Health & Safety Manual

Subject: Safety Standards for Use of Ionizing Radiation

Approved P. D. L. [signature] Date: November 7, 1983

Supersedes: March 11, 1983

1.0 PURPOSE

1.1 To establish the procedures and practices of TRW pertaining to the use of ionizing radiation sources within company facilities.

1.2 Administrative requirements (i.e., requirements applicable to procurement, accountability, transfer and shipment) for the control of ionizing radiation sources are contained in Health and Safety Policy 7.1, "Ionizing Radiation Control Program".

2.0 SCOPE

This policy applies to the Groups comprising the Common Use Management Systems (Defense Systems Group, Electronic Systems Group, Energy Development Group, Operations and Support Group, and Space and Technology Group), hereinafter referred to in this policy as the company. This policy does not apply to ESL, TRW Electronic Products, Inc., and TRW Microwave Products, Inc.

3.0 DEFINITIONS

3.1 Controlled Area means any area, access to which is controlled by the user for purposes of radiation safety pursuant to the provisions of this policy. Airborne radioactivity areas, high radiation areas, radiation areas, and contaminated areas shall be considered controlled areas.

3.2 Curie is the unit of radioactivity. One curie is the activity corresponding to a disintegration rate of 3.7×10^{10} disintegrations per second.

3.3 Dose means radiation energy absorbed per unit mass. When this policy specifies a dose to the whole body, this shall be considered to mean any dose to the whole body or major portion thereof, head and trunk, gonads, lens of the eye, or active blood-forming organs.

3.4 Health Physics Instruments are those instruments used to detect and measure radiation fields and radioactive materials for purposes of radiation protection.

3.5 High Radiation Area means any area, accessible to individuals, in which there exists radiation at such levels that an individual could receive in any one hour a dose to the whole body in excess of 100 millirem.

3.6 Occupational Dose means the dose received by an individual:

a. In a controlled area; or

b. in the course of employment, education, training, or other activities which involve exposure to radiation; except that occupational dose shall not include the dose from exposure to radiation for the purpose of medical or dental diagnosis or medical therapy of such individual.

3.0 DEFINITIONS - (Continued)

3.7 Personnel Monitoring Equipment means devices designed to be worn or carried by an individual for the purpose of measuring the dose received by that individual (e.g., film badges, pocket chambers, pocket dosimeters, film rings, etc.).

3.8 Rad is the unit of absorbed dose. One rad corresponds to an energy absorption of 100 ergs per gram of absorber.

3.9 Radiation - For the purpose of this policy, the term "radiation" is limited to ionizing radiation which includes gamma rays, x-rays, alpha and beta particles, neutrons, protons, high speed electrons, and other nuclear particles.

3.10 Radiation Area means any area, accessible to individuals, in which there exists radiation at such levels that an individual could receive in any one hour a dose to the whole body in excess of 5 millirem, or in any five consecutive days a dose in excess of 100 millirem.

3.11 Radiation Producing Device means any device (x-ray machine, accelerator, etc.) capable of producing radiation when the associated control devices are operated, but excluding devices which produce radiation only by the use of radioactive material.

3.12 Radioactive Material means any material (solid, liquid, or gas) which emits radiation spontaneously.

3.13 Radiation Protection Officer - A person, usually named in a radioactive materials license, directly responsible for radiation protection. It is his duty to ensure that all uses of sources of radiation are carried out in compliance with pertinent established rules including the terms and conditions of the license and the regulations of the licensing agency.

3.14 Rem is a unit of dose of any radiation to body tissue in terms of its estimated biological effects relative to an exposure of one roentgen of x-rays or gamma rays. For the purpose of this policy, any of the following is considered to be equivalent to a dose of one rem:

a. Any exposure of 1 roentgen due to x- or gamma radiation.

b. A dose of 1 rad due to x-, gamma, or beta radiation.

c. A dose of 0.1 rad due to neutrons or high energy protons.

d. A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye.

e. An exposure of 14×10^6 neutrons per square centimeter, or in accordance with the following table if the energy of the neutrons is known:

3.0 DEFINITIONS - (Continued)

3.14 (Continued)

Neutron Energy (Mev)	Number of neutrons per square centimeter equivalent to a dose of 1 rem
Thermal	970 X 10^6
0.0001	720 X 10^6
0.0005	820 X 10^6
0.02	400 X 10^6
0.1	120 X 10^6
0.5	43 X 10^6
1.0	26 X 10^6
2.5	29 X 10^6
5.0	26 X 10^6
7.5	24 X 10^6
10	24 X 10^6
10 to 30	14 X 10^6

3.15 Roentgen is the unit of exposure to x- or gamma radiation. One roentgen is the exposure corresponding to ionization in air of one electrostatic unit of charge of either sign in 0.001293 gram of air.

3.16 Sealed Source - Any radioactive material that is permanently encapsulated in such manner that the radioactive material will not be released under the most severe conditions likely to be encountered by the source.

4.0 POLICY

All ionizing radiation sources within company facilities are to be identified, used, and stored in accordance with this policy and additional requirements that may be specified by the TRW Radiation Safety Committee; the terms and conditions of the applicable license issued to the company, and the regulations or other requirements of the cognizant licensing or regulatory agency.

5.0 RESPONSIBILITIES

5.1 Radiation Safety Manager (Radiation Protection Officer) - The Radiation Safety Manager, Health and Safety (Radiation Protection Officer) has primary responsibility for:

5.0 RESPONSIBILITIES - (Continued)

5.1 (Continued)

a. Implementation of the radiation safety program.

b. Prescribing the use of personal radiation exposure monitoring equipment and procedures including bioassay and in vivo counting methods and maintaining records of personnel radiation exposure measurements.

c. Categorizing personnel into a Medical Review Program based upon an evaluation of the radiation work conditions.

d. Conducting radiation surveys, inspections, and other surveillance activities necessary to assure the safe use of ionizing radiation.

e. Taking necessary corrective action, including shutdown if necessary, in accordance with Health and Safety Policy 1.7, "Safety Corrective Action" in order to prevent potentially hazardous radiation exposure to employees or facilities.

5.2 Radiation Source Requesters/Users - Radiation source users including requesters and others (custodians) designated in Sections 2 or 3 of the Request for Radiation Source (Systems Form 2233) are responsible for implementing the requirements of this policy in their use of ionizing radiation and for implementing the conditions specified in the approved source request.

5.3 Department/Cost Center Managers - Each department/cost center manager is responsible for assuring compliance with this policy in his organization, and with the specific conditions on the source requests within his organization.

5.4 Equipment Management Center - The Equipment Management Center is Health and Safety's authorized service organization for Health Physics Instrumentation.

6.0 PROCEDURE

6.1 Radiation Exposure Limits and Dosimetry Program

a. General

Radiation exposure to individuals will be kept as low as readily achievable (ALARA). This means that in designing operations utilizing sources of radiation, planned exposure of personnel to radiation levels in controlled or uncontrolled areas shall be kept to a minimum and, under worst case circumstances, shall not exceed one-third the values specified in Sections 6.1 b. and 6.1 c.

b. Occupational Dose Limits

No user shall possess or operate sources of radiation in such a manner as to cause any individual 18 years of age or over to receive an occupational dose in excess of the limits specified below:

6.0 PROCEDURE - (Continued)

6.1b (Continued)

Part of Body	Rem Per Calendar Quarter
Whole body	1.25
Hands and forearms; feet and ankles	18.75
Skin of the whole body	7.5

c. Permissible Levels of Radiation In Uncontrolled Areas

No user shall possess or operate sources of radiation in such a manner as to create in any uncontrolled area radiation levels which could cause any individual to receive a dose to the whole body in excess of:

(1) two (2) millirem in any one hour; or

(2) one hundred (100) millirem in any seven consecutive days; or

(3) 0.5 rem in any one year

d. Surface Contamination Limits

Surface radioactivity contamination for unrestricted use within TRW facilities shall be limited to the values in Table 6.d. Unrestricted use applies to all areas which have been used as controlled radiation areas as defined in Section 3, and are to be released for uncontrolled use. Unrestricted use also applies to clothing, tools, and to other articles or materials which are to be removed from a controlled radiation area. These limits do not apply to packages offered for shipment. Shipments of radioactive materials shall be governed by DOT regulations.

For contamination on the skin surface only (e.g., the hands) the surface contamination levels shall not exceed one half of the average values given in Table 6.d.

In controlled radiation areas, surface contamination shall be cleaned after operations so that resultant levels are "as low as reasonably achievable" with respect to the levels in Table 6.d, and never exceed 10 times the table levels.

6.0 PROCEDURE - (Continued)

6.1d (Continued)

TABLE 6.d
SURFACE CONTAMINATION LEVELS

NUCLIDE[a]	AVERAGE[b/c] (dpm/100 cm^2)	MAXIMUM[b/d] (dpm/100 cm^2)	REMOVABLE[b/e] (dpm/100 cm^2)
(1) U-nat, U-235, U-238, and associated decay products	5000	15000	1000
(2) Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100	300	20
(3) Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000	3000	200
(4) Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5000	15000	1000
(5) H-3, C-14 except as DNA precursors[f]	20000	60000	4000

[a] 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.

[b] As used in this table, 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.

[c] 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.

[d] The maximum contamination level applies to an area of not more than 100 cm^2.

[e] 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.

[f] DNA precursors mean molecules or compounds that are directly incorporated into the DNA molecule during DNA biosynthesis, e.g., purine and pyrimidine bases and their analogs, nucleotides and nucleosides. The acceptable surface contamination levels for H-3 and C-14 in DNA precursors are as tabulated in paragraph(d) for beta-gamma-emitters.

6.0 PROCEDURE - (Continued)

6.1 (Continued)

e. Airborne Radioactivity

As a matter of general policy, operations involving radioactive gases, vapors, or dusts shall be conducted such that employees are not routinely exposed to airborne radioactivity. In circumstances where some generation of airborne radioactivity cannot be avoided, the operation shall be designed such that employees are not exposed to airborne concentration in excess of those specified by the Nuclear Regulatory Commission (NRC) in Code of Federal Regulations, Title 10, Part 20 (10 CFR 20), Sections 103, 104, and 106.

f. External Dosimetry

Potential exposure to radiation users is evaluated by Radiation Safety for each source request. If it is determined that personnel may be exposed in their occupational environment to a dose exceeding 100 millirems to the whole body in one calendar quarter then they are required to wear a personal dosimeter while in their work area.

g. Personnel Status

Source requestors are required to supply Radiation Safety with a current list of proposed radiation source users. No user shall be permitted to work in a radiation controlled area or with a source where dosimetry is required until such dosimetry is available and until the user is approved by Radiation Safety.

6.2 Radiation Caution Signs and Labels

Each custodian of radioactive materials will post warning signs and labels as specified in the following paragraphs.

a. The conventional radiation symbol illustrated below will appear on all warning signs. The symbol will be magenta or purple and the background yellow.

6.0 PROCEDURE - (Continued)

6.2 (Continued)

b. Radiation Area

"Radiation Area" means any area in which there exists radiation at such levels that an individual could receive in any one hour a dose to the whole body of five millirem. Each radiation area will be conspicuously posted with a sign or signs bearing the radiation symbol and the words "Caution" or "Danger" - "Radiation Area".

c. High Radiation Area

"High Radiation Area" means any area in which there exists radiation at such levels that an individual could receive in any one hour a dose to the whole body in excess of 100 millirem.

(1) Each high radiation area will be conspicuously posted with a sign or signs bearing the radiation symbol and the words: "Danger - High Radiation Area."

(2) Each high radiation area will be equipped with a control device which shall either cause the level of radiation to be reduced below that at which an individual might receive a dose of 100 millirem in one hour upon entry into the area or shall energize a conspicuous visible or audible alarm signal in such a manner that the individual entering and the user or supervisor of the activity are made aware of the entry. In the case of a high radiation area established for a period of 30 days or less, such control device is not required.

d. Posting of Radioisotope Use and/or Storage Area

Each area in which there is used or stored more than 35 pounds of natural or depleted uranium, or 100 pounds of natural thorium, or more than 10 times the quantity specified in Attachment 1 of any other radioactive material, shall be conspicuously posted with a sign or signs bearing the radiation symbol and the words: "Caution - Radioactive Material".

Exceptions:

(1) Posting is not required because of the presence of a sealed source if the radiation level at 12" from the source container or housing does not exceed 5 millirem per hour (see paragraph 6.3 a. of this policy).

(2) Posting is not required for temporary use, not to exceed 8 hours, in areas in which there is an individual in constant attendance who shall take the precautions necessary to prevent exposure of any individual to radiation or radioactive material.

6.0 PROCEDURE - (Continued)

6.2 (Continued)

e. Labeling of Containers

Each container in which is used, stored, or transported more than 3.5 pounds of natural or depleted uranium or 10 pounds of natural thorium or more than the quantity of any other radioactive material specified in Attachment 1, shall have firmly affixed to it a durable label bearing the radiation symbol and the words: "Caution - Radioactive Material". The label shall also state the quantity and identity of the radioactive material and the date of measurement or other such information sufficient to permit individuals handling or using the containers, or working in the vicinity thereof to take precautions to minimize exposures. Sealed source containers will, in addition, bear the serial number of the sealed source.

6.3 Storage of Radioactive Materials

a. Shielding of Stored Materials

Unless otherwise authorized by Radiation Safety, radioactive materials will be stored in containers such that the radiation level at 12" from the surface of the container is less than 5 millirem per hour. If radiation levels exceed 5 millirem per hour at distances greater than 12" from the surface of the container the area shall be posted as required by paragraphs 6.2 a. and 6.2 d. of this policy.

b. Security of Stored Materials

Radioactive material will be stored in such a manner as to minimize the likelihood of unauthorized use or removal. Metal cabinets equipped with a key lock will be utilized wherever possible.

c. Identification of Radioisotope Storage Containers

Radioisotope storage cabinets or containers will be marked in accordance with paragraph 6.2 of this policy. In addition, storage cabinets will have a clearly visible inventory of the stored material and the name of the custodian affixed to the outside of the cabinet in accordance with the requirements of Health and Safety Policy 7.1, Section 7.8 a.

6.4 Radioactive Waste Containers

a. Dry Waste Containers

Each user of radioisotopes will store dry radioactive wastes in a covered double container marked with the radiation symbol, the words: "Caution - Radioactive Waste", and the identity and estimated quantity of the principal radionuclides. The inner container may be a plastic bag or pail. The outer container must be a water-tight container of metal construction.

6.0 PROCEDURE - (Continued)

6.4 (Continued)

b. Liquid Waste Containers

Liquid radioactive wastes will be stored in plastic water-tight bottles equipped with screw tops. Bottles used for radioactive waste will be marked with the radiation symbol, the words: "Caution - Radioactive Waste", and the identity and estimated quantity of the principal radionuclide(s).

c. Storage of Radioactive Waste

Radioactive wastes will be stored in accordance with paragraph 6.3 b. of this policy.

d. Prohibited Containers

Ordinary trash receptacles, such as those used in offices or laboratory areas, are not authorized for the storage of waste radioactive material.

6.5 Operational Safety Requirements

a. Procedures

Each radiation source requester shall prepare, promulgate, and maintain within his work group or organization, radiation source use instructions or operating procedures sufficient to assure employee and facility safety. Such procedures are subject to review and approval by the Radiation Safety Committee. This review and approval is normally accomplished concurrently with Request for Radiation Source approval (see Health and Safety Policy 7.1, paragraph 7.1 b., c.).

b. Inspection of Radiation Sources

(1) General

Receipt and pre-shipment inspection of radiation sources is accomplished as specified in paragraphs 7.3 and 7.4 of Health and Safety Policy 7.1, "Ionizing Radiation Control Program". Inspection of radiation sources and radiation work areas at other times shall be conducted by the Radiation Protection Officer or designated alternate to assure conformance with applicable requirements and regulations.

(2) Sealed Source Leak Tests

Sealed sources shall be inspected and leak tested by the Radiation Protection Officer or his/her designated alternate at intervals not exceeding six months.

6.0 PROCEDURE - (Continued)

6.5 (Continued)

Individuals using sealed sources with activities greater than those specified in Attachment 1 shall perform periodic leak contamination tests as necessary to verify source integrity. Where required by Radiation Safety, a record of such tests and sealed source use shall be maintained by the user on Systems Form 3832 "Sealed Source Utilization Log" (see Attachment 2).

Any test result which indicates the presence of more than 0.005 microcuries of removable contamination shall be reported immediately to Radiation Safety and the source withdrawn from use.

(3) User's Inspection

Each user of a source(s) of radiation shall conduct sufficient inspections, contamination tests, and radiation level surveys to assure that any source in his/her possession does not present an uncontrolled radiation hazard.

c. Instrumentation

Each radiation source requester shall have in his/her possession sufficient health physics instrumentation to assure conformance with this policy or other monitoring requirements as may be specified by the Radiation Safety Committee. Instruments shall be maintained in accordance with paragraph 6.6 of this policy.

d. Instruction of Personnel

Each user of ionizing radiation shall inform individuals working in or frequenting any portion of a controlled area as to the presence of sources of radiation, and instruct such individuals in the potential safety problems associated therewith and in precautions or procedures to minimize radiation exposure. Such instruction must be completed prior to the use of any source by a new user.

6.6 Servicing of Health Physics Instrumentation

Health Physics Instrumentation must be maintained in a calibrated condition and within the interval of use identified on an affixed Equipment Management Center (EMC) calibration level. Intervals and conditions of use are authorized by Radiation Safety. The Equipment Management Center's Equipment Control Department (ECD) maintains local instrument pools to coordinate the servicing, inactivation and redeployment of Health Physics Instrumentation.

6.0 PROCEDURE - (Continued)

6.7 Emergency Procedures

a. Radiological Emergency Data Sheet

For each location in which is used or stored quantities of unsealed radioactive materials in quantities in excess of ten (10) times, or sealed (encapsulated) radioactive materials in excess of one thousand (1000) times the quantities listed in Attachment 1, a Radiological Emergency Data Sheet (Attachment 3) shall be prepared by Radiation Safety and a copy posted at the entrance to the work area.

b. Emergency Instructions

(1) Fire, Explosion, or Other Major Emergency

In the event of a fire, explosion, or other major emergency in or adjacent to a radioisotope use or storage area, such fact must be immediately reported to Security via the emergency extension. Every effort should be made to implement the protective measures specified in the Radiological Emergency Data Sheet.

(2) Spills

Spills of radioactive materials, ruptured or damaged sealed sources, or any uncontrolled release of radioactive materials will be immediately reported to Health and Safety. After hours notify Security via the emergency extension.

Laboratory supervisors and/or radiation source custodians are required to control personnel movement in contaminated areas to minimize the likelihood of personnel contamination and the spread of contamination to clean areas. Laboratory supervisors and/or radiation source custodians are required to decontaminate their laboratory equipment and monitor and decontaminate their laboratory area under the supervision, and with the assistance of, the Radiation Protection Officer. Contaminated areas must be clearly designated by means of signs, barricades, or other suitable markers, and if possible, should be closed off from clean (uncontaminated) areas.

(3) Personnel Injuries

All injuries to personnel resulting from exposure to or handling of radiation sources will be immediately reported to the nearest Health Services Unit. Injured persons should be removed from the affected area, if possible, given required medical treatment, and monitored for possible contamination. If the patient is found to be contaminated, such information must be given ambulance and/or medical personnel prior to the removal of the patient to the hospital or other medical treatment facility.

6.0 PROCEDURE - (Continued)

6.7 (Continued)

c. Reportable Occurrences

The events listed below shall be reported immediately by telephone or in person to the Radiation Safety Office, Health and Safety. After hours notify Security via the emergency telephone number.

The responsible radiation source requester and his department (cost center) manager shall make a written report to the Radiation Protection Officer within two (2) working days following the event. This report shall describe: (1) the circumstances surrounding the event; (2) procedural, system, or personnel failures or deficiencies which may have contributed to the event; and (3) recommendations for corrective action(s).

(1) Known or Suspected Radiation Overexposures

Persons known or suspected of having received a radiation exposure in excess of 3000 millirem.

(2) Ingestion of, or Contamination by, Radioactive Materials

Persons known or suspected of having ingested or having been contaminated by radioactive materials.

(3) Loss of Radiation Source

The loss of any radiation source shall be reported to both Security and Radiation Safety immediately upon discovery in accordance with Health and Safety Policy 7.1, paragraph 7.8d.

(4) Uncontrolled Release or Spill of Radioactive Material

Spills of radioactive materials, ruptured or damaged sealed sources, or any uncontrolled release of radioactive materials.

(5) Fire, Explosion, or Other Major Emergency

In the case of a fire, explosion, or other major emergency in or adjacent to a radioisotope use or storage area, such fact must be immediately reported to Security via the emergency extension and to Radiation Safety.

ATTACHMENT 1 TO HEALTH AND SAFETY POLICY 7.2

Radionuclide	Microcuries	Radionuclide	Microcuries	Radionuclide	Microcuries
Antimony-122 (Sb^{122})	100	Iodine-131 (I^{131})	1	Scandium-46 (Sc^{46})	10
Antimony-124 (Sb^{124})	10	Iodine-132 (I^{132})	10	Scandium-47 (Sc^{47})	100
Antimony-125 (Sb^{125})	10	Iodine-133 (I^{133})	1	Scandium-48 (Sc^{48})	10
Arsenic-73 (As^{73})	100	Iodine-134 (I^{134})	10	Selenium-75 (Se^{75})	10
Arsenic-74 (As^{74})	10	Iodine-135 (I^{135})	10	Silicon-31 (Si^{31})	100
Arsenic-76 (As^{76})	10	Iridium-192 (Ir^{192})	10	Silver-105 (Ag^{105})	10
Arsenic-77 (As^{77})	100	Iridium-194 (Ir^{194})	100	Silver-110m (Ag^{110m})	1
Barium-131 (Ba^{131})	10	Iron-55 (Fe^{55})	100	Silver-111 (Ag^{111})	100
Barium-133 (Ba^{133})	10	Iron-59 (Fe^{59})	10	Sodium-22 (Na^{22})	1
Barium-140 (Ba^{140})	10	Krypton-85 (Kr^{85})	100	Sodium-24 (Na^{24})	10
Beryllium-7 (Be^{7})	100	Krypton-87 (Kr^{87})	10	Strontium-85 (Sr^{85})	10
Bismuth-210 (Bi^{210})	1	Lanthanum-140 (La^{140})	10	Strontium-89 (Sr^{89})	1
Bromine-82 (Br^{82})	10	Lead-210 (Pb^{210})	0.1	Strontium-90 (Sr^{90})	0.1
Cadmium-109 (Cd^{109})	10	Lutetium-177 (Lu^{177})	100	Strontium-91 (Sr^{91})	10
Cadmium-115m (Cd^{115m})	10	Manganese-52 (Mn^{52})	10	Strontium-92 (Sr^{92})	10
Cadmium-115 (Cd^{115})	100	Manganese-54 (Mn^{54})	10	Sulphur-35 (S^{35})	100
Calcium-45 (Ca^{45})	10	Manganese-56 (Mn^{56})	10	Tantalum-182 (Ta^{182})	10
Calcium-47 (Ca^{47})	10	Mercury-197m (Hg^{197m})	100	Technetium-96 (Tc^{96})	10
Carbon-14 (C^{14})	100	Mercury-197 (Hg^{197})	100	Technetium-97m (Tc^{97m})	100
Cerium-141 (Ce^{141})	100	Mercury-203 (Hg^{203})	10	Technetium-97 (Tc^{97})	100
Cerium-142 (Ce^{142})	100	Molybdenum-99 (Mo^{99})	100	Technetium-99m (Tc^{99m})	100
Cerium-144 (Ce^{144})	1	Neodymium-147 (Nd^{147})	100	Technetium-99 (Tc^{99})	10
Cesium-131 (Cs^{131})	1,000	Neodymium-149 (Nd^{149})	100	Tellurium-132m (Te^{132m})	10
Cesium-134m (Cs^{134m})	100	Nickel-59 (Ni^{59})	100	Tellurium-127m (Te^{127m})	10
Cesium-134 (Cs^{134})	1	Nickel-63 (Ni^{63})	10	Tellurium-127 (Te^{127})	100
Cesium-135 (Cs^{135})	10	Nickel-65 (Ni^{65})	100	Tellurium-129m (Te^{129m})	10
Cesium-136 (Cs^{136})	10	Niobium-92m (Nb^{92m})	10	Tellurium-129 (Te^{129})	100
Cesium-137 (Cs^{137})	10	Niobium-95 (Nb^{95})	10	Tellurium-131m (Te^{131m})	10
Chlorine-36 (Cl^{36})	10	Niobium-97 (Nb^{97})	10	Tellurium-123 (Te^{123})	10
Chlorine-38 (Cl^{38})	10	Osmium-185 (Os^{185})	10	Terbium-160 (Tb^{160})	10
Chromium-51 (Cr^{51})	1,000	Osmium-191m (Os^{191m})	100	Thallium-200 (Tl^{200})	100
Cobalt-58m (Co^{58m})	10	Osmium-191 (Os^{191})	100	Thallium-201 (Tl^{201})	100
Cobalt-58 (Co^{58})	10	Osmium-193 (Os^{193})	100	Thallium-202 (Tl^{202})	100
Cobalt-60 (Co^{60})	1	Palladium-103 (Pd^{103})	100	Thallium-204 (Tl^{204})	10
Copper-64 (Cu^{64})	100	Palladium-109 (Pd^{109})	100	Thulium-170 (Tm^{170})	10
Dysprosium-165 (Dy^{165})	10	Phosphorus-32 (P^{32})	10	Thulium-171 (Tm^{171})	10
Dysprosium-166 (Dy^{166})	100	Platinum-191 (Pt^{191})	100	Tin-113 (Sn^{113})	10
Erbium-169 (Er^{169})	100	Platinum-193m (Pt^{193m})	100	Tin-126 (Sn^{126})	10
Erbium-171 (Er^{171})	100	Platinum-193 (Pt^{193})	100	Tungsten-181 (W^{181})	10
Europium-152 9.2 h (Eu^{152} 9.2 h)	100	Platinum-197m (Pt^{197m})	100	Tungsten-185 (W^{185})	10
Europium-152 13 yr (Eu^{152} 13 yr)	1	Platinum-197 (Pt^{197})	100	Tungsten-187 (W^{187})	100
Europium-154 (Eu^{154})	1	Polonium-210 (Po^{210})	0.1	Vanadium-48 (V^{48})	10
Europium-155 (Eu^{155})	10	Potassium-42 (K^{42})	10	Xenon-131m (Xe^{131m})	1,000
Fluorine-18 (F^{18})	1,000	Praseodymium-143 (Pr^{143})	100	Xenon-133 (Xe^{133})	100
Gadolinium-153 (Gd^{153})	10	Praseodymium-145 (Pr^{145})	100	Xenon-135 (Xe^{135})	100
Gadolinium-159 (Gd^{159})	100	Promethium-147 (Pm^{147})	10	Ytterbium-175 (Yb^{175})	100
Gallium-72 (Ga^{72})	10	Promethium-149 (Pm^{149})	10	Yttrium-90 (Y^{90})	10
Germanium-71 (Ge^{71})	100	Rhenium-186 (Re^{186})	100	Yttrium-91 (Y^{91})	10
Gold-198 (Au^{198})	100	Rhenium-188 (Re^{188})	100	Yttrium-92 (Y^{92})	100
Gold-199 (Au^{199})	100	Rhodium-103m (Rh^{103m})	100	Yttrium-93 (Y^{93})	100
Hafnium-181 (Hf^{181})	10	Rhodium-105 (Rh^{105})	100	Zinc-65 (Zn^{65})	10
Holmium-166 (Ho^{166})	100	Rubidium-86 (Rb^{86})	10	Zinc-69m (Zn^{69m})	100
Hydrogen-3 (H^{3})	1,000	Rubidium-87 (Rb^{87})	10	Zinc-69 (Zn^{69})	1,000
Indium-113m (In^{113m})	100	Ruthenium-97 (Ru^{97})	100	Zirconium-93 (Zr^{93})	10
Indium-114m (In^{114m})	10	Ruthenium-103 (Ru^{103})	10	Zirconium-95 (Zr^{95})	10
Indium-115m (In^{115m})	100	Ruthenium-105 (Ru^{105})	10	Zirconium-97 (Zr^{97})	10
Indium-115 (In^{115})	10	Ruthenium-106 (Ru^{106})	1	Any radionuclide not listed above other than alpha emitting radionuclides	0.1
Iodine-125 (I^{125})	1	Samarium-151 (Sm^{151})	10		
Iodine-126 (I^{126})	1	Samarium-153 (Sm^{153})	100		
Iodine-129 (I^{129})	0.1				

SEALED SOURCE UTILIZATION LOG

PROGRAM/DEPARTMENT _____ STORAGE LOCATION _____ CUSTODIAN _____

	SOURCE CHECK OUT					SOURCE RETURN			
SOURCE - S/N OR EXPERIMENT	DATE	TIME	LOCATION	CONTAMINATION CHECK	SIGNATURE	DATE	TIME	CONTAMINATION CHECK	SIGNATURE

ATTACHMENT 2 TO HEALTH AND SAFETY POLICY 7.2

SYSTEMS 3832

ATTACHMENT 3 TO HEALTH AND SAFETY POLICY 7.2

Operations & Support Group

TRW

RADIOLOGICAL EMERGENCY DATA SHEET

ISSUE DATE _____

REVISION _____

REQUEST NO. _____

BUILDING	DEPARTMENT	
ROOM(S)	GROUP	DIVISION

	MAIL STATION	EXT.	HOME PHONE
1. DEPT. MANAGER _____			
2. MATL. REQUESTER _____			
3. _____			
4. _____			
5. _____			

6. RADIOLOGICAL DATA

ROOM	RADIONUCLIDES	CHEMICAL OR PHYSICAL FORM	QUANTITY CURIES	HAZARD		
				DIRECT RADIATION	INHALATION	CONTAMINATION

7. PROTECTIVE MEASURES

IMPLEMENT FOR: ___ FIRE, EXPLOSION ___ CONTAINER DAMAGE, SPILL ___ FLOODING ___ BLDG. COLLAPSE

(a) EVACUATE ROOM _____

(b) EVACUATE BUILDING _____

(c) EVACUATE ADJACENT/DOWNWIND AREAS _____

(d) RESPIRATORY PROTECTIVE EQUIPMENT _____

(e) PROTECTIVE CLOTHING _____

(f) PERSONNEL CONTAMINATION _____

(g) EQUIPMENT CONTAMINATION _____

(h) PERSONNEL INJURIES _____

_____

(i) ACCESS CONTROL _____

8. NOTIFICATION REQUIREMENTS

NAME	EXTENSION	HOME PHONE