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KSC IONIZING RADIATION PROTECTION PROGRAM

**National Aeronautics and
Space Administration**

John F. Kennedy Space Center

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PREFACE

P.1 PURPOSE

This manual provides basic KSC Radiation Protection Program policies, requirements, and controls concerning the procurement, use, and handling of radioactive materials and/or

ionizing radiation producing machines/devices.

P.2 APPLICABILITY

These provisions apply to all organizational and user elements under the jurisdiction or direction of NASA at the Kennedy Space Center (KSC), NASA/KSC facilities/personnel located on the U.S. Air Force Command, 45th Space Wing (45 SW), and 30 SW, Vandenberg AFB, and other KSC worksites.

P.3 AUTHORITY

a. Nuclear Regulatory Commission (NRC) Broadscope License for Kennedy Space Center

P.4 REFERENCES

a. KNPD 1860.1, KSC Radiation Protection Program

b. Atomic Energy Act of 1954, as amended

c. Chapter 64E-5 Florida Administrative Code "Control of Radiation Hazards"

d. 45 SW INSTRUCTION 40-201 - Radiation Protection Program

e. 45 SW REGULATION 127-1 - Range Safety Manual

f. International Air Transport Association (IATA) Safety Standard/Regulations for the Transport of Dangerous Goods by Air

g. International Commission on Radiological Protection (ICRP) Publications

h. KNPD 1800.1 (as revised), “Environmental Health Program”

i. KNPD 1810.1 (as revised), “KSC Occupational Medicine Program”

j. KNPD 1860.1 (as revised), “KSC Radiation Protection Program”

k. KNPR 6000.1 (as revised), “Transportation Support System Manual”

l. "Nuclear Safety Review and Approval Procedures for Minor Radioactive Sources in Space" Guide, Approved by the Executive Office of the President, National Aeronautics and Space Council, June 15, 1970

m. International Atomic Energy Commission (IAEA), "1990 Regulations for the Safe

Transport of Radioactive Material, Safety Series No. 6, Section III - Activity and Fissile Material Limits"

n. Presidential Guidelines for Diagnostic X-Rays at Federal Installations, Approved January 26, 1978

o. Title 10 Code of Federal Regulations Chapter 1, Parts 19, 20, 21, 30, 31, 33, 34, 71, 150, 170, and 171

p. Title 21 Code of Federal Regulations Chapter 1, Subchapter J Radiological Health

q. Title 21 Code of Federal Regulations Parts 1000-1040

r. Title 29 Code of Federal Regulations Parts 1910.96 and 1910.97

s. Title 49 Code of Federal Regulations Parts 100-177

t. U.S. Department of Energy Radiological Control Criteria for Contractors and/or Users of Nuclear Power Systems for Space and Terrestrial Applications

u. Memorandum of Understanding Between the Department of Energy and the National Aeronautics and Space Administration Concerning Radioisotope Power Systems for Space Missions, July 26, 1991

v. National Security Council/Presidential Directive No. 25, (NSC/PD-25), dated 12/14/77, as revised 5/8/96

P.5 SUPERSESSION

This revision supersedes KHB 1860.1, Rev. D, KSC Ionizing Radiation Program.

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SECTION 1 GENERAL DESCRIPTION

1.1 PURPOSE

This Procedure details policy, administrative direction, organizational guidance, and procedural requirements of the NASA/Kennedy Space Center Ionizing Radiation Protection Program.

1.2 POLICY

At KSC, and at any other location/facility under the purview of KSC, centralized control will be exercised over the use of radioactive materials and ionizing radiation producing machines/devices to ensure safe practices and operations, to preclude unnecessary exposure to personnel, and to limit exposure to levels which are "As Low As Reasonably Achievable" (ALARA). All activities involving the use of sources of ionizing radiation shall conform to all pertinent Federal, State, and local regulations/controls. Personnel exposures will not be permitted to exceed applicable Federal or State regulatory limits except in the event of extreme emergency, as defined by relevant and applicable regulations/controls. The KSC Radiation Protection Program has been established to implement and maintain this policy.

1.3 SCOPE

This Procedure defines guidelines and requirements regarding the approval, procurement, use, transfer/shipment, and disposal of sources of ionizing radiation. It provides general guidance concerning personnel monitoring requirements and emergency procedures, and describes the basic organization and responsibilities of the Radiation Protection Program as they pertain to personnel health protection and regulatory compliance.

1.4 APPLICABILITY

The provisions of this Procedure apply to all NASA elements under KSC jurisdiction or direction including associated contractors, tenants, transients, principal investigators, and visitors who are directly or indirectly involved with the procurement, use, storage, or disposition of radioactive materials and/or ionizing radiation producing machines/devices.

1.5 AUTHORITY

KNPD 1860.1, Radiation Protection Program-Policies and General Provisions for Ionizing and Non-Ionizing Radiation.

1.6 ORGANIZATION

a. KSC Radiation Protection Committee (RPC)

The RPC consists of four executive members and not more than eight other members and includes the KSC Radiation Protection Officer (RPO). The RPC develops policy and requirements to assure that adequate facilities, equipment, training, and operational and emergency controls are maintained for all operations utilizing radioactive materials and/or radiation producing machines/devices. The RPC approves or disapproves all uses of such radioactive materials and radiation producing machines/devices at KSC.

b. KSC Radiation Protection Officer (RPO)

The KSC RPO, designated by KNPD 1800.1, is responsible for functional implementation and administration of the Radiation Protection Program at KSC. Specifically, the RPO assures that operations involving radioactive materials and/or radiation producing machines/devices are performed in accordance with applicable Federal, State, and local regulations, and other pertinent health and safety standards. The KSC RPO also serves as the KSC liaison for formal contact and coordination with the U.S. Nuclear Regulatory Commission and other agencies regarding licensing regulations and radiation protection matters in general.

c. The Joint Base Operations Support Contractor Element Providing Health Physics Services (JBOSC HP)

The JBOSC HP, responsive to Center Operations Directorate/Aerospace Medicine and Occupational Health Branch, acts as the functional representative for the KSC RPO. Specific responsibilities of the JBOSC HP include technical review and evaluations of radiation sources and their use, consultations with users of radioactive materials and/or radiation producing machines/devices, administration of the KSC personnel radiation dosimetry program, maintenance of the ionizing radiation source inventory and the waste disposal program, and general surveillance and implementation of the KSC Radiation Protection Program.

SECTION 2 RADIATION PROTECTION PROGRAM TERMINOLOGY

2.1 **AREA RADIATION OFFICER (ARO)** - The individual designated by the user organization's management as their representative for matters pertaining to the local control of radiation hazards.

2.2 **DOSIMETER** - Any device that detects and measures accumulated radiation dose.

2.3 **HAZARD SURVEY** - An onsite technical inspection of material, systems, or devices covered by Radiation Use Authorizations. Such a survey may involve the physical measurement of radiation levels and the evaluation of precautionary control measures, as applicable.

2.4 **HEALTH PHYSICS (HP)** - The profession and science concerned with the protection of people and the environment from unnecessary exposure to radiation, through understanding, evaluation, and control of the risks from radiation exposure relative to the benefits derived.

2.5 **IONIZING RADIATION** - Electromagnetic or particulate radiation capable of producing ions, directly or indirectly, in its passage through matter.

2.6 **LICENSED MATERIAL** - Any material received, possessed, used, or transferred under a general or specific license issued by the United States Nuclear Regulatory Commission or an Agreement State.

2.7 **MAJOR RADIOLOGICAL SOURCE (MRS)** - Nuclear Reactors and other devices with a potential for criticality and radioactive materials to be launched which requires presidential nuclear launch approval per "National Security Council/Presidential Directive No. 25," paragraph 9. Examples would include, but not be limited to, Radioisotope Power Sources (RPSs), and Radioisotope Heater Units (RHUs).

2.8 **MODIFICATION OF RADIATION USE AUTHORIZATION (MRUA)** - Formal submittal format for data and information pertaining to a change in personnel, facilities equipment, or procedures, affecting an existing approved Radiation Use Authorization (RUA).

2.9 **RADIATION INCIDENT** - Any unusual occurrence, accident, or emergency involving a radiation source(s).

2.10 **RADIATION USE REQUEST/AUTHORIZATION (RUR/A)** - Formal submittal format for data and information pertaining to the proposed acquisition, use, and storage of radiation sources.

2.11 **USER** - Any individual designated and approved by the KSC Radiation Protection Committee to possess and/or use radiation sources on KSC.

2.12 **USE SUPERVISOR/CUSTODIAN (US/C)** - Designated onsite user who is authorized to act on behalf of the Area Radiation Officer during ARO absence.

SECTION 3 PROGRAM RESPONSIBILITIES

3.1 THE KSC RADIATION PROTECTION COMMITTEE (RPC) is responsible for:

a. Ensuring the development and maintenance of KSC Ionizing Radiation Protection Program policies on behalf of the Center Director.

b. Reviewing and approving uses of controlled ionizing radiation devices.

c. Advising the Radiation Protection Officer in the execution of duties as designated in KNPD 1860.1.

d. Providing oversight of KSC radiological regulatory matters.

3.2 THE KSC RADIATION PROTECTION OFFICER (RPO) is responsible for:

a. Providing general surveillance over users of radiation sources.

b. Acting as liaison officer for the KSC Radiation Protection Program to ensure compliance with the applicable regulatory agencies' requirements relative to all ionizing radiation related activities and regulatory matters for KSC.

c. Acting as liaison officer between KSC and other nonregulatory agencies, parties, contractors, etc., relative to ionizing radiation matters.

d. Providing technical guidance to KSC organizations on ionizing radiation-related matters and acting as the functional representative of the RPC.

e. Auditing the recordkeeping systems of the ionizing Radiation Protection Program for KSC pertinent to applicable requirements for licenses, registrations, and reports.

f. Performing contract oversight role by participating in the Environmental Health Integrated Process Team, lead by the Cape Canaveral Spaceport Management Office (CCSMO), responsible for reviewing and accessing JBOSC contract indicators.

g. Assuming technical control, initiating investigations, and directing corrective actions in ionizing radiation incidents and emergencies for KSC and coordinating mishap reporting and investigation requirements with the appropriate KSC Safety and Mission Assurance organization, and/or KSC Protective Services Branch, as appropriate.

h. Assuring proper disposition of ionizing radiation records for all employees, both Government and contractor, upon their termination of employment or transfer from KSC.

i. Representing the RPC and speaking and acting for KSC on matters of policy and procedures relating specifically to control of ionizing radiation sources for KSC.

j. Making interim approvals for the Radiation Protection Committee, subject to subsequent RPC ratification.

3.3 THE KSC JOINT BASE OPERATIONS SUPPORT CONTRACTOR (JBOSC) ELEMENT FOR HEALTH PHYSICS SERVICES (HP), will, to the extent provided by contract, provide services to include:

a. Operational implementation of the Ionizing Radiation Protection Program for KSC under the direction of the RPO.

b. Provide, in the RPOs absence and after formal notification by the RPO, an individual to act on behalf of the Radiation Protection Officer.

c. Maintain appropriate licenses and registrations with associated records and reports in compliance with applicable regulatory agencies' requirements.

d. General surveillance functions for the KSC Ionizing Radiation Protection Program.

e. Technical evaluation of proposed uses of ionizing radiation, make recommendations, and provide other assistance to the RPO on matters concerning ionizing radiation protection.

f. Act as the field representative of the KSC Ionizing Radiation Protection Program and as liaison between user organizations and the RPO on radiological matters.

g. Perform onsite surveillance, inspections, surveys, or monitoring of ionizing radiation uses and users, as required.

h. Provide radiation protection training if needed for Use Authorization approval or if requested through the RPO. Such training will be provided on a case by case basis and tailored to the intended Area Radiation Officer and users activities involving nonionizing radiation sources.

3.4 HEADS OF PRIMARY ORGANIZATIONS are responsible for:

a. Ensuring all requests from their organizations for procurement, possession, use, transfer or other disposition of controlled ionizing radiation devices are coordinated with and routed through the RPO to the RPC for approval prior to forwarding to the Procurement Officer, Transportation Officer, or other appropriate official.

b. Ensuring the project leaders, technical representatives, and supervisors:

(1) familiarize themselves with all policies and procedures governing radiation sources/devices;

(2) ensure those personnel within their respective organizational responsibility are provided appropriate orientation and/or systems training; and

(3) review projects, plans, and procedures involving the use of ionizing radiation sources and identify all controlled sources to the RPO for applicable use authorization approval.

c. Ensuring Procurement Requests and Statements of Work involving radiation sources (directly or indirectly):

(1) stipulate compliance with KSC Ionizing Radiation Protection Program requirements; and

(2) require all contractor ionizing radiation source user personnel who are terminating or transferring employment to be identified in accordance with the Use Authorization requirements.

d. Ensuring the designation of a user organization Area Radiation officer (ARO). The ARO shall have training and experience in radiation protection that is commensurate with the scope of proposed activities and is satisfactory to the RPO.

3.5 AREA RADIATION OFFICERS (AROs) are responsible for:

a. Ensuring the safe use and accountability of the ionizing radiation device(s) under their control in accordance with the provisions specified and approved by the applicable KSC Use Authorization.

b. Ensuring all sources of ionizing radiation under their jurisdiction have been identified to and approved by the RPO.

c. Giving prior notification to the JBOSC Health Physics Office of movement of controlled ionizing radiation devices, as required.

d. Ensuring all personnel utilizing sources of ionizing radiation under their jurisdiction are properly trained in safe practices for the possession and use of such sources and are oriented to the applicable regulatory and program requirements.

e. Ensuring the individual users have been approved through the KSC Radiation Protection Program.

f. Providing immediate notification to the JBOSC Health Physics Office upon determination or suspicion of any accident or incident involving a potential overexposure of personnel.

g. Designating a "Use Supervisor/Custodian" (US/C) under the UA process to act as designated representative in their absence, or whenever they are unable to maintain direct supervision of the sources under their jurisdiction. The US/C shall have training and experience in radiation protection that is commensurate with the scope of proposed activities.

3.6 THE USE SUPERVISOR/CUSTODIAN (US/C) as designated by the ARO, is responsible for:

a. Ensuring the operational implementation of control provisions and requirements levied by the applicable KSC approved Use Authorization.

b. Acting on behalf of the ARO in their absence.

3.7 EACH USER is responsible for:

a. Ensuring proper personnel access controls at all identified Radiation Controlled Areas.

b. Observing applicable provisions of this KNPR and the specific control provisions and requirements as stated in the approved KSC Use Authorization.

c. Consulting with their ARO and supervision when deviation from approved procedures, equipment, personnel, or planned schedules would necessitate a modification of the approved KSC Use Authorization.

d. Immediately notifying the JBOSC Health Physics Office of any real or suspected accident or incident involving a potential over exposure.

3.8 DIRECTORS, SAFETY, AND MISSION ASSURANCE ORGANIZATIONS are responsible for:

a. Coordinating provisions of the KSC Safety, Reliability, and Quality Assurance Program with KSC Ionizing Radiation Protection Program provisions or with the KSC Radiation Protection Officer, as necessary.

b. Reviewing and monitoring procedures from a safety standpoint involving the use, movement, and transportation of ionizing radiation devices, as required by KNPR 8715.3, or KHB 1700.7, as appropriate.

c. Providing safety surveillance of all activities involving the use of ionizing radiation devices as such activities relate to KNPR 1710.2.

d. Coordinating with the RPO on emergency operations concerning ionizing radiation devices.

e. Supporting enforcement of radiological controls established by the KSC Ionizing Radiation Protection Program and any applicable approved KSC Use Authorization.

3.9 DIRECTOR, CENTER OPERATIONS is responsible for ensuring that:

a. Protective Services Branch will:

(1) Ensure that fire protection personnel are properly trained in personnel protective practices relative to fighting fires involving hazards associated with ionizing radiation sources.

(2) Review and make final determination of requirements for the physical security of ionizing radiation sources.

b. Emergency Preparedness Office will:

(1) Coordinate with the RPO or designated representative on the development of emergency plans and procedures relative to major emergency situations involving ionizing radiation devices which might significantly affect KSC operations or personnel safety.

(2) Coordinate resources to support implementation of approved emergency plans and procedures as directed by the RPO relative to radiation sources.

c. Property Disposal Office will:

Ensure identified controlled ionizing radiation devices are not released from KSC without approval of the RPO or designated representative.

d. Logistics Consultant will:

(1) Ensure shipments of controlled ionizing radiation devices off KSC properties comply with applicable regulations and have been released for shipment by the RPO or designated representative.

(2) Ensure inbound shipments of controlled ionizing radiation devices are identified to, and approvals are received from, the RPO or designated representative.

3.10 DIRECTOR, ENGINEERING DEVELOPMENT is responsible ensuring that:

a. Chief, Facilities Division will:

Ensure that requests for construction, siting, and modifications of facilities and equipment involving ionizing radiation hazards, have been reviewed and approved by the RPO.

3.11 DIRECTOR, PROCUREMENT OFFICE is responsible for:

a. Ensuring procurement requests for equipment, which incorporates controlled ionizing radiation devices, have been identified to the RPO prior to procurement.

b. Incorporating into all Requests for Proposal and Invitations for Bid (to include KSC form 7-49, “Request for Equipment/Materials”) all ionizing radiation protection requirements identified by the heads of primary organizations in their Purchase Requests or Statements of Work.

c. Ensuring contractor compliance with the requirements of the KSC ionizing Radiation Protection Program, to the extent delineated in their contract.

3.12 DIRECTOR, EXTERNAL RELATIONS AND BUSINESS DEVELOPMENT is responsible for coordinating public affairs activities involving announcements and releases concerning ionizing radiation hazards under KSC jurisdiction with the RPC or RPO.

3.13 DIRECTORS OF SPACECRAFT PROCESSING OPERATIONS are responsible for assuring all payload organizations coordinate through proper channels with the RPO

for compliance with KSC Ionizing Radiation Protection Program requirements.

3.14 CONTRACTING OFFICERS are responsible for including in contracts, the requirement that all contractor personnel who have been associated with operations involving nonionizing radiation devices and are terminating or transferring employment be identified in accordance with Use Authorization requirements.

3.15 HUMAN RESOURCES OFFICE is responsible for ensuring all NASA/KSC civil service tenant employees who have been classified as radiation workers and are terminating or transferring employment have cleared through the Occupational Medicine and Environmental Health Facilities.

SECTION 4 ADMINISTRATIVE PROVISIONS FOR CONTROL OF IONIZING RADIATION SOURCES

4.1 GENERAL PROVISIONS

The following general provisions are provided to assist users of controlled ionizing radiation devices under the purview of the KSC Radiation Protection Programs. Radiation source(s) may be exempted from some or all of the KSC Radiation Protection Program control requirements, if the specific source(s) have been appropriately analyzed and evaluated. Questions of program applicability regarding a specific source of ionizing radiation, which the user cannot otherwise determine, may be addressed by submitting the appropriate form and information as described in Section 5 of this KNPR.

a. All proposals for procurement and use of controlled ionizing radiation devices will be submitted to the KSC RPC through the KSC RPO, or designee, for review and approval prior to procurement and use.

b. Approved KSC Ionizing Radiation Protection Program forms, as described by Section 5 of this KNPR, will be utilized in submittals to the KSC Radiation Protection Officer through the JBOSC HPO.

c. All receipt, internal transfer, and shipment of controlled ionizing radiation devices will be coordinated with and approved in advance by the KSC RPO or designee. Responsible individuals designated in the approved Use Authorization (e.g., AROs, US/Cs) will review plans and procedures to assure such coordination and approval.

d. Constraints imposed upon the use of controlled ionizing radiation devices will be no less than those required by applicable regulatory authorities and will include any additional constraints deemed necessary by the KSC RPC or the KSC RPO.

e. Applicable records pertaining to the KSC Radiation Protection Program will be maintained by the RPO, or designee. Such records may include, but not necessarily be limited to, records of procurement, receipt, use authorization, exemption, licensing or registration, inventory, surveys, dosimetry, shipments, and investigations.

f. Controlled ionizing radiation devices transferred to, or stored or used on, CCAFS by organizations under KSC purview must also be approved by the 45th SW RPO. This approval is accomplished by concurrence signature of the 45th SW RPO on the appropriate KSC Use Authorization form. This

coordination is performed by the KSC RPO or designee and does not require separate submittals to the 45th SW RPO by the user organization.

4.2 PROCUREMENT AUTHORIZATION

All procurement requests for controlled ionizing radiation-producing devices, except as specifically exempted by the provisions of Section 5 of this KNPR, must be accompanied by an explanatory statement or by the signature of approval from the KSC RPO.

4.3 POSSESSION AND USE AUTHORIZATION

Authorization for possession or use of controlled ionizing radiation devices requires review by and approval of the KSC RPC and the KSC RPO. To begin the authorization process, submittal of a completed Use Request Authorization forms package, as outlined in Section 5 of this KNPR is required. These forms, in conjunction with any necessary supportive data, will be submitted as soon as practicable, but in no case later than 90 days prior to the intended arrival of the source(s) at KSC.

a. Specific Use Authorization

A specific Use Authorization (UA) will be issued subsequent to evaluation of information/data submitted on the appropriate KSC forms. Attachments to these forms should include all relevant data and information pertaining to the specified devices and use. Details of the type of information required are delineated in Section 5 of this KNPR.

b. General Use Authorization

(1) A General Use Authorization (GUA) may be issued under certain circumstances subsequent to evaluation of information submitted on appropriate KSC forms. GUAs will usually pertain only to devices which represent a minimal hazard potential for personnel.

(2) Use of devices under General Use Authorizations may be subject to specific controls or restrictions.

(3) General Use Authorization will normally be issued for indefinite periods of time.

4.4 USER QUALIFICATIONS

a. Prior to utilizing controlled ionizing radiation devices, individuals must possess pertinent experience, an understanding of the limiting provisions of the Use Authorization, and have received training or orientation covering at least the following topics:

(1) General description of the applicable radiation type and associated biological effects.

(2) Basic principles of radiation protection.

(3) Radiation protection procedures relevant to intended use.

(4) Provisions of this KNPR and appropriate Federal, State, and local regulations.

(5) Emergency procedures.

b. Personnel subject to certain ionizing radiation hazards may be required to obtain additional training and medical certification as deemed necessary by the KSC RPC or the KSC RPO.

c. AROs will ensure all potential users of ionizing radiation devices under their purview supply the necessary information as delineated above on KSC Form 16-450, “Training and Experience Summary (Ionizing Radiation Users).”

4.5 HAZARD ANALYSIS AND EVALUATION

The KSC RPO or designee will evaluate each Use Request to assess the potential hazards associated with the possession and use of the ionizing radiation source. Additional information may be requested, and site inspections or surveys may be utilized in the course of analysis and evaluation.

4.6 RADIATION PROTECTION SURVEYS

Surveys may be required to ensure compliance with procedures and controls described by the provisions of this KNPR. Also, based on the preliminary assessment of a Use Request, an initial survey may be required by the KSC RPO or designee, either prior to or in conjunction with initial use of the controlled ionizing radiation device(s).

4.7 ASSIGNED CONTROLS

In addition to compliance with applicable Federal, State, and local regulations, an individual Use Authorization may stipulate additional controls assigned by the KSC RPO as a result of unique source or operational characteristics.

4.8 SCHEDULING AND NOTIFICATIONS

a. Based upon the potential hazard represented by the use of certain ionizing radiation devices, organizations responsible for use of such devices may be required to schedule use operations through the KSC Scheduling System or to provide other prior notification of operations to the JBOSC HP Office. Such requirements will be specified in the Use Authorization, if required.

b. The user organization shall ensure all KSC Ionizing Radiation Protection Program support requirements for activities involving hazardous radiation sources, as stipulated in the approved KSC Use Authorization, are included in the appropriate KSC Scheduling System document sections.

4.9 WAIVERS, DEVIATIONS, AND SUSPENSIONS

a. Waivers of or deviations from the requirements described by this KNPR may be issued by the KSC RPO on an individual basis.

b. Authorization for possession and use of ionizing radiation devices may be rescinded at any time as a result of noncompliance with provisions of the applicable Use Authorization or other regulatory requirements.

4.10 LOSS OR THEFT OF NONIONIZING RADIATION DEVICES

Loss or theft of controlled ionizing radiation devices shall be immediately reported to the KSC RPO, or the JBOSC Health Physics Office. Refer to Appendix A of this KNPR for emergency notification telephone numbers.

4.11 UNATTENDED NONIONIZING RADIATION DEVICES

Unattended controlled ionizing radiation devices shall be secured against unauthorized access at all times.

4.12 INCIDENTS, ACCIDENTS, AND EMERGENCIES.

All real or suspected incidents, accidents, or emergencies involving sources of ionizing radiation shall be immediately reported to the KSC RPO or to the JBOSC Health Physics Office. Refer to Appendix A, paragraph A.3 for radiation incident

notification requirements and telephone numbers. Mishaps shall also be reported as described by KNPR 8715.3.

4.13 MODIFICATION OF USE AUTHORIZATION

a. Changes to authorized use of ionizing radiation devices will be coordinated with, and approved in advance by, the KSC RPO. This coordination and approval process may be initiated by submittal of KSC Form 16-353, “Modification of Radiation Use Authorization,” to the KSC RPO, or designee.

b. Requests for modification should be submitted as soon as practicable but in no case later than 30 days prior to implementation of the planned change.

c. Examples of changes requiring Modification of Use Authorization include, but are not limited to, changes in approved procedures, location of storage or use, device operating parameters, personnel, or other associated equipment.

4.14 ANNUAL RENEWAL

Specific Use Authorizations will expire after one year from effective date if request for renewal is not made to the KSC RPO, through the JBOSC HPO, for extension of the use period. Such renewal requests will be submitted by the user on KSC Form 16-353 "Modification of Radiation Use Authorization." Submittal of requests for extension of authorized period of use should be made as early as practicable, but not earlier than 90 days prior to the expiration of the Use Authorization. Requests for extension must be received by the RPO not later than 30 days prior to expiration to preclude expiration of the Use Authorization.

SECTION 5 CONTROL PROVISIONS AND GUIDELINES FOR SOURCES OF IONIZING RADIATION

5.1 GENERAL

Procurement, possession, and use of sources of ionizing radiation under the purview of the KSC Radiation Protection Program require coordination with the KSC RPO and approval by the KSC RPC. Notwithstanding such program approvals, the unique nature of certain radiation sources may cause regulatory agencies outside of NASA/KSC to require authorization/registration of the intended use/location, specific licensing, etc., of such sources. It must be noted, however, that such outside authorization/registration of radiation sources would be required in addition to, and concurrently with, KSC Radiation Protection Program approval. The provisions and guidelines described in this KNPR are provided to assist intended users of radiation sources in their effort to comply with NASA/KSC requirements as well as those of other regulatory agencies as they apply at KSC.

5.2 LICENSING

Licenses issued by the U.S. Nuclear Regulatory Commission (USNRC) or the State of Florida are required for possession/use of licensable quantities/concentrations of radioactive materials on pertinent areas of CCAFS/KSC (see Figure 5-1). In some cases, reciprocal recognition of other Agreement State licenses may be approved for possession/use of radiation sources authorized by such licenses. Copies of all such licenses, pertinent supportive documentation, and reciprocity authorizations (if applicable) must be provided to the KSC RPO through the JBOSC HPO, in conjunction with the Use Request/Authorization package.

5.3 REGISTRATION

Certain radiation producing devices on pertinent areas of CCAFS/KSC may require specific registration by the State of Florida. Copies of all such registrations must be provided to the KSC RPO through the JBOSC HPO, as part of the data submittal required for KSC Radiation Protection Program authorization of radiation-producing machines/devices.

5.4 AREAS of JURISDICTION

a. A USNRC license, reciprocal license authorization, or USNRC license exemption is required for use of licensable quantities/concentrations of radioactive material on CCAFS, except for the areas shown on Figure 5-1, for NASA and other Federal agency activities on KSC, and for areas outside the

geographical limits of the United States, but under the jurisdiction of the USNRC (U.S. territories, possessions and protectorates).

b. Regulation of activities involving the use of radioactive materials in areas not designated above and the use of radiation-producing machines/devices is the responsibility of the State of Florida, unless preempted by some other Federal authority.

c. Space-launched radioactive materials, radiation-producing machines/devices, etc., are generally viewed as exempted from the jurisdiction of Federal and/or State regulatory purview while in space. The applicable NASA Program Center originally responsible for launch into space of radiation sources will retain the regulatory accountability for such sources while in space and/or upon their return to earth.

d. In cases where regulatory purview is unclear, the KSC RPO or designated representative shall be consulted for determination of regulatory jurisdiction.

5.5 KSC REQUIRED AUTHORIZATIONS/PROVISIONS

a. GENERAL PROVISIONS

A license, registration, reciprocal authorization or petitioned exemption issued by the USNRC, an Agreement State, or a non-agreement State to an individual or organization is not valid on KSC/CCAFS until Radiation Protection Program approval has been obtained. Any organization or individual functioning under KSC jurisdiction proposing to procure, use, store, transfer, or dispose of radiation sources must obtain authorization from the KSC RPC. The KSC RPO is the focal point of the KSC Radiation Protection Program for such coordination/approval.

(1) KSC use authorization is required (unless specifically exempted by the KSC RPO/RPC action) for:

(a) Byproduct, source, or special nuclear material (SNM).

(b) Naturally occurring radioactive material in any form other, or quantity/concentration greater, than that found in the natural environment.

(c) Accelerator-produced radioisotopes.

(d) Generally licensed items or devices acquired under the general license provisions of Title 10 Code of Federal

Regulations (CFR) 31, "General Domestic Licenses for Byproduct Material," or issued under the provisions of an Agreement or Nonagreement State.

(e) Machines/devices whose purpose is to produce ionizing radiation, or for which ionizing radiation is a byproduct of their operation.

(2) Prior written authorization to procure for use or to transport radioactive materials or radiation producing devices onto KSC must be obtained from the KSC RPO or designated representative. Radiation Protection Program authorization is also required for responsible individuals and for all documented instructions or procedures (and subsequent revisions) applicable to operations involving radiation sources. This applies to requests and plans which involve the acquisition, possession, use, storage, and transfer/disposal of such radiation sources. No operation or modification to an existing operation will be initiated prior to issuance of KSC Radiation Protection Program authorization.

(3) KSC Radiation Protection Program authorization of storage and use areas/facilities will be obtained prior to commencing initial operations.

(4) Overall inventory control and administrative accountability of all sources of radiation on KSC will be maintained by the KSC Radiation Protection Program Office. Individual users/use organizations will ensure inventory control and accountability for their sources and coordinate this effort with the KSC RPO or designated representative.

(5) Radiation areas as described in paragraph 5.5 b.(2) will be posted and restricted by the user.

(6) All personnel exposure to radiation sources on KSC/CCAFS will be kept As Low As Reasonably Achievable (ALARA).

(7) Any radioactive materials or radiation-producing devices improperly or illegally transported onto KSC will be subject to impoundment until either the irregularities are corrected and appropriate KSC authorizations are obtained or removal from KSC is arranged.

(8) Noncompliance with KSC Radiation Protection Program requirements, provisions, etc., relative to the authorized use of sources of radiation will result in the revocation/suspension of such authorizations, and impoundment of sources.

b. SPECIFIC PROVISIONS

(1) Data Submittals and Approvals - KSC Radiation Protection Program authorization for the possession/use of ionizing radiation sources requires submittal of the appropriate completed KSC Radiation Protection Program form(s) for the type of source(s) along with any necessary supportive data.

Submittals must be made as soon as practicable, but in no case later than 90 days (unless otherwise specified) prior to the intended receipt of the subject radiation sources. The appropriate KSC forms required for specific types of radiation sources and the data submittal requirements for KSC Radiation Protection Program approval are described in the following subparagraphs.

(a) Radioactive Materials

KSC Form 16-295, "Radiation Use Request/Authorization (Radioactive Materials)," must be completed and submitted for evaluation of all intended uses of radioactive materials including sources incorporated in equipment, instrumentation, or devices. In cases where applicability of program requirements is unclear to the user organization or cannot be otherwise determined, KSC Form 16-295 will be submitted, with Sections I and II of that form completed, for review/evaluation by the KSC RPO through the JBOSC HPO. Based upon this review, additional data/information may be requested as deemed necessary by the KSC RPO.

(b) Radiation Producing Machine/Device

KSC Form 28-34, "Radiation Use Request/ Authorization (Ionizing Machine/ Device)," must be completed and submitted for review/evaluation of all intended use of ionizing radiation producing machines/devices. In cases where applicability of program requirements is unclear or cannot be otherwise determined, KSC Form 28-34 will be submitted, with Sections I and II of that form completed, for evaluation by the KSC RPO through the JBOSC HPO.

Based upon this review, additional data/information may be required, as deemed necessary by the KSC RPO.

(c) Radiation User Authorization

KSC Form 16-294, "Radiation Training and Experience Summary (Ionizing Radiation)," must be completed and submitted for evaluation of all Users, Area Radiation Officers, and Use Supervisor/Custodians intended to possess and use the specific radiation sources.

(d) Modification of Approved Use Authorization

KSC Form 16-353, "Modification of Radiation Use Authorization," must be completed and submitted for evaluation of any intended changes or modifications to applicable procedures, licenses/registrations, facilities, personnel, or equipment/materials described by the current KSC authorization. Submittal of modification requests should be made no later than 30 days prior to such intended changes taking effect.

(e) Specific Data Submittal Requirements

Certain information is required to be submitted in support of a specific KSC Radiation Use Request form. All documentation will be submitted as a single complete original package and one complete package copy, as early as practicable, but in no case later than 90 days (unless otherwise specified) prior to intended use. Elements of this complete package include, but may not necessarily be limited to, those described below.

1. The appropriate Radiation Protection Program Radiation Use Request/Authorization form.

2. USNRC or Agreement State license(s) or other appropriate authorizations (i.e., registrations possessed by the requester to own, maintain and use the specific radiation source). Copies of basic license/registration applications, subsequent amendments, and any pertinent correspondence between the regulatory agency and the licensee/registrant will be submitted with the license or registration.

3. All applicable operating and emergency procedures

involving procurement, possession, and use of radiation sources for which KSC authorization is being requested.

4. Completed original of KSC Form 16-294 for each individual User, for the designated ARO, and Use Supervisor/Custodian(s) who will use or control the source(s) of ionizing radiation.

5. Name(s) and telephone number(s) of responsible individuals (ARO, Use Supervisor) assigned the control and accountability responsibilities for the source(s) at KSC.

6. Approximate dates of intended arrival and departure of the source(s) of radiation to and from KSC, the proposed mode of transportation to be utilized, description and specifications of packaging and any special containment, and any shielding or special handling instructions, as applicable.

(2) Radiation Area Identification and Access Control

(a) Area Identification Requirements

All radiation areas on KSC will be identified, posted, and restricted to prevent unnecessary exposure to personnel. Identification of such areas will be made by, or in coordination with, the KSC RPO or designee. Normally, areas requiring posting and control as radiation areas will be identified by the KSC RPO as part of the specific provisions of the Use Authorization. User organizations will ensure that all radiation areas (and sources) under their control are properly posted (labeled) and restricted. Areas as defined herein will be posted with appropriate signs, tags, labels, barriers, and notices/instructions, as specified. A sufficient number of warning signs will be used to adequately identify the restricted area.

1. Radiation Restricted Area (RRA)

An RRA is any area in which access is restricted for purposes of protection of personnel from unwarranted exposure to ionizing radiation.

2. Radiation Area (RA)

An RA is any area accessible to personnel, in which radiation levels could result in the individual receiving a dose equivalent in excess of 2 mrem (20 uSv) in 1 hour at 30 centimeters from the radiation source or from any surface that radiation penetrates. Such an area will be posted on a sign with black or magenta lettering on a yellow background bearing the radiation symbol and the words **"CAUTION - RADIATION AREA"** (See Figure 5-2).

3. High Radiation Area (HRA)

An HRA is any area accessible to personnel, in which radiation levels could result in the individual receiving a dose equivalent in excess of 100 mrem (1 mSv) in 1 hour at 30 centimeters from the radiation source or from any surface that radiation penetrates. Such an area will be conspicuously posted on a sign with black or magenta lettering on a yellow background bearing the words **"DANGER - HIGH RADIATION AREA**" (see Figure 5-3).

4. Very High Radiation Area (VHRA)

A Very High Radiation Area (VHRA) is any area accessible to personnel, in which radiation levels could result in the individual receiving a dose equivalent in excess of 500 rads (5 Gy) in 1 hour at 1 meter from the radiation source or from any surface that radiation penetrates. Such an area will be conspicuously posted on a sign with black or magenta lettering on a yellow background bearing the words **"GRAVE DANGER-VERY HIGH RADIATION AREA"** (see Figure 5-4).

5. Airborne Radioactivity Area (ARA)

An Airborne Radioactivity Area (ARA) is any area in which airborne radioactive materials are potentially present in concentrations which could exceed the limits specified by applicable regulatory agency requirements. These areas will be conspicuously

posted on a sign with black or magenta lettering on a yellow background bearing the radiation symbol and the words **"CAUTION-(or DANGER) AIRBORNE RADIOACTIVITY AREA"** (see Figure 5-5).

6. Radioactive Material Storage Areas and Containers

Areas and containers in which radioactive materials are stored will be posted on a sign/label with black or magenta lettering on a yellow background bearing the radiation symbol and the words **"CAUTION-(or DANGER) RADIOACTIVE MATERIAL"** (see Figure 5-6).

7. Ionizing Radiation-Producing Device/Equipment

Devices which produce ionizing radiation will be labeled **"CAUTION - THIS EQUIPMENT PRODUCES X-RAYS WHEN ENERGIZED,"** or equivalent wording.

8. Contaminated Area or Item

A contaminated area or item is any area or item where contamination levels exceed those specified in Table 5-1. Such areas or items will be posted/labeled with appropriate signs, tags, or labels indicating radioactive contamination, and will be treated as a Radiation Restricted Area.

9. Area Identification Methods

Radiation lettering (i.e., black or magenta lettering/yellow background), rope, tape, etc., will be used whenever possible to demarcate the extent of a radiation restricted area. Where other barrier material without the characteristic radiation colors has to be substituted, a sufficient number of appropriate signs will be employed to adequately identify the area and the nature of the existing hazard to ensure recognition by personnel.

(b) Area Access Control Requirements

Access to radiation areas on KSC/CCAFS will be restricted by

the approved users. No personnel will enter a radiation area without prior Radiation Protection Program authorization and appropriate dosimetric devices. Violations of radiation areas by unauthorized personnel will be viewed as incidents. In such cases, the user organization will immediately secure operations; escort the violator out of the radiation area; obtain the individual's name, organization, badge number, and supervisor's name/telephone number; and report the incident to the KSC RPO, or designee, as soon as possible for investigation.

(3) Radiation Exposure Control

Radiation exposures to personnel on KSC/CCAFS will be monitored and will be maintained at levels "As Low As Reasonably Achievable" (ALARA). All operations involving the use of radiation sources will be designed to conform to the principles of ALARA. In all cases, operations involving potential radiation exposures will be reviewed, evaluated, and control provisions identified to minimize radiation exposure. It is the responsibility of each individual involved in the use of radiation sources to use any reasonable means available to ensure the minimization of radiation exposure to themselves and to others from sources of radiation under their control. In the absence of specifically identified external radiation exposure control provisions, all personnel will employ the advantageous use of limiting stay times in radiation areas, maximizing distance from radiation sources (consistent with operational requirements), and employing any appropriate means of shielding available. No radiological operations, excluding specifically approved medical procedures, will be performed on KSC/CCAFS which would inherently result in internal deposition of radionuclides. Operations having a potential of resulting in internal deposition of radioactive materials as a result of an accident/ incident will include the identification and use of limiting provisions, control measures, and protective equipment to preclude such potential uptake.

(a) Radiation Protection Guides (RPGs) for Whole Body Total Exposure (External Plus Internal)

The amount of exposure to ionizing radiation that an individual is allowed to receive in any period of time is limited. The following exposure guides are provided to identify the whole body total exposure limits established for KSC.

The limits are designed to be consistent with applicable regulating agencies' (USNRC, State of Florida, U.S. Department of Energy, OSHA, etc.) exposure limit criteria and with recommendations of the Federal Radiation Council, the National Council on Radiation Protection, and the International Commission on Radiological Protection. Exposure limits are not to be viewed as exposure goals. Any intended operation that could potentially cause limits to be exceeded must be identified to the KSC RPO for review and evaluation.

All real or suspected overexposures will be reported immediately to the KSC RPO for investigation and assessment.

1. Occupational Radiation Workers

a. Exposure is limited to a Total Effective Dose Equivalent (TEDE) of 5.0 rem (50 mSv) per year. TEDE is the sum of whole body deep-dose equivalent (from external sources) and committed effective dose equivalent for critical organs (from internally deposited radionuclides). Whole body includes the head, trunk (including male gonads), arms above the elbow, or legs above the knee. Table 5-2 specifies additional external exposure limits for occupational radiation workers.

b. It is the employee's responsibility to provide a complete lifetime accumulative occupational radiation exposure record(s) to the employer. It is the employer's responsibility to take into account all occupational radiation exposures accrued by an employee in past and current employment.

c. Individuals who require access into an area restricted or controlled (for purposes of radiation protection) and are likely to receive a dose exceeding 10% of the dose limit specified in Table 5-2, shall submit the following data to

the NASA/KSC RPO prior to working in such an area:

Provide records of radiation doses received during the current year and lifetime cumulative totals (current NRC Form 4) prior to entering such an area;

Where prior occupational dose records are not available for the current year, the annual allowable dose limit will be reduced by 1.25 rem (12.5 mSv) for each quarter the individual was employed as an occupational radiation worker; and

Previous occupational exposure history must be documented on a properly completed USNRC Form 4, "Occupational Radiation Exposure History," or equivalent.

d. Radiation exposure resulting from necessary diagnostic medical and dental procedures will not be included in the determination of the total occupational radiation exposure status of the individual concerned.

2. Occupational Limits to an Embryo/Fetus

It is the employee's responsibility to declare pregnancy to the NASA/KSC RPO. The total effective dose equivalent limit to the embryo/fetus of a declared pregnant worker shall not exceed 500 mrem (5.0 mSv) during the entire pregnancy.

3. General Population (Non-Radiation Workers)

a. General population will not be exposed to ionizing radiation in excess of 100 mrem/year (1.0 mSv/year) Total Effective Dose Equivalent, and

b. The dose in any unrestricted area from external sources does not exceed 2.0 mrem (0.02 mSv) in any 1 hour.

(b) Radiation Protection Guides (RPGs) for Airborne and Waterborne Activity

The following guides are provided to identify the concentration limits for airborne and waterborne radioactivity. The limits are consistent with applicable regulatory agencies' restrictions. In keeping with the KSC Radiation Protection Program objective of ALARA for radiation exposure to individuals, these guides are primarily intended to be addressed in emergency or contingency situations as the result of an accident or incident. They are not intended for application in routine/programmed operations designed to introduce or to cause airborne or waterborne radioactivity concentrations greater than the appropriate regulatory agency's unrestricted area limits.

1. Unrestricted Area

The concentration above natural background of radioactive materials in breathing air in unrestricted areas must not exceed levels derived from or listed in Chapter 64E-5, Florida Administrative Code (FAC), Table II, Column 1 (USNRC 10 CFR 20, Appendix B, Table 2, Column 1). The guidelines and restrictions established in 64E-5, FAC (10 CFR 20.1302) will apply on KSC.

2. Restricted Area

The concentration above natural background of radioactive material in breathing air in restricted areas must not exceed levels derived or listed in Chapter 64E-5, FAC, Table I, Columns 2 & 3 (10 CFR 20, Appendix B, Table I, columns 2 & 3). The guidelines and restrictions established in 64E-5 Florida Administrative Code (FAC) (10 CFR 20.1202), will apply on KSC.

3. Respiratory Protection

No allowance will be made for respiratory protection in determining exposure concentrations except as provided in 64E-5 FAC (10 CFR 20, Subpart H).

4. Waterborne Concentrations

Concentrations of waterborne radioactive materials above natural background released to unrestricted areas, via effluents or sanitary sewerage, must not exceed the limits derived or listed in Chapter 64E-5 FAC, Table II, Column 2 or Table III (10 CFR 20.1202, Appendix B, Table 2, Column 2 or Table III).

(c) Radiation Protection Guides (RPGs) for Surface Contamination

The following guides are provided to identify the surface contamination limits for KSC. The KSC Radiation Protection Program policy requires the control of radioactive materials in such a manner as to preclude radiological contamination. However, in the event of an accident/incident involving radioactive material which results in radiological contamination, the limits specified will be adhered to as minimum criteria pertaining to decontamination efforts. Notwithstanding the limits specified, every effort will be made to decontaminate to levels as low as possible, as approved by the KSC RPC/RPO.

1. The limits specified in Table 5-1 will be attained through the process of radiological decontamination of facilities, materials, and equipment prior to release for unrestricted use. Notwithstanding the specified limits, all decontamination procedures must receive prior approval from, and be conducted under the supervision of, the KSC RPO or designee. Any item/area, which has been decontaminated, must receive written clearance from the KSC RPO or designee before being released for unrestricted use.

2. Attempts will be made to decontaminate all personnel to nondetectable levels (externally). Personnel will not be released until localized skin contamination is reduced to background levels. Special measures will be employed concerning individuals believed to have sustained internal contamination. Decontamination will be followed by nasal swabs and in vivo/in vitro assay as directed by the KSC RPO or designee. Attempts may be made, under medical direction and supervision,

to remove internal contamination by use of chelating agents, or other appropriate means.

3. All decontamination operations will be carried out under the supervision/direction of the KSC RPO, or designee, and under such conditions as to minimize the possibility of cross contamination of other areas and/or personnel. During such operations, every consideration will be given to efforts directed toward prevention of resuspension of surface contaminants.

4. Personnel involved in decontamination activities will be appropriately rained in personnel protection methods, hazards associated with decontamination operations, and contamination control. Personnel will be equipped with appropriate anticontamination clothing, exposure-monitoring devices, and respiratory protection devices as specified by the KSC RPO or his designee. Personnel will enter and exit through established control points for purposes of access and contamination control. Approved health physics practices will be followed and records will be maintained on all personnel participating in decontamination activities. Selected individuals may, depending upon contamination levels and the nature of operations performed, be required to undergo in vivo evaluations and submit bioassay samples. Such need and selection of personnel will be determined by the KSC RPO or designee.

5. Other personnel performing normal job functions in areas adjacent to contaminated areas will be briefed on any potential radiological hazards near their location. In no case will these personnel be subjected to situations, which would endanger their health and/or safety.

(4) Radiation Protection Guides (RPGs) for Transportation, Receipt, and Shipment of Ionizing Radiation Sources on KSC

The following guides are provided for transportation of radiation sources. These guides apply to radioactive materials, and spacecraft or payload elements containing such items. All such activities will be in accordance with the requirements described by KNPR 6000.1 and must be identified in advance to the KSC RPO, or designee.

(a) Transportation within KSC/CCAFS boundaries:

1. Transportation/movement of radiation sources exclusively within the KSC (or NASA/KSC to/from CCAFS) will be performed only after notification has been provided to and authorization received from the KSC RPO, or designee. Transportation/movement of sources on or to CCAFS must also be coordinated with the 45 SW RPO through the Consolidated Support Operations Center.

2. The JBOSC HP will be notified at least 2 hours prior to scheduled movement of radiation sources if such notification is a specific provision of the KSC approved Use Authorization.

3. Requests for transportation authorization will include the following information:

   a. name of person (ARO,US/C) responsible for the procedure

   b. identification of the source (isotope, form, type, activity, etc.)

   c. type of vehicle

   d. point of origin and delivery

   e. name of authorized receiver, if applicable

   f. description of container and shielding

   g. proposed route of travel

   h. special handling equipment

   i. procedures, restrictions, and precautions

4. The ARO or US/C is responsible for assuring that the material/shipment, including the transport vehicle, has been properly monitored and that marking and labeling of the material and transportation vehicle is in

compliance with requirements of applicable transportation regulations. The ARO or US/C will obtain receipt signature of the authorized receiver on shipping documents and will provide copies of the shipping voucher to the receiver, the applicable RPO, or designated representative, and the appropriate Supply Officer representative.

(b) Transportation to/from KSC/CCAFS:

Transfer of radiation sources will be in accordance with applicable State and Federal Department of Transportation (DOT) regulations (Chapter 64E-5 FAC, Part XV Transportation of Radioactive Material, Title 49 CFR Part 173 and IATA Dangerous Good Regulations). All such transfer activities will be coordinated and approved, in advance, through the applicable KSC RPO, or designated representative. Shipments of radioactive materials require completion of DD 1149 (or Request for Shipping Document), KSC Form 28-45NS, "Radioactive Material Transfer Receipt" and KSC Form 7-526NS, "Radioactive Material Transfer and Shipment Record (Outbound).

(c) Vehicle Placarding

Motor vehicles or trailers used to transport radioactive material requiring a DOT "Radioactive Yellow - III" label, regardless of the quantity, will display markings or placards showing "RADIOACTIVE."

Placards or markings will be displayed at the front, rear, and on each side of the motor vehicle or trailer or other cargo-carrying body while it contains any quantity of "Radioactive Yellow - III" labeled material. The front marking or placard may be displayed on the front of either the truck, truck body, truck tractor, or the trailer, but the area of display will not have any other markings, lettering, or graphic display for at least 3 inches in each direction.

(d) Loss, theft, or accident involving radiation sources in transit will be immediately reported to the local emergency response/security agencies and to the KSC RPO, or designee. (See Appendix A, paragraph A.3 for radiation incident notification requirements and telephone numbers.)

(e) Unless otherwise specifically exempted by the KSC RPO, any organization on KSC receiving radioactive material or devices which produce ionizing radiation will notify the JBOSC HPO prior to delivery or pick up by the user organization, and give a description of the material and the destination. Each receiving organization will have a designated restricted access storage area for short-term holding of such materials. Under no circumstances will such material be released to the consignee/user until the JBOSC HPO has been notified. Transportation vehicles carrying packages labeled with "Radioactive Yellow-III" labels, or other as designated by the KSC RPO, will not be allowed to unload packages until the vehicle has been surveyed by HP.

(5) Radiation Protection Guides (RPGs) for Medical/Dental X-Ray Equipment

The basic objective of the medical use of radiation is to obtain optimum diagnostic information or therapeutic effect with minimum exposure to the patient, to medical personnel involved, and to the general public. The general guidelines presented below are for the purpose of minimizing unnecessary radiation exposure of personnel.

(a) Guidelines

In addition to KSC Radiation Protection Program requirements/provisions for ionizing radiation producing equipment specified in other parts of this Section, the design and operational guidelines for medical/dental X-ray presented in the following documents apply to the KSC.

1. National Council on Radiation Protection Reports 33 and 49, Medical X-Ray and Gamma-Ray Protection for Energies up to 10 MeV.

2. 21 CFR Parts 1000-1050, (Chapter 1, Subchapter J, Radiological Health).

3. Presidential Guidelines for Diagnostic X-Rays at Federal Installations, Approved January 26, 1978.

4. Chapter 64E-5, Florida Administrative Code (FAC), "Control of Radiation Hazards" Part VI.

(b) General Provisions

Medical/dental X-ray equipment on KSC will be operated by KSC authorized personnel who are properly trained and qualified in subject matters to include radiation protection, safe operation of equipment, biologic effects of ionizing radiation, and exposure-limiting techniques. Operator trainees may be permitted to use such equipment when under the direct supervision of a qualified, KSC authorized operator. Such training activities will not incorporate the use of human subjects. The following general provisions will be followed by all personnel involved in the use of medical/dental X-ray units.

1. Equipment shall be operated only by qualified, KSC authorized personnel.

2. All operational personnel will be appropriately monitored during radiation exposures, as required by the applicable Use Authorization or KSC RPO instructions. Dosimetric devices will be worn outside lead aprons when aprons are worn and dosimetric devices will be stored outside of radiation areas when not in use.

3. Personnel will be allowed to hold patients during X-ray exams only in emergency situations.

4. Only persons required for the radiographic operation will be in the radiographic room during exposures.

5. The useful beam will be limited to the smallest area practicable and consistent with the objectives of the examination.

6. The operator will stand behind a shielded protective barrier during exposures.

7. Radiographs can only be authorized by a licensed practitioner of the healing arts.

8. Individuals will not be exposed solely for the purpose of demonstration or training.

9. A quality control program will be initiated to reduce exposures through optimization of techniques, choice

of film/screen combinations, preventive maintenance of equipment, proper film processing, and equipment calibration.

10. Lead sheets, gonadal shields, or aprons will be used to protect critical organ areas of the patient whenever possible.

11. An initial radiation protection survey will be performed by the KSC RPO or designee on all facilities, and copies maintained on file in the appropriate X-ray department or with the responsible individual (ARO). A resurvey is required for any of the following reasons:

a. When new radiographic units are installed.

b. After major changes in equipment, workload, or procedures which could potentially increase the hazard present.

c. At 12-month intervals.

d. At the discretion of the KSC RPO, or designated representative.

12. All requests for radiation protection surveys will be directed to the JBOSC HPO.

(6) Radiation Protection Guides (RPGs) for Industrial Radiography

This Section provides specific guidelines for organizations which may possess, use, and maintain industrial radiographic sources on KSC. The KSC Radiation Protection Program policy of restricting exposures to ALARA from industrial radiographic sources/operations must be strictly adhered to.

(a) General Guidelines

The Radiation Protection Program guidelines described herein are applicable to industrial radiography use organizations/operations in addition to applicable provisions otherwise identified in this KNPR, specific KSC Radiation Protection Program Use Authorizations, and applicable USNRC or State of Florida license provisions and regulations.

1. Radiation areas will be identified and access restricted as described by paragraph 5.5.b (2). Additionally, operations during hours of darkness will require that warning signs be properly illuminated and flashing red lights used to identify the restricted area.

2. Coordination of planned radiographic operations with responsible scheduling agencies, launch complex/facility supervisors, and the KSC RPO, or designee, is the responsibility of the radiographer and the organization requesting the service.

3. A copy of current leak test certification will accompany each radiography source (material) if such certification is not currently on file with the JBOSC HP. A leak test must have been performed within the previous 6 months.

4. Appropriate dosimetric (whole body) badges, alarming rate meters, and paired pocket dosimeters (direct reading type) as specified or approved by the KSC RPO will be worn by each individual involved in radiographic operations. A pocket dosimeter log shall be maintained on a daily or operation basis and shall include data as follows:

   a. Name of Individual

   b. Social Security Number (except resident NDE radiographers)

   c. Organization/Phone Number

   d. Address or Office Mail Code

   e. Initial Reading of Dosimeter

   f. Final Reading of Dosimeter

   g. Net Exposure

h. Type, Model, and Serial Number of Dosimeter

A copy of the pocket dosimeter log will be forwarded to the KSC RPO, or designee, on a periodic basis as defined by the approved Use Authorization.

5. If a pocket dosimeter worn by an individual is read to be "off-scale," greater than 200 mrem (>2 mSv), an emergency situation will be assumed to exist and the individual(s) will immediately secure operations and notify the KSC RPO, or designated representative.

6. Pocket dosimeters will be charged (zeroed) at the beginning of each working day and must be calibrated at intervals not to exceed 12 months.

7. Care must be taken to prevent mechanical shock to dosimeters and to protect such devices from excessive moisture and heat.

8. Dosimetry badges must be stored in areas protected (shielded) from radiation when not in use.

9. Personal audible alarming rate meter must be preset to alarm in radiation levels >500 mR/hr and must be calibrated at intervals not to exceed 12 months.

10. A minimum of 2 calibrated radiation survey meters capable of and appropriate for detection of the type and energies of the radiation involved must be used for radiographic operations.

11. Radiation survey meters used in industrial radiography must be calibrated (every 6 months and after repair) and records must be maintained for each calibration.

12. Notification of intended radiographic operations by offsite organizations will be made by the radiographer no less than eight hours prior to planned operations with verification notification upon arrival at the site. After-hours notifications will be made to the Consolidated Support Operations Center . Telephone numbers are listed in Appendix A of this KNPR. If the

proposed operation is canceled, postponed, or the time is changed prior to commencement of the operation, the radiographer will notify the appropriate parties of such changes. Onsite (KSC) radiography organizations shall notify the KSC RPO or designee of intended operations upon being assigned a specific radiographic task. Information required to be provided by the radiographer at the time of prior notification will include:

a. Name of radiographic organization.

b. Names of radiographers and radiographers assistants.

c. Location, date and time of operation.

d. Item(s) to be radiographed.

e. Type of radiography source (isotope, machine, etc.).

f. Strength of source.

g. Estimated number of exposures.

h. Estimated duration of exposures.

13. Notification of operation completion is also required of the radiographer. Information to be provided by the radiographer at the time of completion notification will include:

a. Time of operation completion or termination.

b. Net pocket dosimeter readings for each of the radiography personnel involved in the operation.

14. All radiographic operations require a minimum of two KSC authorized individuals to be present during the conduct of radiographic operations.

15. Radiation areas established during radiographic operations will be under constant control and surveillance by the radiographer(s) during the entire operation.

16. In the event of theft or loss of radiation source(s), real or suspected overexposures, accidents involving ionizing radiation sources, or other unusual incidents/occurrences involving such sources, the KSC RPO, or designated representative, must be notified immediately. (See Appendix A, paragraph A.3 for radiation incident notification requirements and telephone numbers.)

17. All radiography source changeout procedures will be coordinated, in advance, with the KSC RPO, or designated representative.

(b) Guidelines for Fixed Installations

In addition to the general guidelines above and the specific provisions of KSC Radiation Protection Program Use Authorizations for such facilities, some or all of the following guidelines will be applied to fixed radiographic installations, as deemed necessary by the KSC RPO.

1. Review and approval by the KSC RPO of the design for construction of a facility or modification to an existing facility to be used for radiographic operations.

2. Use of an independent radiation monitor with alarm capability within the radiography cell.

3. Use of interlocked doors, access ports, etc., to the radiography room to terminate the exposure if intrusion occurs.

4. Assurance of access control by KSC Radiation Protection Program authorized users of the facility.

5. Employment of key-interlocked mechanisms to facilitate system shutdown and control.

6. Proper posting of facilities with appropriate radiation hazard warning signs.

(c) Guidelines for Temporary Job Sites

In addition to the general guidelines listed and the specific provisions of the KSC Radiation Protection Program's approved Use Authorizations for radiographic operations, the following guidelines are applicable to radiographic operations at temporary job sites.

1. Radiation areas must be established and verified by survey by the radiographer.

2. Radiation areas must be properly posted with appropriate radiation hazard warning signs. At a minimum, Radiation Area signs (at the 2 mrem/hr (20 uSv/hr) boundary), must be posted in sufficient numbers to adequately identify the area and provide ample warning to approaching personnel, and High Radiation Area signs (at the 100 mrem/hr (1 mSv/hr) boundary) must be posted in sufficient numbers to adequately identify the high radiation area associated with the radiographic operation(s).

3. Whenever possible, physical restraining barriers will be utilized, in conjunction with appropriate radiation hazard warning signs, to preclude access to restricted areas by unauthorized personnel.

4. In the event that violation of the restricted area by an unauthorized individual occurs, the radiographer will:

   a. Immediately secure the radiographic operation.

   b. Escort the individual out of the restricted area.

   c. Obtain the name and organization of the individual and appropriate supervisor's name/telephone number.

   d. Record pertinent data involving the incident.

e. Report the incident and provide information from c. and d. above to the KSC RPO, or designated representative. (See Appendix A, paragraph A.3, for radiation incident notification requirements and telephone numbers.)

5. In the event that a source cannot be retracted into its storage container or becomes disconnected from the control mechanism, the radiographer will:

a. Immediately secure the operation.

b. Maintain control over the area.

c. Notify the KSC RPO, or designated representative. (See Appendix A for emergency notification telephone numbers.)

(7) Radiation Protection Guides (RPGs) for Radioactive Waste Disposal

The following guidelines are provided for user organizations on KSC that generate or temporarily possess radioactive waste. All radioactive waste will be strictly restricted and disposal will be in accordance with KSC Radiation Protection Program approved procedures. Procedures for control of radioactive waste will be so designed as to preclude the release to or contamination of the local environment by any radioactive material. Radioactive waste burial or release to the environment at KSC is prohibited unless specifically approved by the KSC RPC. In general, radioactive wastes include unusable radioactive items, or manufactured items/articles containing radioactive sources, or substances contaminated with radioactive materials.

(a) Area Radiation Officers/Use Supervisors are responsible for maintaining records of radioactive waste accumulated within their areas. Temporary storage of such waste must be authorized by the KSC RPO. Records will include isotope identity, date of preparation and activity, and date placed in storage. Periodic exposure readings will be taken at the surface of the storage container and recorded. Frequency of surveys will depend on the rate of accumulation of waste but will generally be a quarterly requirement, as a minimum.

(b) No radioactive waste material may be disposed of or removed from KSC by the individual user without prior approval of the

KSC RPO, or designated representative. In the absence of other approved prior arrangements, waste material will be collected and disposed of by the JBOSC HP on KSC/CCAFS using methods consistent with all applicable regulations and accepted radiation protection practices.

(c) Radioactive waste (dry, liquid, and sharps) will be disposed into appropriate containers. User organization will maintain utilization/ accumulation logs indicating radioisotope, approximate amount, activity, physical state, and date.

(d) All radioactive waste generated will be disposed of by a qualified offsite contractor. The selected organization will be contacted by representatives from the user organization to arrange for pickup and disposal of the waste. The KSC RPO must be notified in advance of all shipments of radioactive waste.

(e) All biohazardous materials mixed with radioactive waste must be decontaminated prior to disposal. After the biohazard and/or radioactive component is eliminated, the waste will be handled as appropriate (i.e., either radioactive or biohazardous).

(f) Operations should be avoided that have the potential to create mixed waste (i.e., radioactive and other hazardous agents mixed together). Prior arrangements and approvals must be made before performing any operations which may result in generation of a mixed waste. This includes:

1. Completion of a "Process Waste Questionnaire" prior to generation of a mixed waste.

2. Prior approval from KSC RPO.

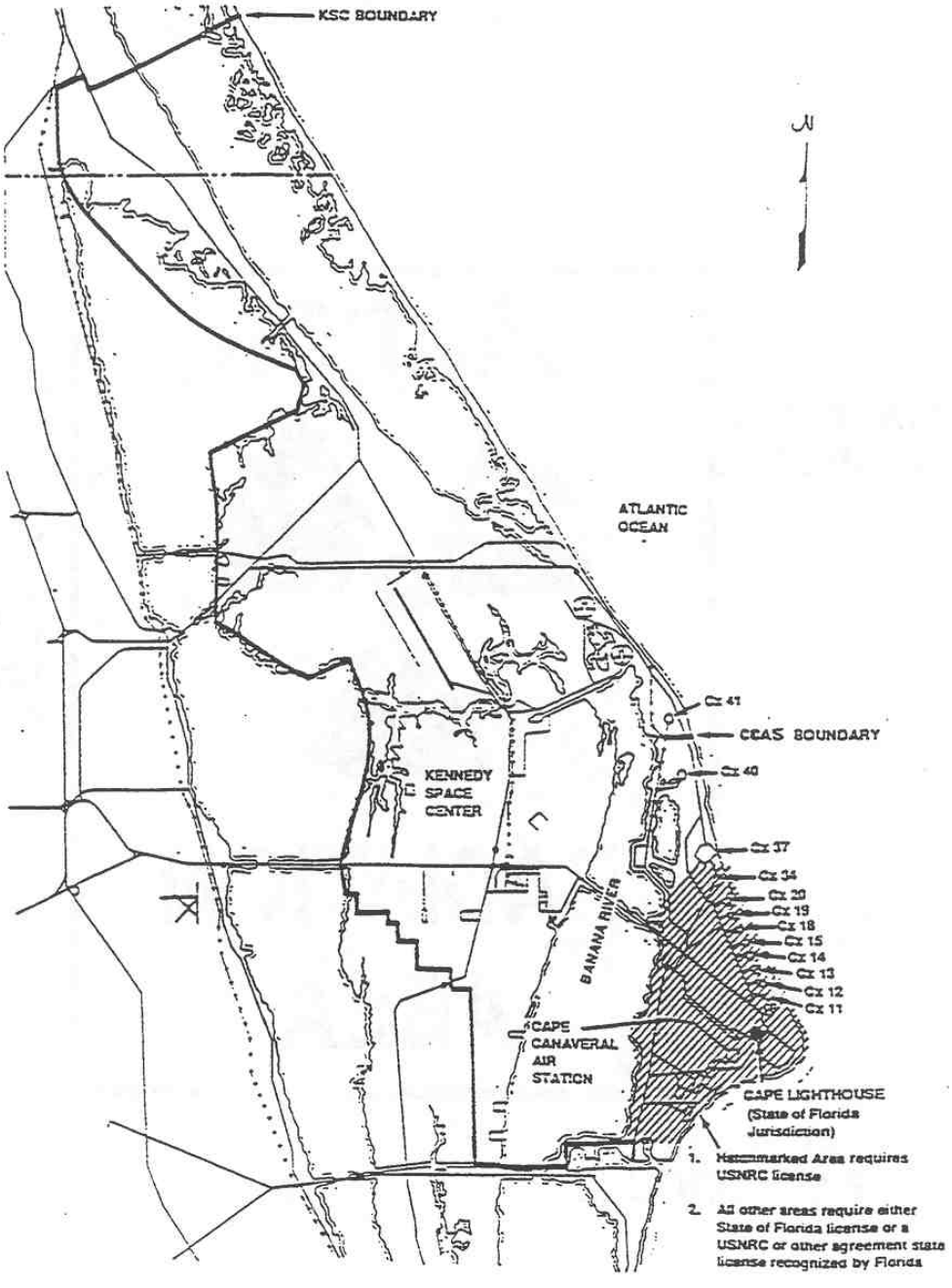

Figure 5-1
NRC Licensing Jurisdictional Areas

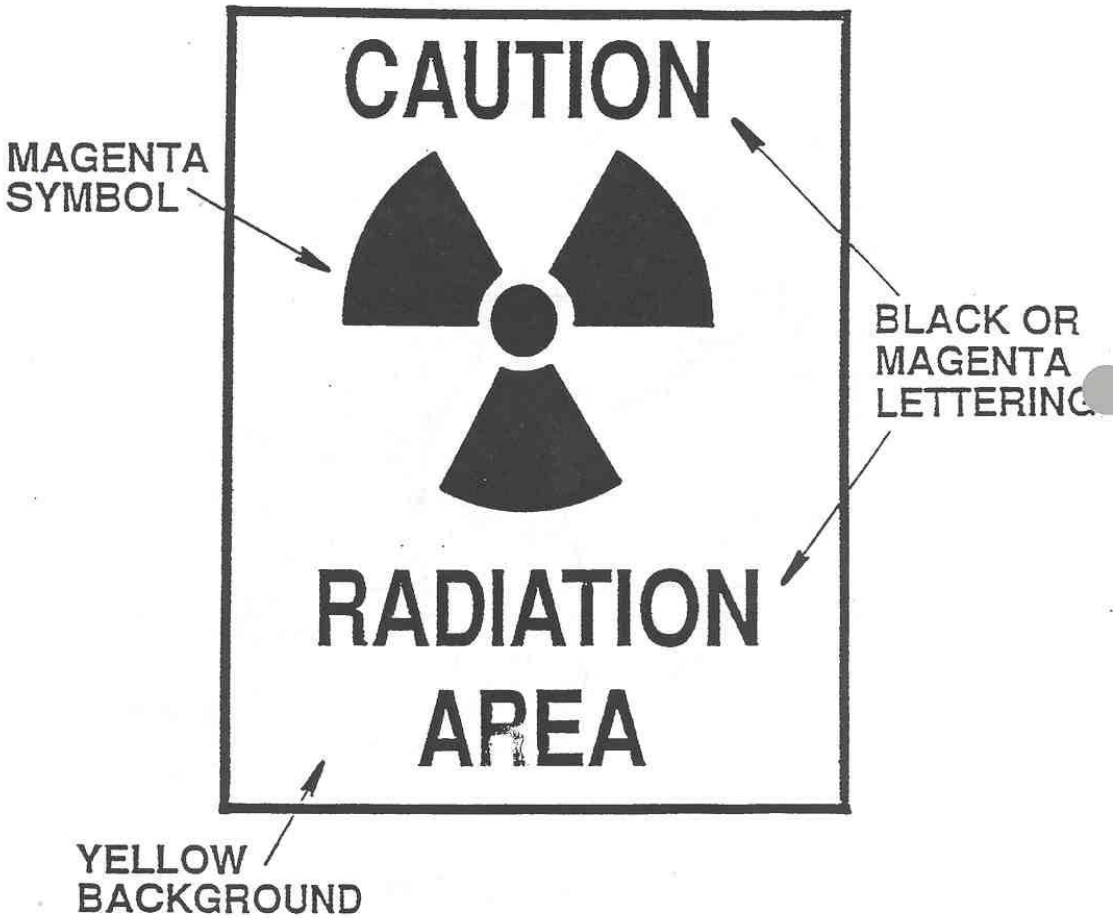

Figure 5-2
RADIATION AREA
Warning Sign

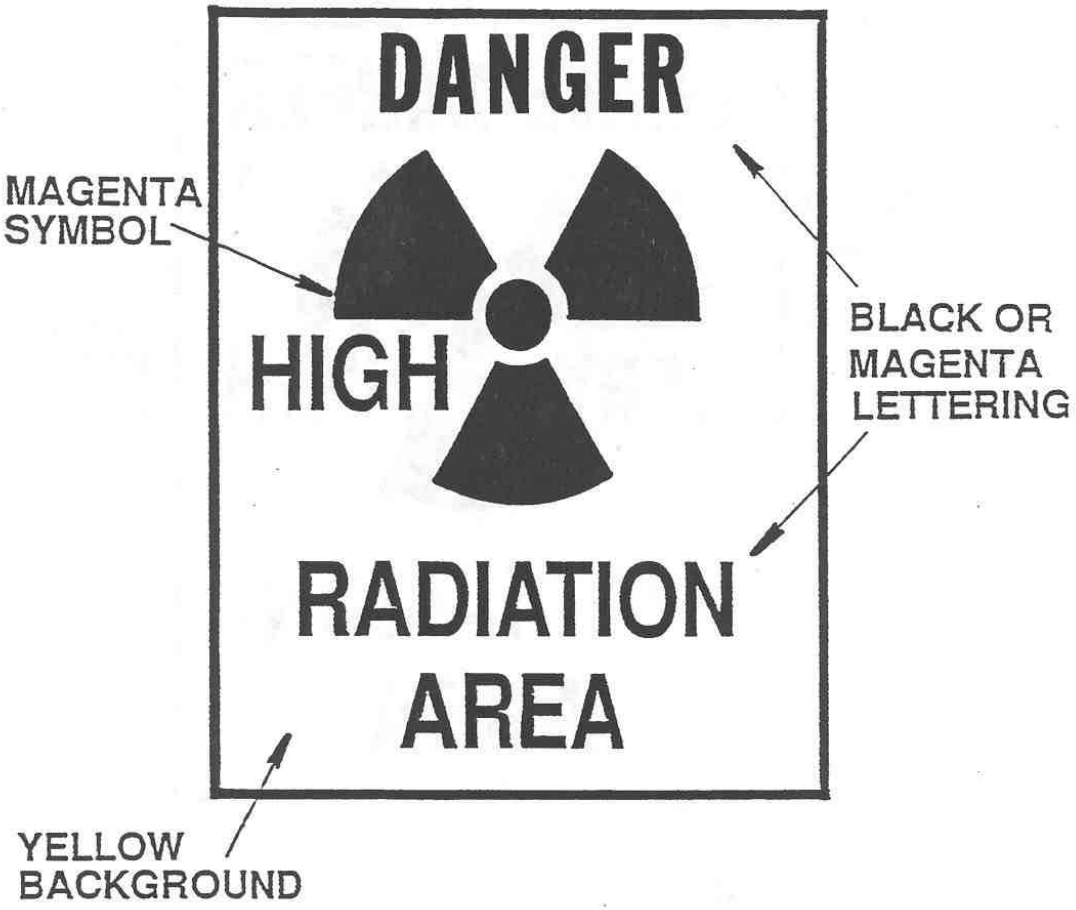

Figure 5-3
HIGH RADIATION AREA
Warning Sign

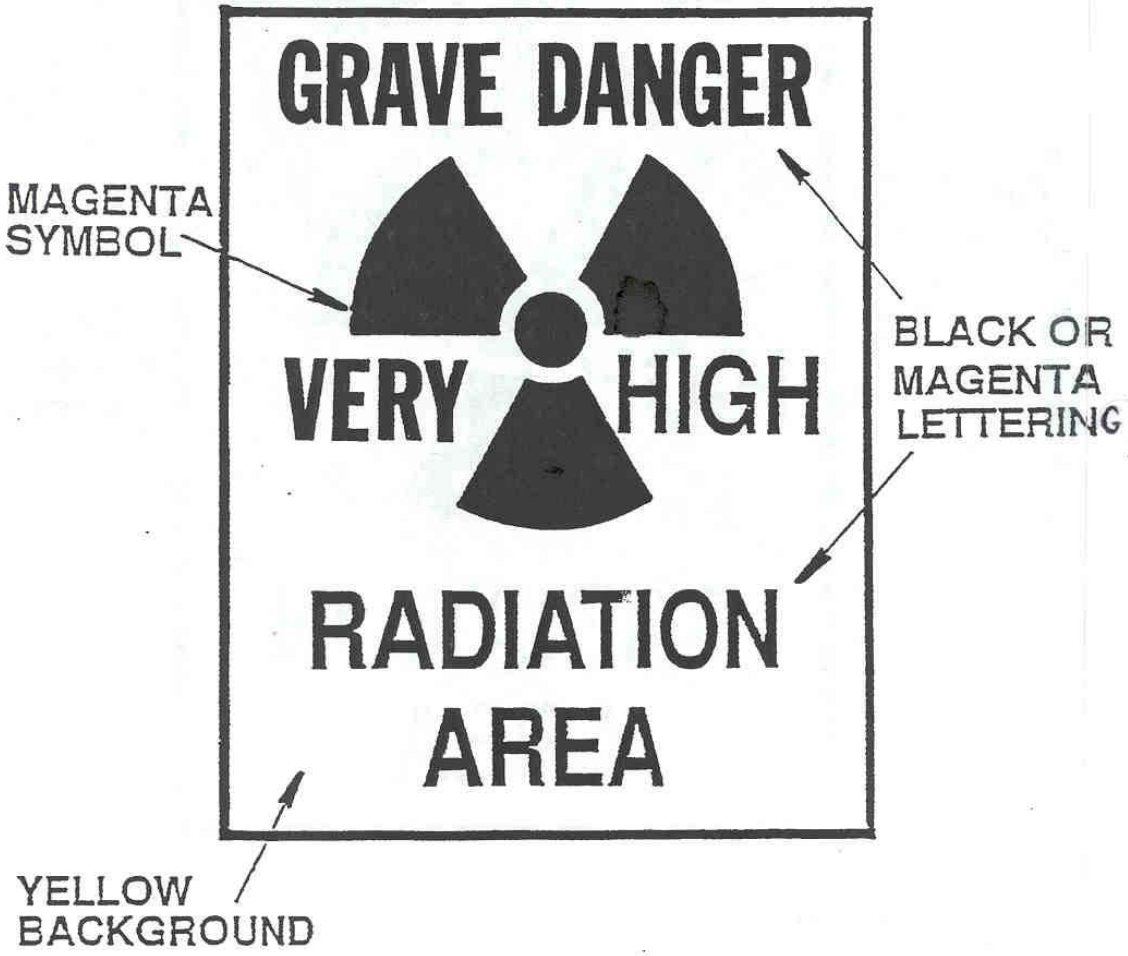

Figure 5-4
VERY HIGH RADIATION AREA
Warning Sign

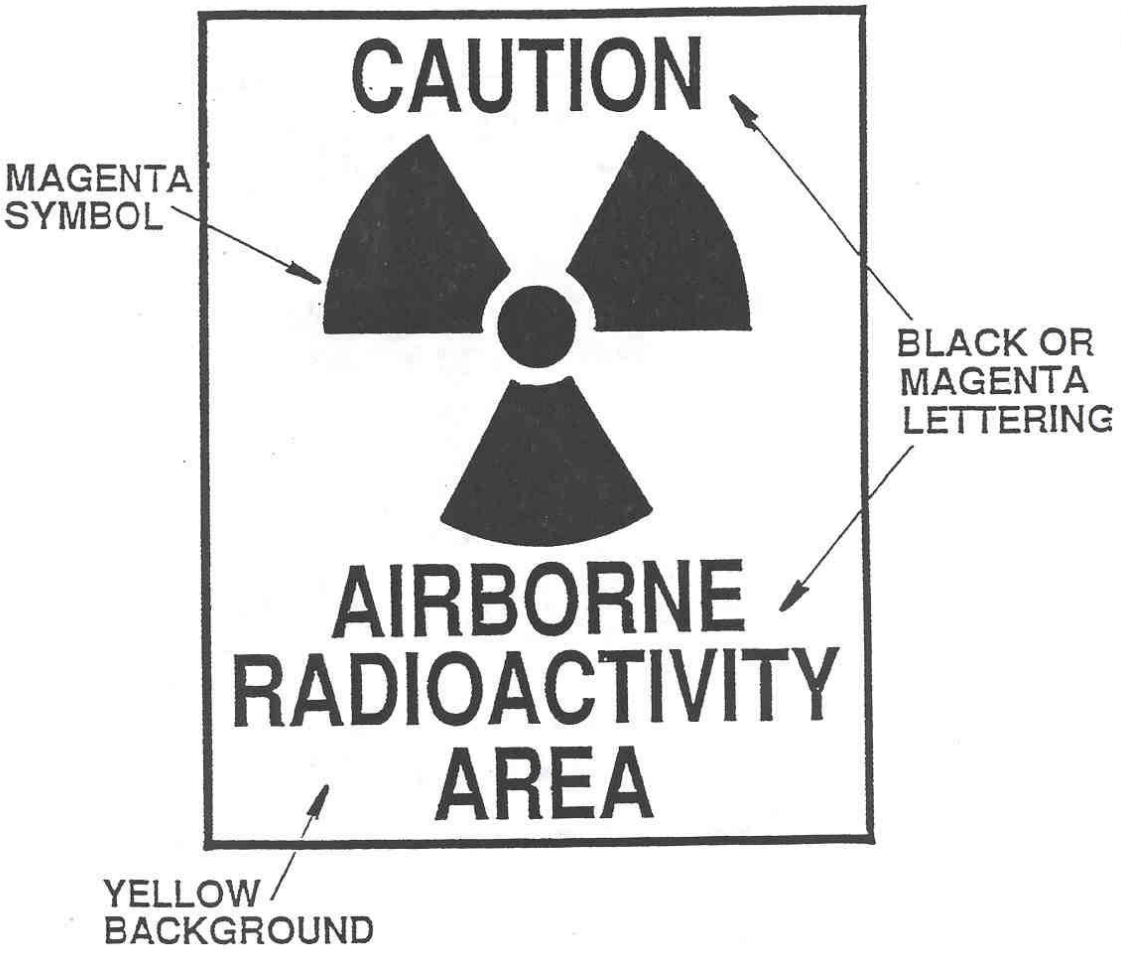

Figure 5-5
AIRBORNE RADIOACTIVITY AREA
Warning Sign

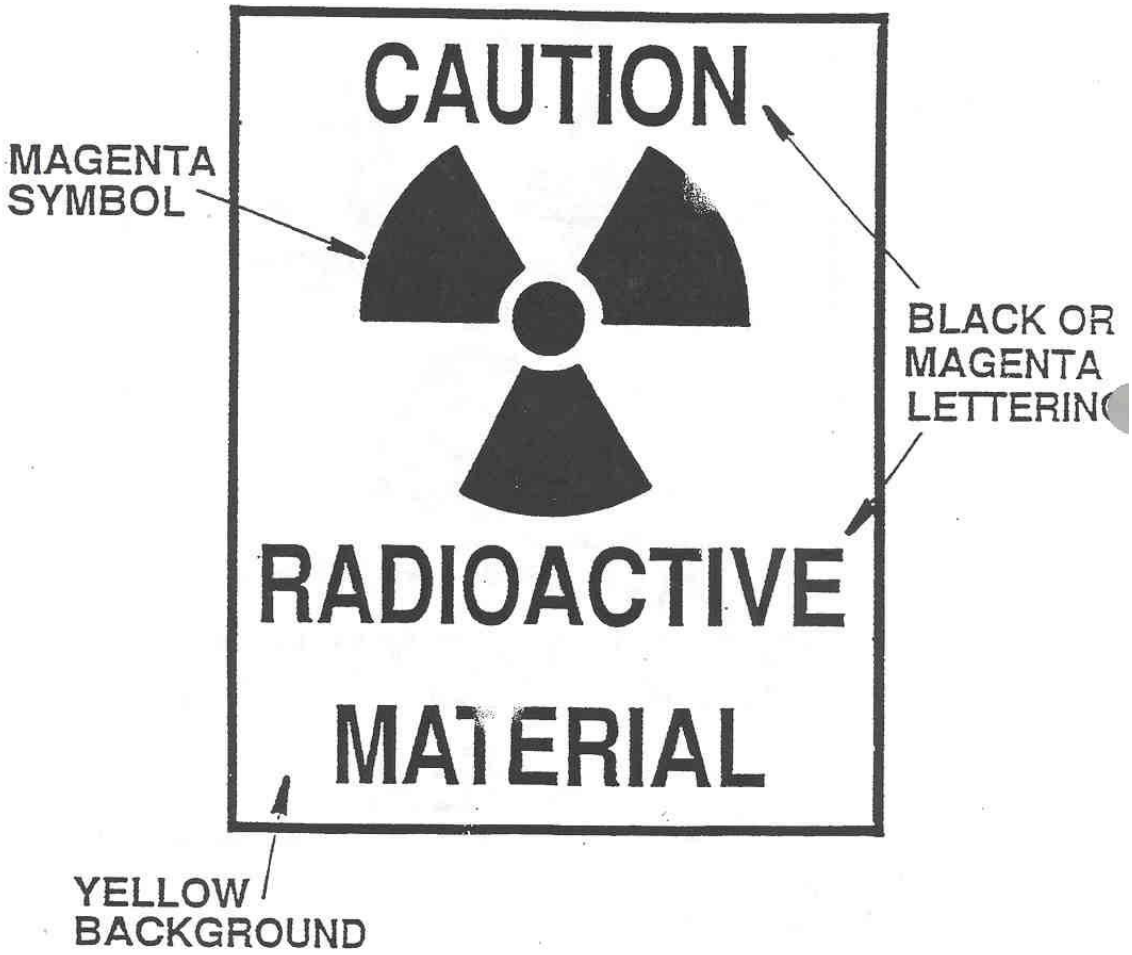

Figure 5-6
RADIOACTIVE MATERIAL
Warning Sign

ACCEPTABLE SURFACE CONTAMINATION LIMITS

NUCLIDES(1)	AVERAGE(2)(3x6)	MAXIMUM(2)(3x6)	REMOVABLE(2)(3x6)
U-naf, U-235, U-238, and associated decay products	5,000 dpm/100 cm^2	15,000 dpm/100 cm^2	1,000 dpm/100 cm^2
Transuranies, Ta-236, Ra-238, Th-230, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133 and	1,000 dpm/100 cm^2	3,000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (neulides with decay modes other than alpha emission or spontaneous fission) except SR-90 and other noted above	5,000 dpm/100 cm^2	15,000 dpm/100 cm^2	1,000 dpm/100 cm^2

Adopted from *Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Use Termination of Licenses for By-product Source, or Special Nuclear Material, “USNRC Division of Fuel Cycle and Material Safety”, dated June 1980.

Guidelines

(1) Where surface contamination by both alpha and beta-gamma-emitting nuclides exists, the limits established for alpha and beta-gamma-emitting nuclides should apply independently.

(2) As used in tables, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

(3) Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

(4) The maximum contamination level applies to an area of not more than 100 cm^2.

(5) The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

(6) The maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

Table 5-1
Acceptable Surface Contaminatin Levels

OCCUPATIONAL RADIATION WORKER DOSE LIMITS

Exposure Period	Whole Body, (Deep Dose)	Lens of the Eye	Skin or to any Extremity (Shallow Dose Equivalent)
Quarterly	1,250 mrem (12.5 mSv)	3,700 mrem (37 mSv)	12,500 mrem (125 mSv)
Yearly	5,000 mrem (50 mSv)	15,000 mrem (150 mSv)	50,000 mrem (500 mSv)

Radiation doses from routine operations will not exceed the above limits. Approval to exceed the above limits must be obtained from the KSC RPO, and will follow current applicable regulatory guidelines.

Requests for such approval shall include explanation of requirements and adequate justification.

Table 5-2
Occupational Radiation Worker Dose Limits

APPENDIX A

RADIATION INCIDENT GUIDELINES AND NOTIFICATIONS

A.1 GENERAL

Radiation incidents may result in exposures and/or radioactive contamination which can spread or be dispersed in situations; such as, fire, flood, explosion, spillage, or breach of containment.

A.2 BASIC EMERGENCY PROCEDURES

a. Isolate the Contamination (Ionizing)

(1) Close doors, windows, etc.

(2) Shut down air handling systems, lab hoods, etc.

b. Evacuate Personnel

Evacuate personnel to a safe upwind marshaling area and detain.

c. Notify Appropriate Response Elements

(1) See A.3 for notification requirements and telephone numbers.

(2) Emergency Response elements, (Fire, Medical, Security, etc.) as determined necessary.

(3) KSC Radiation Protection Officer, or designated representative.

d. Standby Activities for Affected Area Personnel

(1) Control unauthorized access to the area.

(2) Inform response element(s) of the nature of the radiological hazard (e.g., type/quality of material, etc.).

(3) Detain evacuated personnel in marshaling area until released by the RPO, or designated representative.

e. Personnel Conduct

(1) Unauthorized personnel will not attempt to survey or clean up the spillage (contamination).

(2) Personnel leaving a contaminated area will keep their movements to a minimum to avoid spreading the contamination.

(3) Survey and decontamination efforts will, in all cases be conducted under the supervision of the KSC RPO, or designated representative.

A.3 RADIATION INCIDENT NOTIFICATION

a. Notification requirements

(1) Radiation incidents involving fire, explosion, personnel injury or facility damage requiring emergency response by medical, fire and/or security elements, should be reported by using telephone number 911. Caller must identify the radiation source and describe its involvement in the emergency. See paragraph b below for telephone numbers.

(2) All other radiation incidents not requiring emergency notification (e.g., isolated spills, source damage, loss of source control or accountability, suspected exposure/contamination) must be immediately reported to the KSC RPO or designated representative. See paragraph b below for telephone numbers.

b. Telephone Numbers

(1) All Hours Emergency Response (Medical, Fire, Security)

Operations occurring on KSC/CCAFS 911

(2) Normal Duty Hours (0730-1630) Radiation Incident

KSC Radiation Protection Officer	(321) 867-6958
JBOSC Health Physics	(321) 853-5688
KSC Emergency Preparedness Officer	(321) 867-3795
45 SW Radiation Protection Officer	(321) 494-5435

(3) After Normal Duty Hours (0730-1630), Holidays and Weekends

Call 911

(4) Listings above are subject to change without notice or may not be applicable to your area. Consult the local installation telephone directory for current listings and for areas not listed.

A.4 LOCAL NOTIFICATION TELEPHONE NUMBERS/PROCEDURES

Use this section to record other or additional telephone numbers and procedures for notifications, as required for your specific area.

FIRE _____

MEDICAL _____

SECURITY _____

RADIATION PROTECTION

_____ _____

_____ _____

_____ _____

_____ _____

NOTES:

_____

_____

_____

APPENDIX B
GLOSSARY

ABSORPTION	The transformation of radiant energy into a different form of energy by interaction with an absorbing medium.
ACCELERATOR	A device that accelerates electrically charges particles to high velocities.
ACTIVATION	The process of inducing radioactivity by neutron irradiation of a material.
AIRBORNE RADIOACTIVITY AREA	Any area where airborne radioactive material concentrations exceed the derived air concentration (DAC) limits, or cause an individual to exceed an intake of 0.6 percent of the ALI (or 12 DAC hours) during hours the individual is present during the week.
ALPHA EMITTER	Any nuclide that emits alpha radiation.
ALPHA PARTICLE	A positively charged particle emitted from the nucleus of certain radionuclides during the decay process.
ANION	Negatively charged ion.
ANNUAL LIMIT ON INTAKE (ALI)	A limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion during a year, that would result in a CEDE of 5 rem (0.05 Sv) or a CDE of 50 rem (0.5 Sv) to any organ or tissue.
ANODE	A positively charged electrode.
APERTURE	Any opening through which radiation can pass.
ATOM	The smallest component of an element which retains all the unique characteristics of that element.
ATOMIC MASS NUMBER	The number of nucleons (protons and neutrons) in the nucleus of an atom (symbol A).
ATOMIC MASS UNIT	The mass of a neutral atom of a nuclide, expressed in atomic mass units (amu). One amu is equivalent to one-twelfth the weight of a C-12 atom; numerically equivalent to 1.66×10^{-24} gram.

ATOMIC NUMBER	The number of protons contained in the nucleus of an atom (symbol Z).
BACKGROUND RADIATION	Radiation from cosmic sources; naturally occurring radioactive materials, and global fallout as it exists in the environment from nuclear explosive devices.
BACKSCATTER	Radiation deflected 180 degrees with respect to the direction of the incident beam.
BEAM	A collection of rays which may be parallel, divergent, or convergent.
BETA EMITTER	Any radionuclide which emits beta radiation.
BETA PARTICLE	A charged particle, emitted from the nucleus of a nuclide, with a mass and charge equal in magnitude to that of the electron.
BECQUEREL (Bq)	An SI unit of radioactivity equal to one disintegration per second.
BIOASSAY	The analysis of biological material to determine the presence and quantities of radioactive material internally deposited in the human body.
BREMSSTRAHLUNG	Secondary electromagnetic radiation produced by interactions of charged particles in an absorbing medium.
BYPRODUCT MATERIAL	Any radioactive material (excluding source and special nuclear material) obtained in the process of producing or using source or fissionable materials; includes fission products produced by nuclear reactions.
CALIBRATION	Determination of variation from a standard (accuracy of a particular measuring instrument for the purpose of developing correction factors).
CATHODE	A negatively-charged electrode.
CATION	A positively-charged ion.

COLLIMATED BEAM	Effectively, a beam of radiation with a very low degree of divergence or convergence.
COLLIMATOR	A device used for treating a beam of radiation in such a way that the beam exits the collimator with very small divergence or convergence.
COMMITTED DOSE EQUIVALENT (CDE)	The dose equivalent to organs or tissues that will be received from an intake of radioactive material by an individual during the 50-year period following the intake.
COMMITTED EFFECTIVE DOSE EQUIVALENT (CEDE)	The sum of the products of the weighing factors applicable to each of the body organs or tissues that are irradiated and the CDE to these organs or tissues.
CONTAMINATION (RADIOACTIVE)	The presence of radioactive material anywhere it is not desired.
CURIE (Ci)	The unit of radioactivity; equivalent to 3.7×10^{10} nuclear transformations (disintegrations) per second or 2.22×10^{12} disintegrations per minute. One millicurie (mCi) = 10^{-3}Ci One microcurie (µCi) = 10^{-6}Ci
DECAY (RADIOACTIVE)	Spontaneous disintegration of the nucleus of an unstable nuclide, resulting in the emission of particulate and/or electromagnetic radiation.
DECONTAMINATION	The removal of contamination.
DENSITOMETER	An instrument used to measure the degree of darkening of developed photographic film.
DERIVED AIR CONCENTRATION (DAC)	The concentration of a radionuclide in air which, if breathed by an individual for a working year (2,000 hours) and under light working (inhalation rate of 1.2 m^3/hr), results in an intake of one ALI.
DOSE	The quantity of radiation energy absorbed per unit mass of any absorbing medium other than air.
DOSE EQUIVALENT	The quantity of radiation energy absorbed by biological tissues, corrected for biological hazard potential.

DOSE RATE	The radiation dose delivered per unit time.
DOSIMETER	A device that detects and measures accumulated radiation exposure.
ELECTROMAGNETIC RADIATION	The propagation of varying electrical and magnetic fields through space at the velocity of light.
ELECTRON	A stable elementary particle found outside the nucleus of an atom.
ELECTRON VOLT (eV)	A unit of energy equivalent to 1.6×10^{-12}erg.
EXPOSURE, ACUTE	Radiation exposure of short duration.
EXPOSURE, CHRONIC	Radiation exposure of long duration by fractionation or protraction.
EXPOSURE, IONIZING	A measure of ionization produced in air by gamma or X-Radiation.
FILM BADGE	A packet of photographic film used for measurement of accumulated radiation dose.
FISSILE MATERIAL	Fissionable material capable of sustaining a chain reaction, (i.e., plutonium-238, plutonium-239, plutonium-241, uranium-233 or uranium-235, or any material containing the foregoing materials).
FISSION	The splitting of a heavy nucleus, accompanied by the release of energy and radiation.
FISSIONABLE MATERIAL	Material capable of undergoing fission.
FISSION PRODUCTS	Elements or compounds resulting from fission reactions.
GAMMA DEVICE	Any device containing a sealed, radioactive source fastened or contained therein, in which the sealed source, or shielding thereof may be moved or otherwise changed from a shielded to an unshielded position for the purpose of making a radiographic exposure.

GAMMA EMITTER	Any nuclide which emits gamma radiation.
GAMMA RADIATION	Electromagnetic radiation with a neutral electrical charge and zero rest mass which is emitted from the nucleus of an atom.
GRAY (Gy)	The SI unit of absorbed dose; equivalent to 1 joule per kilogram (100 rad).
HALF-LIFE, BIOLOGICAL	The period of time required for biological system to eliminate one-half of an internally deposited quantity of any substance by regular elimination processes.
HALF-LIFE, EFFECTIVE	The period of time required for an internally distributed radionuclide in a biological system to be reduced to one-half of the initial quantity as a result of combined action of the radioactive decay and biological elimination processes.
HALF-LIFE, RADIOLOGICAL	The period of time required to reduce an initial quantity of radionuclide by 50% through the radioactive decay process.
HAZARD EVALUATION SURVEY	Evaluation of hazard to personnel working or remaining in the vicinity of potentially hazardous radiation sources.
HEALTH PHYSICS (HP)	The profession and science concerned with the protection of people and the environment from unnecessary exposure to radiation, through understanding, evaluation, and control of the risks from radiation exposure relative to the benefits derived.
HIGH RADIATION AREA (HRA)	An area, accessible to personnel, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.1 rem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.
INTERLOCK	A device to prevent activation of a control or to prevent hazardous operations until a preliminary condition has been met.
IONIZATION	The production of ions.

IONIZING RADIATION	Any electromagnetic or particulate radiation capable of directly or indirectly producing ion in its passage through an absorbing medium.
ISOTOPE	Nuclides with the same atomic number but different atomic mass.
LICENSED MATERIAL	Any material received, possessed, used, or transferred under a general or special license issued by the U.S. Nuclear Regulatory Commission or an Agreement State.
MINOR	An individual under 18 years of age.
NUCLIDE	A general term applicable to all atomic forms of the elements, which are characterized by a specific number of protons and neutrons in its nucleus.
PARTIAL BODY IRRADIATION	A case in which part of the body is exposed to the radiation.
PERSONNEL DOSIMETRY	The estimation of an individual's radiation dose by physical measurements relevant to their person.
PLANNED SPECIAL EXPOSURES (PSE)	An infrequent exposure to radiation that is monitored and recorded separately from routine annual doses limits. A PSE must have prior approval by the KSC Radiation Protection Committee.
POCKET DOSIMETER	A small condenser ionization chamber (pocket-sized) used for directly monitoring radiation exposure.
QUALITY FACTOR	A numerical factor used to compare the biological effectiveness of absorbed radiation dose due to different types of ionizing radiation.
RAD	The unit of absorbed dose; equivalent to an energy disposition of 100 ergs per gram of absorbing medium.
RADIATION	The emission and propagation of energy through space or through an absorbing medium in the form of waves, or; the energy propagated through space or through materials as waves; usually referring to electromagnetic radiation, or; by extension, particulate radiation such as alpha, beta, or neutron radiation, or emissions of mixed type.

RADIATION AREA (RA)	An area, accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.002 rem in 1 hour at 30 centimeters from the radiation source or from any surface that the radiation penetrates.
RADIATION USER	A person who has been approved by the Radiation Protection Committee to use specific sources of ionizing radiation for a specific purpose at a specific location.
RADIATION PROTECTION GUIDE (RPG)	An accepted upper limit of dose that the body of a person, or specific part thereof, shall be allowed to receive in a stated period of time.
RADIATION SURVEY METER	A portable instrument for measuring radiation fields.
RADIOACTIVE WASTE	Solid, liquid and gaseous materials from nuclear operations that are radioactive or become radioactive and for which there is no further use.
RADIOACTIVE WASTE (MIXED)	Radioactive waste that contains other hazardous agents.
RADIOACTIVITY	The spontaneous decay or disintegration of any unstable atomic nucleus, accompanied by the emission of radiation.
RADIOGRAPHER	Any individual who performs or who, while in attendance at the site where sources of radiation are being used, personally supervises radiographic operations, and who is responsible to the licensee or registrant for assuring compliance with the requirements of this instruction and all license conditions.
RADIOGRAPHER ASSISTANT	Any individual who, under the personal supervision of a radiographer, uses sources of radiation, related handling tools, or radiation survey instruments in radiography.
RADIOGRAPHY	The use of penetrating ionizing radiation to examine solid material.
RADIOISOTOPE	An unstable isotope of an element that decays or disintegrates spontaneously, emitting radiation.

SCATTER	The deflection of radiation relative to the direction of the incident beam.
SEIVERT (Sv)	The SI unit equal to the absorbed dose (Gy) multiplied by the quality factor (1 Sv = 100 rem).
SOURCE MATERIAL	Any material, except special nuclear material, which contains 0.05 percent or greater of uranium, thorium, or any combination of the two.
SPECIAL NUCLEAR MATERIAL (SNM)	Plutonium, uranium-233; uranium containing more than the natural abundance of uranium-235, or any material enriched by any of these substances.
STORAGE CONTAINER	Any device in which radioactive sources are transported or stored.
SURVEY	An evaluation of the radiation hazards incidental to the production, use, or presence of radioactive materials or other sources of radiation under a specific set of conditions.
THERMOLUMINESCENT DOSIMETER	A device used to estimate accumulated radiation dose by means of the latent luminescent effects.
TOTAL EFFECTIVE DOSE EQUIVALENT (TEDE)	The sum of the deep-dose equivalent (for external exposures) and the committed dose equivalent (for internal exposures).
USE SUPERVISOR/ CUSTODIAN (US/C)	In addition to Radiation User, the individual responsible for ensuring that the provisions of the Radiation Protection Program are followed. The Use Supervisor/Custodian also serves as the custodian for specific sources listed on the Use Authorization for which he/she is the Use Supervisor/Custodian.
VERY HIGH RADIATION AREA (VHRA)	An area, accessible to individuals, in which radiation levels could result in an absorbed dose in excess of 500 rad (5 Gy) in 1 hour at 1 meter from the radiation source or from any surface that the radiation penetrates.
WHOLE BODY RADIATION	A case in which the entire body is exposed to the incident radiation or in which the cross section of the body is smaller than the cross section of the incident radiation beam.

X-RADIATION Penetrating ionizing electromagnetic radiation of non-nuclear origin.

X-RAY DEVICE Any instrument which electronically produces ionizing radiation for the purpose of making a radiographic exposure.