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Aerospace Medicine

RADIATION PROTECTION PROGRAM

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This instruction implements AFD 48-1, *Aerospace Medical Program*, AFI 40-201, *Managing Radioactive Materials in The U.S. Air Force*, and AFI 48-148, *Ionizing Radiation Protection*. It establishes procedures and assigns responsibilities for implementing the radiation protection program at Kunsan Air Base, Korea. It applies to all military personnel assigned, attached and associated units that use radioactive materials or devices that generate radiation. It applies only to ionizing radiation; it does not apply to non-ionizing radiation such as lasers or radar. It does not apply to radioactive materials transferred from the Department of Energy to the Department of Defense as parts of nuclear weapon systems, nuclear reactor parts, fuel controlled under Section 91b of the Atomic Energy Act, and Department of Energy activities related to SAFE HAVEN requirements.

SUMMARY OF REVISIONS

AFI 48-148 requirements have been added. The 8th Maintenance Squadron, Test, Measurements and Diagnostic Equipment Laboratory (8 MXS/MXMD), Radioactive Material (RAM) Permit has been rescinded due to mission changes since CY-2000, and references to this Permit are removed in this version. The 8th Medical Group's Chemical Agent Monitor RAM Permit has been added. The 8th Maintenance Squadron's LANTIRN RAM Permit has been added. A template radiation safety training package is included as an attachment for reference by supervisors and unit safety training personnel. Organizations and office symbols are updated and minor administrative changes are made. A bar (|) indicates revision from the previous edition .

1. General Information:

- 1.1. There are two potential sources of ionizing radiation, devices that generate radiation and radioactive materials.

1.1.1. **Devices that generate X-Ray radiation.** The 8th Maintenance Squadron, Nondestructive Inspection Element, 8th Medical Operations Squadron, Dental Clinic (8 MDOS/SGOD), 8th Medical Support Squadron, Radiology Section (8 MDSS/SGSAR) and 8th Civil Engineering Squadron, Explosive Ordnance Disposal (8 CES/CED) operate X-Ray machines .

1.1.2. **Radioactive Material (RAM).** Most organizations on base have some items that contain RAM. The majority of materials (such as lensatic compasses and electron tubes) do not require a permit, but some materials do. Regardless of permit status, RAM requires special storage and disposal procedures. Contact the 8 MDOS/SGOAB if there are any questions concerning RAM.

1.1.2.1. RAM Permits. Organizations that currently have RAM permits issued by the USAF RIC are listed below, along with the permitted material.

1.1.2.1.1. 8th Medical Support Squadron, Medical Logistics Flight (8 MDSS/SGSL) (Chemical agent detectors).

1.1.2.1.2. 8th Civil Engineering Squadron, Readiness Flight (8 CES/CEX) (Chemical agent detectors).

1.1.2.1.3. 8th Maintenance Squadron, Avionics Flight (LANTIRN Pods).

1.1.2.1.4. Echo Battery (Chemical agent detectors).

1.1.2.1.5. Foxtrot Battery (Chemical agent detectors).

1.1.2.1.6. 8th Logistics Readiness Squadron, Packing and Crating may handle permitted radioactive material. The most common shipment is LANTIRN Pod sensors to and from Depot-level repair.

1.2. **Radiation Safety Officer (RSO).** There are two types of RSO, the base RSO and the permit RSO. At Kunsan AB, the 8th Medical Operations Squadron, Bioenvironmental Engineering (8 MDOS/SGOAB) serves both functions, for all AF agencies. The Patriot Batteries provide their own permit RSO.

1.3. All exposures to ionizing radiation shall be ALARA consistent with existing technology, cost, and operations requirements. All organizations listed in this paragraph require initial and annual ALARA training.

2. Definitions (See AFI 40-201, for Definitions).

3. Responsibilities: AFI 40-201 lists basic responsibilities concerning radioactive material. AFI 48-148 lists basic responsibilities for machine-produced radiation safety (i.e., X-Ray units). This paragraph clarifies and expands those responsibilities .

3.1. The 8th Fighter Wing Commander (8 FW/CC) will:

3.1.1. Appoint a base RSO, in writing, as required by AFI 40-201 and AFI 48-148. The RSO is normally the senior ranking person in the 8 MDOS/SGOAB.

3.2. Squadron Commanders will:

3.2.1. Ensure personnel in their squadrons follow radiation safety procedures.

3.2.2. Ensure personnel comply with the conditions of their RAM permits.

3.2.3. Ensure the 8 MDOS/SGOAB is notified of all new RAM or X-Ray producing devices used within the squadron.

3.2.4. Apply for RAM permits prior to procurement, storage, or use of the RAM or apply for amendments whenever storage location or operating procedures changes.

3.2.5. Ensure personnel make RAM permit renewal applications at least 90 days prior to the expiration of the existing permit.

3.2.6. Appoint authorized users for each permit issued by the USAF RIC, and provide a copy of the appointment letter to the base RSO (8 MDOS/SGOAB).

3.3. The U.S. Army Contracting Command Korea (USACCK) will:

3.3.1. Ensure contractors using RAM (e.g., soil density gauges) submit copies of their RAM permits to the base RSO at least 30 days prior to work.

3.3.2. Ensure contractors have received approval from the base RSO to use the material on base.

3.3.3. Give the base RSO the authority to conduct periodic checks of contractors using RAM on base.

3.3.4. Give the base RSO the authority to suspend contractor operations involving RAM believed to be unsafe (Reference AFI 40-201, para 3.4.18.2).

3.4. The 8th Civil Engineer Squadron Engineering Flight Chief (Along with USACCK) will:

3.4.1. Ensure that the base RSO has approved the use of RAM on base by contractors.

3.5. The Commander, 8th Logistics Readiness Squadron (8 LRS/CC) will:

3.5.1. Ensure personnel ship RAM according to U.S. Department of Transportation Regulations (Title 49 Code of Federal Regulations).

3.5.2. Ensure personnel notify the 8 MDOS/SGOAB of all RAM shipments originating from Kunsan AB. Prior to shipping, the 8 MDOS/SGOAB will ensure the package is appropriately monitored for activity and contamination .

3.5.3. Ensure TMO personnel notify the 8 MDOS/SGOAB of any radioactive shipment arrivals as soon as possible.

3.5.4. Ensure personnel notify the 8 MDOS/SGOAB of any radioactive shipment arrivals as soon as possible.

3.5.5. Comply with the requisition, receiving, and storage requirements for radioactive materials establish by T.O. 00-110N-3.

3.6. The Commanders of the Echo and Foxtrot batteries will:

3.6.1. Appoint their permit RSO and qualified RAM users, in writing, to the base RSO.

3.6.2. Ensure the permit RSO provides the base RSO the most current copy of the RAM permit.

3.6.3. Ensure the permit RSO completes an annual RAM compliance inspection.

3.7. The RSO 's for Echo and Foxtrot batteries will:

3.7.1. Coordinate storage and relocation of RAM with the base RSO.

3.7.2. Provide the base RSO with copies of the current RAM inventory and annual compliance inspection .

3.8. The 8 MDOS/SGOAB (Through the base RSO) will:

3.8.1. Act as the main point of contact for radiation protection matters.

3.8.2. Perform announced and unannounced radiation protection surveys and other monitoring to ensure radioactive sources and materials are being stored and used safely.

3.8.3. Be the main point of contact with the USAF RIC (HQ AFMOA/SGZR) for all radiation protection matters.

3.8.4. Act as the approval authority for the use of RAM by non-Air Force organization on Kunsan AB.

3.8.5. Have the authority to suspend operations that may be unsafe from a radiation safety standpoint.

3.8.6. Provide ALARA, radiation safety and thermoluminescent dosimeter training to personnel, and approve the content of training provided by supervisors and unit safety personnel on these topics.

3.8.7. Administer the TLD program.

3.9. All permittees will:

3.9.1. Follow all permit requirements at all times.

3.9.2. Contact the base RSO if any questions or problems arise concerning the permitted radioactive material.

3.9.3. Maintain a binder concerning the radioactive material permit as described in this instruction.

3.9.4. Be familiar with the requirements of AFI 40-201 and AFI 48-148, especially the incident reporting procedures .

3.9.5. Coordinate all shipment, receipts and transfers with the base/permit RSO.

3.10. Supervisors will:

3.10.1. Enforce radiation safety and ALARA procedures.

3.10.2. Ensure personnel receive radiation safety/ALARA/TLD training either administered or approved by 8 MDOS/SGOAB with 30 days of arrival at Kunsan AB, and repeat this training annually when personnel extend or volunteer for indefinite DEROS.

3.10.3. Notify the base RSO and the squadron commander of any radiation safety problems.

3.11. All Personnel using RAM or devices that generate X-Rays will:

3.11.1. Follow established radiation safety procedures, AFI 48-148 requirements, and practice ALARA.

3.11.2. Notify their supervisor of potential or existing radiation safety hazards.

3.11.3. Notify the 8 MDOS/SGOAB of any off-duty employment that may involve exposure to radiation .

3.11.4. If pregnant, notify the 8 MDOS Public Health Element (8 MDOS/SGOAM) and supervisor as soon as possible after finding out about the pregnancy.

3.11.5. Complete radiation safety training within 30 days of arrival at Kunsan AB, and repeat this training annually in the event of extension.

4. RAM Permit Requirements: The requirements in this paragraph apply only to organizations that have, or are applying for a RAM permits from the USAF RIC.

4.1. RAM permits are issued through the USAF RIC (HQ AFMOA/SGZR). All permit applications shall be submitted to the USAF RIC through the base RSO.

4.2. All questions concerning the RAM permit shall be directed to the base RSO.

4.3. Coordinate all communication with the USAF RIC with the base RSO.

4.4. The permit RSO and the permittees are responsible for maintaining a binder with permit information. All documentation shall be maintained in the binder for a period of at least three years. The binder shall be organized as follows:

4.4.1. **Tab A.** Appointment Letters (Base/Permit RSO and Authorized Users).

4.4.2. **Tab B.** Permit.

4.4.3. **Tab C.** Permit Application and Tie-Down Documents.

4.4.4. **Tab D.** Shop Operating Instruction (Must include instructions for receiving, opening and shipping packages of radioactive materials).

4.4.5. **Tab E.** Emergency Checklist.

4.4.6. **Tab F.** Training Documentation.

4.4.7. **Tab G.** Annual Inspection Results (RSO).

4.4.8. **Tab H.** IG Inspection Results.

4.4.9. **Tab I.** Copies of receipt documents and receipt package surveys.

4.4.10. **Tab J.** Periodic storage wipes.

4.4.11. **Tab K.** Inventory of radioactive materials.

4.4.12. **Tab L.** Radioactive shipment documents and transfer package surveys.

4.4.13. **Tab K.** AFI 40-201.

4.4.14. **Tab L.** 8 FWI 48-108.

4.5. RAM owners must post a NRC Form 3, *Notice to Employees*, and a supplemental notice in the area where the RAM is stored or used. The supplemental notice shall contain the information in AFI 40-201, para 3.5.3.

5. USAF Use of RAM and Devices That Produce Radiation: RAM and devices that produce ionizing radiation shall be used according to established operating procedures and technical orders. Supervisors shall establish operating procedures if they do not exist already. All locally developed operating proce-

dures shall be approved by the base RSO before implementation. Deviation from these procedures could result in exposures to radiation that is not ALARA.

5.1. **Exposure to ionizing radiation must be ALARA.** There are three ways to reduce radiation exposure: Time, distance, and shielding .

5.1.1. Time. Minimize, whenever possible, the amount of time a person is around a radiation source.

5.1.2. Distance. Radiation levels decrease with distance. The farther the person is from the source, the smaller the radiation exposure.

5.1.3. Shielding. Shielding is most effective for X-Ray and gamma radiation sources. Use shielding whenever it is present.

6. Use of RAM or Devices That Produce Radiation by Non-Air Force Organizations: Any use of RAM or devices that produce X-Ray radiation by non-Air Force organizations on Kunsan AB shall be approved by the base RSO.

6.1. Non-Air Force organizations, including contractors, who plan to use RAM or devices that produce X-Ray radiation on base shall notify the base RSO in writing. Notification for RAM use by contractors shall be done in accordance with AFI 40-201, para 3.4.18.2., at least 30 calendar days before bringing the materials on base.

6.2. The base RSO will notify the 8 CES/CEF and 8 CES/CEX chiefs when non-Air Force organizations are approved to use RAM on base.

7. RAM Storage:

7.1. Radiation storage areas are classified as “restricted” or “unrestricted” according to T.O. 00-110N-3. The classification is dependent on the radiation exposure levels measured in the storage area. The base RSO determines the storage area classification. Even if RAM is stored in an “unrestricted” area, provisions shall be established to prevent unauthorized removal of RAM. Organizations must coordinate with the base RSO prior to changing storage locations, even temporarily.

7.2. All commodities that contain RAM shall be labeled unless excepted by T.O. or regulation.

8. Shipping RAM:

8.1. Instructions for shipment of a particular RAM may be specified in a technical order or other directive. If this is the case, follow those instructions in addition to the requirements in this instruction .

8.2. Before shipping RAM, the organization must contact the 8 MDOS/SGOAB for packaging, labeling, and other shipping requirements.

8.3. The 8 LRS will notify the 8 MDOS/SGOAB of all RAM shipments originating from Kunsan AB. They will ensure the 8 MDOS/SGOAB checks the package prior to shipment.

9. Transporting RAM on Public Roads: In some situations, it may be necessary for base personnel to transport RAM on public roads off base in government or privately owned vehicles. Whenever this occurs, the Department of Transportation requirements (Including labeling) apply. Organizations that may

transport radioactive materials on public roads must contact the 8 MDOS/SGOAB for additional information on labeling and transportation requirements. Organizations shall obtain approval from the 8 MDOS/SGOAB before transporting RAM off base.

10. RAM Disposal:

10.1. Coordinate all RAM disposals with the base RSO. Specific disposal procedures depend on the isotope and the activity of the RAM .

10.2. Some lensatic compasses and other RAM can be recycled through Wright-Patterson AFB. Coordinate all recycling with the base RSO .

11. Monitoring: The 8 MDOS/SGOAB will conduct all applicable radiation monitoring. In some work-places (Such as 8 MXS Nondestructive Inspection), personnel may also conduct radiation monitoring whenever they use devices that produce X-Ray radiation. Monitoring methods include the use of TLD, radiation survey meters, pocket dosimeters, and alarms.

11.1. **TLD.** Personnel who use RAM or devices that produce X-Ray radiation in the following work areas must wear TLD's.

11.1.1. 8th Maintenance Squadron, Nondestructive Inspection Element.

11.1.2. 8th Medical Support Squadron, Radiology section.

11.1.3. Individuals receive their TLD's from the 8 MDOS/SGOAB after receiving ALARA and TLD training. The individual will receive an appointment for TLD enrollment and training during in-processing .

11.1.4. All personnel who wear TLDs shall do so according to instructions. Store TLD's with the control badge when not in use.

11.1.5. **Pregnancy.** If a woman who is on the TLD program becomes pregnant, she shall notify the 8 MDOS/SGOAB (Extension 782-4670) and her supervisor of the pregnancy.

11.1.6. **Off-Duty Employment.** Individuals must notify the 8 MDOS/SGOAB before engaging in any off-duty employment involving RAM, or radiation producing devices.

11.2. Results of monitoring, including dosimetry and survey results, are available for review in the 8 MDOS/SGOAB in Bldg 396.

12. Training: The following workplaces require initial and annual ALARA training.

12.1. 8 MXS Non-Destructive Inspection.

12.2. 8 MXS Avionics (Sensors Shop).

12.3. 8 CES, EOD.

12.4. 8 CES Readiness Flight and DPST.

12.5. 8 MDSS Radiology.

12.6. 8 MDSS Medical Logistics Flight.

12.7. 8 MDOS Dental Clinic.

12.8. 8 LRS Packing and Crating.

12.9. 1/43 ADA Echo Battery NBC (May be conducted with U.S. Army Training materials).

12.10. 1/43 ADA Foxtrot Battery NBC (May be conducted with U.S. Army Training materials).

12.11. The supervisor is responsible for personnel either receiving training from the 8 MDOS/SGOAB, or conducting it with BEE-approved training materials. **Attachment 2** of this instruction consists of an approved ALARA training curriculum that can be used. The supervisor must maintain a copy of the AF Form 2767, *Occupational Health Training and Protective Equipment Fit Testing*, and document training on each individual's AF Form 55, *Employee Safety and Health Record*.

13. Incidents and Accidents:

13.1. Report any incidents or accidents to the base RSO and supervisor immediately. For all incidents involving serious personal injury, or injuries of unknown severity, call 911 according to standard practice. Follow-up with the base RSO as soon as time allows in these cases.

13.2. Report loss or theft of RAM to the base RSO, supervisor, and 8th Security Forces Squadron immediately .

14. Radio-Luminescent Exit Signs:

14.1. No new radio-luminescent exit signs shall be installed or used on base. Existing exit signs shall be taken out of service as soon as practicable and feasible. Turn all out of service exit signs taken in to the 8 MDOS/SGOAB.

14.2. The managers of building with radio-luminescent exit signs shall comply with the following:

14.2.1. DO NOT attempt to repair the exit sign if the sign no longer illuminates. NEVER try to open the sign.

14.2.2. DO NOT removes the exit signs. Submit a work order to remove the sign if you cannot do it yourself .

14.2.3. DO NOT disposes of the exit signs. The signs MUST be disposed of as radioactive material. Bring the exit sign to the 8 MDOS/SGOAB (Bldg 396) during normal duty hours for proper disposal.

ROBIN RAND, Colonel, USAF
Commander

Attachment 1**GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION*****References***

AFI 40-201, *Managing Radioactive Materials in the U.S. Air Force*.

AFI 48-148, *Ionizing Radiation Safety*.

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

Title 10, Part 19, Code of Federal Regulations, *Notices, Instructions and Reports to Workers: Inspection and Investigation*.

Title 10, Part 20, Code of Federal Regulations, *Standards for Protection Against Radiation*.

T.O. 00-110N-2, *Radioactive Waste Disposal*.

T.O. 00-110N-3, *Requisition, Handling, Storage, and Identification of Radioactive Material*.

Abbreviations and Acronyms

ALARA—As Low As Reasonably Achievable

ANSI—American National Standards Institute

BEE—Bio Environmental Engineering

CY—Calendar Year

NCRP—National Council on Radiation Protection and Measurements

NRC—Nuclear Regulatory Commission

RAM—Radioactive Material

RIC—Radioisotope Committee

RSO—Radiation Safety Officer

TLD—Thermo-luminescent Dosimeter

T.O.—Technical Order

Attachment 2

APPROVED RADIATION SAFETY TRAINING CURRICULUM DISCUSSION OF RADIATION

A2.1. Ionizing Radiation is defined as energy or small particles (Beta, alpha, gamma, or X-Ray) emitted from the decay of radioactive materials. These materials may be contained in instruments or exist separately as an item, such as a calibration source. The amount of radiation an individual receives is called the “dose” and is measured in “REM”. The average individual in the United States accumulates a dose of one REM from natural sources “background radiation” every ten years. Background radiation results from the decay of trace radioactive materials in rocks and brick structures, cosmic rays, and underground deposits of naturally occurring radioactive materials. The dose from natural radiation is higher in some states, such as Colorado, Wyoming, and South Dakota, primarily because of greater cosmic radiation exposure at higher altitudes. In these states an average individual receives one REM every eight years.

A2.1.1. Many people receive additional radiation exposure for medical reasons. This results from medical and dental X-Rays, some cancer treatments, and several diagnostic tools such as barium treatments. The average individual dose to the U.S. population for medical treatment and diagnosis is 0.090 REM per year.

A2.1.2. Radiation can also be received from consumer products such as television and glow-in-the-dark watches, and from air travel. The average annual dose in the U. S. from consumer products is 0.00003 REM.

A2.1.3. Radiation, like many things, can be harmful. A large dose to the whole body (Such as 600 REM in one day) would probably cause death in about 30 days, but such large doses result only from rare accidents. Control of exposure to radiation is based on the assumption that any exposure, no matter how small, involves some risk. The occupational exposure limits are set very low, Medical evidence gathered over the past 50 years indicates no clinically observable injuries to individuals due to radiation exposures when the established radiation limits are not exceeded. Thus the risk to individuals at the occupational exposure levels is considered to be very low. However, it is impossible to say that the risk is zero. To decrease the risk still further, Air Force policy is to keep actual exposures as far below the limits as possible .

A2.1.4. The current exposure limits for people working with radiation have been developed and reviewed by nationally and internationally recognized groups of scientists. These include the ANSI and the NCRP. It must be remembered, however, that these exposure limits are for adults. Special considerations must be made when the individual exposed is, or may be, an expectant mother. Ionizing radiation exposure is significantly more harmful to a developing baby than to an adult.

A2.2. Radiation Source in Your Work Area.

A2.2.1. Obtain assistance from 8 MDOS/SGOAB in filling out the specifics of this paragraph. Can be X-Rays, a certain Radioisotope (i.e., Nickel-63, Americium-241), or other source of ionizing radiation.

Attachment 3

HEALTH EFFECTS OF IONIZING RADIATION EXPOSURE

A3.1. X-Ray, gamma and neutron radiation strip electrons from molecules in the body. This can affect body cells in three ways. These are:

A3.1.1. The cell is damaged but repairs itself.

A3.1.2. The cell dies, or.

A3.1.3. The cell is altered.

A3.1.4. Health effects are divided into three categories: Prompt effects, delayed effects, and genetic effects.

A3.2. Prompt Effects are Due To Large Exposure, Usually Greater Than 450 REM. Symptoms include vomiting and diarrhea within a few hours. Within weeks the exposed person may develop weight loss, fever, loss of hair and 50% will die if not treated within 60 days. Male fertility is reduced when the dose of ionizing radiation is 500 REM or more, and this will also result in death for 50% of the exposure victims within 60 days. The Maximum Permissible Exposure for a year is **5 REM**.

A3.3. Delayed effects are due to an accumulation of low doses over an extended period of time. The most common hazards are leukemia and other forms of cancer. Studies on these effects generally involve individuals who were exposed to doses over 100 REM.

A3.4. Genetic effects are effects that are passed on to the children of individuals exposed to radiation. These are usually birth defects involving the central nervous system resulting in mental retardation and small skull size. Like delayed effects, genetic effects have been studied and documented primarily for exposures of over 100 REM during the pregnancy.

A3.4.1. It is assumed that *any* exposure to ionizing radiation increases the risk of developing some type of health effect. The *ALARA principle* has been developed based on this assumption, and its purpose is to minimize exposure to ionizing radiation as much as possible.

A3.5. ALARA.

A3.5.1. The *ALARA concept* is the basis for the Air Force Exposure Control Program for ionizing radiation. The program uses management, administrative and engineering controls to reduce radiation exposures to as low a level as possible. ALARA is based on the following guidelines :

A3.5.1.1. A task involving exposure to ionizing radiation will only be performed when the benefits exceed the risk.

A3.5.1.2. Individual and collective doses will be decreased as much as possible by decreasing the total exposure time and/or decreasing radiation levels.

A3.5.1.3. The ALARA concept was developed in response to scientific evidence that suggests that no level of radiation exposure is totally risk free. While the established maximum permissible doses are conservative and offer a low risk of adverse health effects, every effort should be made

to reduce exposures to the lowest level that is reasonable - thereby minimizing the health risk associated with that exposure.

A3.6. How can the ALARA concept be implemented in the workplace?

A3.6.1. Plan the work to be performed.

A3.6.2. Gather the necessary materials for the work ahead of time.

A3.6.3. Avoid unnecessary work near the radioactive source.

A3.6.4. Provide positive supervision to ensure the timely completion of tasks.

A3.6.5. When possible, consolidate work requirements to minimize the total time required around the radioactive source.

A3.6.6. Where practical, use fewer workers for the operation.

A3.6.7. Work no closer than necessary to the radioactive source consistent with procedural, safety and security requirements.

A3.6.8. Keep excess and unnecessary personnel out of the areas that are close to where the radioactive source is used and stored.

A3.7. Maximum Permissible Exposure Limits.

A3.7.1. Exposure limits for ionizing radiation are established by the NRC in 10 CFR 20. The Air Force must abide by these regulations the same as any other organization. Some of these exposure limits are as follows.

A3.7.2. **Lifetime Exposure** – Occupational lifetime exposure limits are calculated using the equation:

A3.7.2.1. $\text{Exposure} = 5 (N-18) \text{ REM}$.

A3.7.2.2. Where $N = \text{Age in years}$.

A3.7.2.3. Personnel under age 18 are not permitted to work in radiation areas. A worker's radiation exposure on the job must be documented so that this lifetime exposure can be calculated. This is one of the purposes of the Air Force TLD program.

A3.7.3. **Yearly Occupational Exposure Limit** – 5 REM per year. This level has been established so that the Lifetime Exposure limit cannot be exceeded.

A3.7.4. **Quarterly maximum** – 3 REM per quarter (Remember the yearly exposure still cannot exceed 5 REM).

A3.7.5. **Non-Occupational Exposure Limit** – 0.1 REM per year. This is the level for the general public .

A3.8. Radiation Exposure Action Levels.

A3.8.1. **Overexposure Action Level** - An exposure that exceed the maximum permissible dose. Formal investigation and documentation of the incident is required IAW AFI 48-125.

A3.8.2. **Abnormal Exposure Action Level** - An exposure which if continued on an annual basis, would result in an annual overexposure. This equates to 1.25 REM on a quarterly TLD badge for the whole body and head exposures of 16 REM. A formal investigation to determine the cause of this exposure must be made IAW AFI 48-125.

A3.8.3. **Investigative Action Level** - An exposure which action should be taken to determine the reason for the exposure. This level at Kunsan AB is 0.5 REM on a quarterly TLD. Results above the investigation action level will be investigated by the base RSO and reported to the Hospital Aerospace Medicine Council.

A3.8.4. **Pregnant Female Action Level** - An exposure above which, if continued for the term of the pregnancy would exceed the 0.5 REM exposure limit for the fetus. If a pregnant female's TLD results are above 0.05 REM in a month, it is investigated and reported to the Aerospace Medicine Council.

A3.9. Radiation Effects On Developing Babies.

A3.9.1. The prediction that an unborn child would be more sensitive to radiation than an adult is supported by observations for relatively large doses. Large doses delivered before birth alters both physical development and behavior in experimentally exposed animals. Concern about prenatal exposure at the permissible occupational levels is primarily based on the possibility that cancer (especially leukemia) may develop during the first ten years of the child's life.

A3.9.2. The scientific organization called the NCRP recommends that because unborn babies may be more sensitive to radiation than adults, their radiation dose as a result of occupational exposure of the mother should not exceed **0.5 REM** during the pregnancy.

A3.9.3. The Air Force has established a policy which is intended to ensure that occupational exposure to pregnant workers are not likely to result in a dose to the unborn child which would exceed the 0.5 REM limit recommended by the NCRP. This policy requires that female workers who may be occupationally exposed to radiation:

A3.9.3.1. Must be told about the potential hazards to an unborn child of radiation exposures above the NCRP-recommended limit of 0.5 REM.

A3.9.3.2. Must be told of the importance of promptly telling her supervisor if she believes she may be pregnant, so that appropriate action may be taken to assure the protection of the fetus from excessive radiation exposures .

A3.9.3.3. Must have pregnancies confirmed.

A3.9.3.4. Must be given the opportunity to ask, and have answered, questions concerning the risks of radiation exposure to herself and her child.

A3.9.3.5. Must be temporarily restricted from duties where exposures would exceed 0.5 REM.

A3.10. Risk Comparison.

A3.10.1. The average person in the United States receives 0.3 REM per year from background radiation, such as radon, cosmic rays and naturally occurring radioactive materials in the soil. 0.06 REM is received from man-made sources, such as medical X-Rays, television, cooking with natural gas and smoke detectors. These doses do not include smoking. It is estimated that the average smoker receives **16 REM** per year from naturally occurring Polonium-210 found in tobacco products.

A3.10.2. The tables on the following pages compare the number of days of life expectancy lost from various occupational and recreational activities. These estimates indicate that the health risks from occupational radiation exposure are smaller than the risks associated with many other events we encounter and accept in normal day-to-day activities.

Table A3.1. Estimated Loss of Life Expectancy from Health Risks.

Health Risk	Estimate of days of Life Expectancy Lost (Average)
Smoking 20 cigarettes/day	2370 (6.5 years)
Being 20% overweight	985 (2.7 years)
All accidents combined	435 (1.2 years)
Auto accidents	200
Alcohol Consumption (U.S. average)	130
Home accidents	95
Drowning	41
Natural Background Radiation (Calculated)	8
Medical Diagnostic X-Rays, U.S. Average (Calculated)	6
All Catastrophes (Earthquake, etc.)	3.5
1 REM of Occupational Radiation Exposure (Calculated)	1

Table A3.2. Estimated Loss of Life Expectancy from Industrial Hazards.

Health Risk	Estimate of days of Life Expectancy Lost (Average)
All Industry	74
Trade	30
Manufacturing	43
Service	47
Government	55
Transportation and Utilities	164
Agriculture	277
Construction	302
Mining and Quarrying	328
Radiation Accident Resulting in Death from Exposure	< 1
Radiation Dose of 0.65 REM per Year for 30 Years	20
Radiation Dose of 5 REM per Year for 50 Years	250
Industrial Accidents at Nuclear Facilities	58

Table A3.3. Probability of Accidental Death by Occupation.

Occupation	Number of Accidental Deaths per 10,000 Workers for 40 Years
Wholesale and Trade	24
Transportation and Public Utilities	116
Services	28
Nuclear Industry	40
Mining	252
Manufacturing	36
Government	44
Construction	228
All Industries	56
Agriculture	216

A3.10.3. One-in-a Million Risk of Death.

A3.10.3.1. Smoking 1.4 cigarettes.

A3.10.3.2. Drinking 0.5 liters of wine.

- A3.10.3.3. Spending three hours in a coal mine.
- A3.10.3.4. Living two days in New York City.
- A3.10.3.5. Traveling six minutes by canoe.
- A3.10.3.6. Traveling ten miles by car.
- A3.10.3.7. Flying 1,000 miles by jet.
- A3.10.3.8. Eating 100 charcoal broiled steaks.
- A3.10.3.9. Drinking 30-12 oz cans of diet soda.
- A3.10.3.10. Eating 40 Tablespoons of peanut butter.
- A3.10.3.11. Living 150 years 20 miles from a nuclear plant.
- A3.10.3.12. Being exposed to two milligrams of radiation.

A3.11. If You Have Any Questions About Radiation.

- A3.11.1. Contact the Base RSO:

8 MDOS/SGOAB

DSN: (315) 782-5421 or 4670

NOTE: The RSO's office is located in Building 396. You are welcome to stop by or to make an appointment if you have questions or concerns .

- A3.11.2. Contact a Flight Surgeon:

8 MDOS/SGOA

DSN: (315) 782-4509

NOTE: Flight Medicine is located in the Base Hospital (Building 405).

- A3.11.3. Contact your supervisor or unit safety representative.