A2.1.2.1. 62d Medical Operations (62 MDOS) Clinic, Medical and Dental X-Ray.

A2.1.2.2. 62d Maintenance Squadron (62 MXS), Non-Destructive Inspection (NDI) Laboratory.

A2.1.2.2.1. Hangar 1 (Shielded Facility).

A2.1.2.2.2. Hangar 2.

A2.1.2.2.3. Building 745 (Shielded Facility).

A2.1.2.2.4. Building 1175.

A2.1.2.2.5. Building 1166.

A2.1.2.2.6. Building 1164.

A2.1.2.3. 62d Civil Engineer Squadron, Explosive Ordnance Disposal (62 CES/EOD).

A2.1.2.4. 62d Aerial Port Squadron (62 APS).

A2.1.2.5. 62d Communications Squadron, Base Information Transfer Center (62 CS/SCSA).

A2.2. Non-ionizing Radiation:

A2.2.1. 62d Communications Squadron (62 CS).

A2.2.2. 22d Special Tactics Squadron (22 STS).

A2.2.3. Air Force Office of Special Investigation (AFOSI Det 305).

A2.2.4. 62d Supply Squadron (62 SUPS).

A2.2.5. 62d Maintenance Squadron (62 MXS).

A2.2.6. 62d Security Police Squadron (62 SPS).

A2.2.7. 62d Aircraft Generation Squadron (62 AGS).

A2.2.8. 262d Combat Communication Squadron (262 CCS).

A2.2.9. 111th Air Support Operations Center (111 ASOC).

A2.2.10. 143rd Combat Communications Squadron (143 CCS).

A2.2.11. 5th Air Support Operation Center (5 ASOC).