

ATTACHMENT 4



NOSCINST 5100.2A
15 AUGUST 1980

Ionizing Radiation Control Manual



**NAVAL OCEAN SYSTEMS CENTER
SAN DIEGO, CALIFORNIA 92152**

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To: Directors, Department Heads, Major Staff Office Heads, and above

Subj: Ionizing Radiation Control Manual

Ref: (a) NAVMED P-5055, Radiation Health Protection Manual
(b) Title 10, Code of Federal Regulations, parts 20, 30, 31, and 33

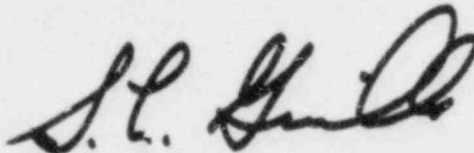
1. Purpose. To define NOSC policies governing radiological safety, to establish safety criteria governing the use of ionizing radiation sources, and to provide guidance to users of radioactive materials.

2. Cancellation. NOSCINST 5100.2 and NOSCNOTE 5100 of 14 Aug 1978, Administrative control of radioactive materials. (R)

3. Scope. These regulations apply to ionizing radiation sources that are used within NOSC for research and development, diagnostic, and industrial purposes.

4. Action. NOSC personnel using or supervising the use of radiation sources will conduct their operations in accordance with references (a) and (b) and the policies and procedures contained in this manual.

5. Directive Responsibility. The Head, Safety Office, Code 037, is responsible for keeping this instruction current. (R)



S. L. GUILLE

Distribution:
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CHAPTER I

ORGANIZATION AND RESPONSIBILITIES

1. Introduction

a. NOSC is engaged in the use of radiation sources of various types in the research, development, test, and evaluation of nuclear devices and systems, animal medical research, tracer technology, industrial radiography, and other nondestructive testing. The hazards to personnel incident to the use of radiation sources require a program to ensure control of radiation exposures to occupational personnel and to the public. NAVMED P-5055, Radiation Health Protection Manual, specifies the responsibilities and components of a radiological health program.

b. Radioactive materials are used under licenses issued by the Nuclear Regulatory Commission (NRC). As prescribed by Title 10, CFR, parts 20, 30, 31, and 33, administrative and safety controls are required as conditions of these licenses. This manual describes committee review functions, safety responsibilities, and administrative procedures that constitute the NOSC control program.

2. Duties and Responsibilities

a. The Ionizing Radiation Control Committee (IRCC)

(1) Membership. The IRCC membership will include a qualified representative and an alternate from each of the codes listed below and others deemed to be necessary by the IRCC chairman: (A)

(a) Director, Independent Research and Development (Code 013)
(Chairman)

(b) Chief Staff Officer (Code 03) (A)

(c) Radiological Safety Officer (Code 037) (Member and alternate
chairman) (R)

(d) Biosciences Department (Code 51)

(e) Ocean Technology Department (Code 52)

(f) Electronics Engineering and Sciences Department (Code 92)

(g) Arctic Submarine Laboratory (Code 54) (A)

(2) Nomination of Members

(a) Members and alternates will be designated by name and in writing to the Chairman by each department head and will serve until specifically relieved. The Chairman may also request the attendance of specific qualified personnel from other organizational groups at certain meetings to provide advice to the Committee.

(b) Persons appointed as members to the IRCC will be senior engineers or scientists who have been actively engaged in or associated with nuclear operations and the radiological safety aspects of nuclear operations. Committee members must have thorough knowledge of radiation control procedures, measuring techniques, and safety procedures resulting from formal training or experience.

(3) Functions. The IRCC will review proposals for the use of radioactive materials on the Center. Committee review will include, but is not limited to:

- (a) Compatibility of proposal with Center mission.
- (b) Adequacy of facilities to conduct the program.
- (c) Effect of the program on the location and surroundings.
- (d) Safeguards employed to limit exposures to occupational personnel and the public.
- (e) Security and control of nuclear materials and devices.
- (f) Procedures for use, storage, transportation, and monitoring of nuclear materials.
- (g) Qualifications of personnel applying as users or custodians of nuclear materials.
- (h) Possible emergencies and procedures for handling accidents or emergencies.

(4) Procedures. Applications for the use of radioactive materials will be submitted in writing to the Chairman (Code 013). Radionuclide Use Application/Approval (appendix A) is the format to be used for this application. The Committee will review and act on the proposals and the Chairman will prepare and distribute Committee actions to the applicant, committee members, the Commander, and other appropriate organizations. Applications will include the following information:

- (a) Description of program.
- (b) Radioisotopes, quantities, physical or chemical form, intended use, location of use, containment, and shielding.
- (c) Names, codes, and qualifications of custodian and users.
- (d) A statement of protective measures, including operating procedures; plans for storage, transportation, and disposal; and safety handling equipment to be used.
- (e) A statement of preventative safeguards and any special decontamination procedures.

b. Chairman, Ionizing Radiation Control Committee. The Chairman of the IRCC is responsible to the Commander for:

- (1) Arranging for and presiding at the IRCC meetings to be held semi-annually or more frequently when directed by the Chairman.
- (2) Assuring that minutes are taken and compiled for the Commander and for distribution as directed by the Committee.
- (3) Ensuring that the actions of the Committee are implemented.
- (4) Utilizing the Committee effectively in matters pertaining to ionizing radiation control.

c. Radiological Safety Officer. The Radiological Safety Officer (RSO) is assigned responsibility for conducting a Radiological Safety Program in accordance with NRC regulations, for initiating correspondence with the NRC concerning licenses, and for providing accountability and control measures for all licensed material used and stored at the Center. In carrying out these responsibilities, the RSO will:

(R)

- (1) Establish and coordinate safety policy and criteria for nuclear and ionizing radiation hazards associated with Center operations, provide consultation and technical assistance to applicants and users on the degree of hazards associated with programs and operations involving ionizing radiation, and make recommendations of measures and procedures to control these hazards.
- (2) Establish and maintain a continuing radiation safety program to ensure the safety of personnel working with or near ionizing radiation sources, in accordance with criteria established in this manual and applicable regulations established by higher authority.
- (3) Ensure that pertinent procedures and regulations of the Navy, Department of Defense, NRC, and Department of Transportation are followed.
- (4) Review all requests for acquisition and use of licensed materials. (A)
- (5) Ensure that usage is within the scope of the licensing held by NOSC, arranging for additional licensing if required. (A)
- (6) Specify radiological safety measures to be taken. (A)
- (7) Arrange for review of radioisotope project plans by the Ionizing Radiation Control Committee. (A)
- (8) Monitor incoming shipments of radioactive material. (A)
- (9) Arrange for training and/or indoctrination in radiological safety, as needed, to reinforce the qualifications of the user. (R)
- (10) Assist and advise in providing monitoring and safety equipment for the program. Arrange for calibration of instruments as required. (A)

- A) (11) Routinely check work areas for radiation levels and inspect posting and labeling in work areas.
- A) (12) Arrange for semiannual leak test of sealed sources.
- A) (13) Keep fire and security personnel notified of material locations and hazards involved.

D) d. Security Group. The Security Group, Code 33, will take necessary action, as part of the admittance procedure, to prevent unauthorized entrance onto the Center of radioactive materials or of instruments or systems containing radioactive materials.

e. Supply Department. The Supply Department, Code 42, will take the necessary action to:

(1) Maintain records of radioactive materials either entering or leaving the Center through Supply Department channels and notify the RSO of all such actions.

(2) Provide a controlled area for the storage of radioactive materials and radioactive waste materials.

(3) Follow the provisions of NAVSUPINST 5101.9B for the disposition of radioactive waste materials.

f. Industrial Medical Officer. The Industrial Medical Officer, Code 292, will arrange for physical examinations, maintain dosimetry records, and submit film for processing as required by NAVMED P-5055, Radiation Health Protection Manual.

A) g. Using Department

(1) The using department will be responsible for:

(a) Maintaining an inventory of materials on hand. (Copy to RSO.)

(b) Ensuring that area boundaries are established, as needed, and posted for controlling entry into the area.

(c) Writing, posting, and following standard operating procedures (SOP's) for use of sources.

(d) Notifying the RSO and the Chairman of the IRCC whenever radioactive sources are purchased or brought on board.

(2) The using department will submit to Code 037, in writing, a project plan containing the following information whenever a significant change in a program occurs or prior to the initiation of a program:

(a) Description of program.

(b) Licensed material needed for program (type, form, and quantity).

(c) Details of use, including locations, dates, safety and handling equipment, storage plans, area control measures, and instrumentation required.

(d) Names and qualifications of individual users.

(e) Special hazards anticipated (fire, security, etc.).

(f) An SOP for the program.

(3) The using department will ensure that all radioactive materials brought aboard the Center are accompanied by a valid NRC license, if appropriate, or are destined for transfer to personnel authorized by license to use radioactive materials of the types and amounts being transferred. Whenever such materials are brought aboard, the Radiological Safety Officer will be notified by telephone at Ext. 6458, San Diego.

3. User Qualifications. Any person whose name is submitted as a user of radioactive materials must show evidence that, through education, experience, or training, he is familiar with:

- a. Basic nuclear concepts.
- b. Biological effects of radiation and internal contamination.
- c. Basic radiation and contamination control methods.
- d. Characteristics and hazards of the materials to be used.
- e. Use of radiation survey instruments and personnel dosimetry devices.

CHAPTER II

RADIATION PROTECTION STANDARDS

1. Radiation Exposure Limits. The basic radiation exposure limits (table I) are those specified in 10 CFR 20.101, "Exposure of individuals to radiation in restricted areas." These limits are adopted for the control of occupational exposures to personnel and do not include medical or dental diagnostic or therapeutic exposures.

Table I - Radiation Exposure Limits
(REM* per Calendar Quarter)

Whole body, head and trunk, active blood-forming organs, lenses of eyes, or gonads	1.25
Hands and forearms, feet and ankles	18.75
Skin of whole body	7.50

*REM - Roentgen Equivalent Man

A whole body exposure of 3 rem per quarter to an individual may be permitted if a complete occupational exposure history has been documented; however, no individual may receive an occupational exposure to more than 5 rem per year. (D)

2. Minors. The dose limit for individuals under 18 years of age is 0.125 rem per calendar quarter. Under no circumstances will a person under the age of 18 be exposed to ionizing radiation (10 CFR 20.104). (A)

3. Pregnant Females. Due to the sensitivity of the fetus, a pregnant female or a female who suspects she is pregnant will not be exposed to ionizing radiation (NRC Regulatory Guide 8.13). (A)

4. Surface Contamination Limits. Areas and equipment will be considered contaminated, requiring radiological controls, when the surface contamination exceeds the levels listed in table II. (See table II on page II-2.)

5. Airborne Contamination Limits. Release of radioactive materials into restricted or unrestricted environments shall not exceed limits specified in 10 CFR 20.103 and 10 CFR 20.106. Note that appendix B to 10 CFR 20 has two tables. Table I applies to release into a restricted area. Table II is for a release into an unrestricted area. Center operations which generate airborne contamination will attempt to meet the release limits specified by the State of California. (R)

6. Waterborne Contamination Limits. Release of radioactive material into restricted or unrestricted environments shall not exceed limits specified in 10 CFR 20.106 and 10 CFR 20.303. Note that appendix B to 10 CFR 20 has two tables. Table I applies to release into a restricted area. Table II is for a release into an unrestricted area. Center operations which generate waterborne contamination will, meet, if possible, the release limits specified by the State of California. (A)

Table 11 - Acceptable Surface Contamination Levels

MUCLIDES ^a	AVERAGE ^b c f	MAXIMUM ^b d f	REMOVABLE ^b e f
U-nat, U-235, U-238, and associated decay products	5,000 dpm alpha/100 cm ²	15,000 dpm alpha/100 cm ²	1,000 dpm alpha/100 cm ²
Transuramics, Ra-226, Ra-228, Th-230, Th-232, Pa-231, Ac-227, I-125, I-129	100 dpm/100cm ²	500 dpm/100 cm ²	20 dpm/100 cm ²
Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1,000 dpm/100 cm ²	3,000 dpm/100 cm ²	200 dpm/100 cm ²
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	5,000 dpm beta-gamma/100 cm ²	15,000 dpm beta-gamma/100 cm ²	1,000 dpm beta-gamma/100 cm ²

^aWhere surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

^bAs used in this table, dpm (disintegrations per minute [2.22 x 10¹² dpm = 1 Curie]) 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.

^cMeasurements 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.

^dThe maximum contamination level applies to an area of not more than 100 cm².

^eThe amount of removable radioactive material per 100 cm² 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.

^fThe average and 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.

7. Neutron Flux Dose Equivalents. Provided in table III is a summation of the neutron flux dose equivalents (10 CFR 20.4(c)(4)).

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Table III - Neutron Flux Dose Equivalents

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Neutron Energy (MeV)	Number of neutrons per square centimeter equivalent to a dose of 1 REM (neutrons/cm ²)	Average flux to deliver 100 millirem in 40 hours (neutrons/cm ² per sec.)
Thermal.....	370 x 10 ⁶	670
0.0001.....	720 x 10 ⁶	500
0.005.....	820 x 10 ⁶	570
0.02.....	400 x 10 ⁶	280
0.1.....	120 x 10 ⁶	80
0.5.....	43 x 10 ⁶	30
1.0.....	26 x 10 ⁶	18
2.5.....	29 x 10 ⁶	20
5.0.....	26 x 10 ⁶	18
7.5.....	24 x 10 ⁶	17
10.....	24 x 10 ⁶	17
10 to 30.....	14 x 10 ⁶	10

8. Bioassay, Body Burdens, and whole Body Counts. Bioassay and determination of body burdens will be performed upon request of the Radiological Safety Officer or a radiation user. Factors such as the radionuclide, the critical organ, the number of curies on hand, and the chemical form, all can affect the body's ability to assimilate the radioactive material and must be considered when the need for a bioassay is evident (NRC, Regulatory Guide 8.9). All bioassays will be entered in the individual's health records and will be used in computing that individual's radiation exposure.

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9. ALARA. Even though current occupational exposure limits provide a very low risk of injury, it is prudent to avoid unnecessary exposure to radiation. The objective is thus to reduce occupational exposures as far below the specified limits as is reasonably achievable by means of good radiation protection planning and practice, as well as by WOSC's commitment to policies that foster vigilance against departures from good practice. In addition to maintaining dose to individuals as low as reasonably achievable (ALARA), the sum of the doses received by all exposed individuals should also be maintained at the lowest practicable level (NRC Regulatory Guide 8.10).

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CHAPTER III

MONITORING AND CONTROL MEASURES

1. Purpose. The basic purpose of a radiation protection program is to preserve the health of personnel who, because of occupational needs, are required to work with or near radiation sources and to prevent unnecessary exposure of nonradiation workers to ionizing radiation.

2. Policy. Every effort shall be made to maintain radiation exposures as far below the limits given in chapter II as possible. Work should be planned so as to keep individual radiation exposures below 100 millirem per 40-hour week for radiation workers.

3. Restricted Areas. Restricted areas are areas where entry is controlled for the purposes of radiological protection. These are areas where radioactive materials are used or stored or where ionizing radiations are being generated by any means. Magenta (purple) on yellow background signs, bearing the standard radiation symbol, as defined in 10 CFR 20.203, and the appropriate legend to indicate the hazards, will be posted in restricted areas. Visitors to these areas shall be accompanied by personnel authorized to work in the area and who are familiar with the radiation hazards. Means of restriction and area boundaries will be established by the Radiological Safety Officer.

a. Radioactive Materials Area. Any area or room in which radioactive material is used or stored in quantities, as specified in 10 CFR 20.203(e) (1) and (2), is designated as a "Radioactive Materials Area" and shall be posted with the radiation symbol and the words, "Caution - Radioactive Materials."

b. Radiation Area. Any area, accessible to personnel, in which there exists ionizing radiation at such levels that a major portion of the body can receive a dose in excess of 5 millirem in one hour, or 100 millirem in 5 consecutive days, shall be designated as a "Radiation Area" and shall be conspicuously posted with a sign bearing the radiation symbol and the words, "Caution - Radiation Area." (10 CFR 20.202(b) (2))

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c. High Radiation Area. Any area, accessible to personnel, in which there exists ionizing radiation at such levels that a major portion of the body can receive in one hour a dose in excess of 100 millirem is designated as a "High Radiation Area" and shall be conspicuously posted with a sign bearing the radiation symbol and the words "Caution - High Radiation Area." (10 CFR 20.202(b) (3)) In addition, positive controls over entry are required, as defined in 10 CFR 20.203(c).

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4. Container Labeling. Each container of radioactive materials shall bear a durable, clearly visible label identifying the contents. The label shall bear, where appropriate, the radiation caution symbol, the words "Caution - Radioactive Materials," the radionuclide(s), the quantity, and the date of measurement.

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5. Personnel Monitoring. A film badge or thermoluminescent dosimeter will be worn by personnel entering or working in a radiation area except those individuals being exposed for medical or dental diagnostic purposes. Dosimeters are not required for those individuals working with weak beta and alpha emitters only. Film dosimeters will be processed at monthly intervals or more often if necessary, and permanent records of radiation exposure will be maintained on DD Form 1141, Record of Occupational Exposure to Ionizing Radiation. In addition to the film badge, a self-reading pocket dosimeter may be worn by personnel entering radiation areas, if appropriate. These dosimeters will be read and recharged before and after each use. Each reading will be recorded in a permanent log book, available for inspection. The Radiological Safety Officer will be notified immediately when any reading in excess of 100 mrem is observed. Thermoluminescent dosimeters will be processed at seven-week intervals, or more often if necessary, and permanent records of radiation exposure will be maintained on DD Form 1141.

6. Environmental Monitoring

- R) a. Areas. The areas around radiation sources and radioactive materials shall be surveyed by the Radiological Safety Officer and the radioactive material user after each experimental arrangement. The RSO shall ensure that additional surveys necessary to ensure a safe working environment are performed. These surveys may include direct radiation measurements; wipe samples of spaces and equipment; air, water, soil, and vegetation monitoring; posted film badges to measure accumulated radiation exposures; measurements of radioactivity in air and water effluents; and personnel and clothing surveys. Surveys made by the RSO shall be documented for inspection.

- A) b. Users. Users of radiation sources and radioactive materials will be responsible for monitoring their own operations as frequently as necessary to keep fully informed on the radiation intensities of contamination in the environment. They will receive instruction from the RSO concerning monitoring procedures and interpretation of radiation measurements. All surveys made by the user shall be documented and made available upon request for inspection.

- A) 7. Radiological Instrumentation. The RSO will provide operable and calibrated survey instruments for users of radioactive materials. Instrument calibration will be on a semiannual frequency. Users are responsible for notifying the RSO that an instrument has malfunctioned or needs calibration.

8. Incoming Shipment Monitoring

- A) a. Incoming Shipments. Incoming shipments of radioactive materials will be inspected and monitored by the Radiological Safety Officer within three hours after receipt. Monitoring will include measurement of surface radiation levels and tests for removable surface contamination. (10 CFR 20.205)

- A) b. Using Personnel. Using personnel shall open incoming packages of radioactive materials within a restricted area and, if available and appropriate, within an operating fume hood which has been designated for the use of radioactive material. The package contents shall be visually inspected for any evidence of leakage or damage. Monitoring instrumentation shall be used to check for radiation levels and radioactive contamination of packing materials, on intermediate containers and on the innermost container. The Safety Office will be notified if any damage, leakage, or contamination is found. A written record shall be maintained of inspection results, including negative findings.

CHAPTER IV
RADIOGRAPHIC SOURCES

1. Medical, Dental, and Veterinary X-Ray Units. All installations must conform to the recommendations of the National Committee on Radiation Protection and Measurements, NCRP Report No. 33, Medical and Gamma Ray Protection for Energies up to 10 MeV; NCRP Report No. 49, Structural Shielding Design and Evaluation for Medical Use of X-rays and Gamma Rays of Energies Up to 10 MeV; and NCRP Report No. 36, Radiation Protection in Veterinary Medicine. Radiographic equipment will be installed and operated in such a manner that the exposure to operating personnel shall be less than 100 mrem per week when use and occupancy factors are considered. Operating personnel will wear film badges. SOP's explaining the operation of the unit, safety procedures, and emergency procedures will be posted near the X-ray unit. (A)
2. Industrial Radiographic Units. All industrial radiographic units currently in use at the Center are of the fixed (shield room) type. These will conform to the recommendations specified in NBS Handbook 114, General Safety Standard for Installations Using Non-Medical X-Ray and Sealed Gamma-Ray Sources, Energies Up to 10 MeV. Operating personnel will wear film badges. All industrial radiographic units should be provided with interlock and warning light systems. SOP's explaining the operation of the unit, safety procedures, and emergency procedures will be posted near the X-ray unit. (D)
3. Analytical X-Ray Units. All analytical X-ray units shall conform to the provisions of NBS Handbook 111. Operating personnel will wear film badges on area of body expected to produce high exposure, i.e., collar (eyes). SOP's explaining the operation of the unit, safety procedures, and emergency procedures will be posted near the X-ray unit. (A)
4. Ion Implanter. The ion implanter will be surveyed periodically and especially after any change in equipment and or function of the implanter. The ion implanter will conform, when appropriate, to the recommendations of NBS Handbook 107. (A)
5. Radiation Surveys. A protection survey will be made by the RSO of existing installations and of new installations before they are put into use. Whenever changes are made in equipment or operating conditions, a report of findings will be made by the supervisor of the installation. Personnel authorized to operate the installation will be aware of operating limitations imposed as a result of protection surveys, with a copy of the limitations posted at the operating console. Operating personnel shall make radiation surveys at their installations on a periodic basis to be aware of any changes that may take place and all surveys made by the user shall be documented and made available for inspection upon request. (R)

CHAPTER V

PROCEDURES FOR USE OF RADIOACTIVE MATERIALS

1. Storage. Applications or proposals for the use of radioactive materials at NOSC must include the provision for approved storage containers and areas. Normally, the applicant will be expected to provide storage facilities. Storage containers must be labeled in accordance with chapter III, paragraph 4, of this manual. In addition, any sealed source that is to be removed from its container for use must be labeled with the radiation symbol and the legend "Caution - Radioactive Material." Small, microcurie-level counting standards are exempted from this provision. Rooms or areas in which radioactive materials are stored must be posted in accordance with chapter III, paragraph 3, of this manual. (R)
2. Shipment. Shipments of radioactive materials from NOSC will be made in accordance with the following applicable regulations:
 - a. Department of Transportation Regulations, Title 49, CFR, parts 171-178, governing highway, water, and rail shipment.
 - b. U.S. Coast Guard Regulations, Title 46, part 146, governing ocean shipment.
 - c. Civil Air Regulations, Title 14, part 49, governing aircraft shipment.
 - d. Packaging of Radioactive Material for Transport and Transportation of Radioactive Material Under Certain Conditions, 10 CFR 71. (A)
3. Receipt. The consignee and the RSO will be notified of receipt of radioactive materials at NOSC. The Supply Department, Code 42, will not release any radioactive material shipments until a radiation survey is performed by the RSO. The Supply Department also has additional responsibilities under chapter I, paragraph 2e, of this publication. (R)
4. Handling. Users of radioactive materials will make every effort to minimize radiation exposures, using remote handling devices, shielding protection, and limiting exposure times. Whenever possible, all radioactive materials shall be used within an operating fume hood. Users should wear gloves whenever handling radioactive materials and have an operating radiation survey instrument nearby. (A)
5. Source Leak Tests
 - a. Sealed Sources. All sealed sources containing more than 100 microcuries of a beta or gamma emitter will be leak-tested at intervals not to exceed six months, except that a three-month interval will be used for unsealed sources of alpha emitters in excess of 10 microcuries unless specified differently in an NRC License. All leak testing will be performed by the Radiological Safety Officer. The leak test shall be capable of detecting the presence of 0.005 microcurie of radioactive material on the test sample. The test sample (A)

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shall be taken from the sealed source or from the surfaces of the device in which the sealed source is permanently mounted or stored on which one might expect contamination to accumulate. Records of leak test results shall be kept in units of microcuries and maintained for inspection.

R) b. Positive Indication. Any positive indication of removable contamination will be cause for further investigation to determine the cause, whether real leakage, surface contamination remaining from source manufacture, or cross-contamination from other sources. If the test records more than 0.005 microcuries of removable contamination, the source will be withdrawn from service and the required repair and disposition will be accomplished. A report shall be filed within five days of the positive leak test with the U.S. Nuclear Regulatory Commission, Region V, Office of Inspection and Enforcement.

6. Special Procedures for Unsealed Sources. The instructions listed in this section are unique to the handling of unsealed sources. They are not all-inclusive in themselves, and the basic regulations in other sections of this manual apply when appropriate. Hazards such as skin penetration, ingestion, inhalation, and area contamination must be considered along with the usual radiation hazards associated with sealed sources.

A) a. Protective Clothing. During the use of unsealed radioactive materials, suitable protective clothing shall be worn at all times in order to minimize the spread of contamination. This clothing includes laboratory coats, rubber or polyethylene gloves, and other items as specified by the Radiological Safety Officer. Protective clothing is available from the Safety Office, Code 037. Items of protective clothing shall not be worn outside of the radiation area in which they are used. In putting on and removing protective clothing, "surgical" techniques shall be utilized, i.e., the possible contaminated areas of these items shall not come in contact with an individual's skin and street clothes. In all instances, utmost attention shall be given to prevent the transfer of radioactivity to the wearer's person or street clothing. Users will provide approved storage space for protective clothing.

b. Personal Hygiene. Smoking, eating, drinking, and the application of cosmetics is prohibited in any area in which unsealed radioactive materials are either stored or being used. No unsealed radioactive materials shall be handled by direct contact with the person nor shall solutions of radioactive materials be pipetted by mouth. Care shall be taken to prevent skin punctures or cuts, and when such are made they shall be brought to the attention of the medical authorities and the Radiological Safety Officer. Persons with open skin wounds or sores on exposed areas of the body, whether or not protected by a bandage, are prohibited from working with unsealed sources of radioactive materials or in contaminated areas. Labels requiring wetting in order to be affixed shall be avoided. Disposable paper towels and paper handkerchiefs shall be used by all personnel, rather than their own personal items, when they are working in and around unsealed radioactive materials. When leaving such areas, all personnel must thoroughly wash exposed areas of the body or, when required by safety regulations, take showers. Following such washing, the person and clothing will be monitored for radioactivity.

c. Safe Handling. Equipment, glassware, tools, and cleaning devices for use in an area where unsealed radioactive materials are stored or manipulated must not be used outside that area unless found to be free of removable radioactivity. Items should not needlessly be brought into such areas. Personnel shall handle and manipulate unsealed radioactive materials in such a way that their exposure to the radiation is minimized. Whenever possible, materials shall be handled by suitable remote methods, such as either tweezers or tongs, in order to take advantage of the decrease in exposure with distance from the person.

7. Waste Disposal

a. Radioactive Materials. Radioactive materials which are no longer usable will be disposed of in accordance with NAVSUPINST 5101.9B. Prior to disposal and while stored in a working area, such materials will be kept in covered, marked, waterproof containers. Liquid waste will be stored in unbreakable containers within a marked waterproof secondary container. Markings will be in accordance with 10 CFR 20.203 and, where appropriate, will include the type and amounts of material and the highest radiation level at the surface in mrem/hr. Access to stored material will be controlled so that radiation levels at the perimeter of the storage area are less than 2 mrem/hour and/or 100 mrem/week. (R)

b. Radioactive Waste. Users in areas or units where radioactive waste is generated shall call the RSO, who will arrange for delivery to a central storage room. The waste material will be accompanied by a memorandum indicating description, quantity, and type/volume of radioactivity.

c. Liquids. Liquids may be released to a water environment provided they are water soluble or dispersible and are first diluted in a controlled environment until the activity per cubic centimeter does not exceed the limits specified in 10 CFR 20.106 and 10 CFR 20.303. Under these conditions, liquid may be disposed of in the sanitary sewage system, provided that the p^H has been adjusted to a point that it is considered to be noncorrosive to plumbing and the requirements of 10 CFR 20.303 are met. Liquid waste shall not be released to septic tank or leach line sewage disposal systems. In all cases, prior disposal arrangements will be cleared with the RSO. (A)

d. Gaseous Material. Gaseous material shall be mixed in a controlled environment until the activity per cubic centimeter of air does not exceed the limits specified in 10 CFR 20.106. In all cases, prior disposal arrangements will be cleared with the RSO. (A)

CHAPTER VI
MEDICAL EXAMINATIONS

1. Routine Examinations

a. Preplacement Examinations (PE). All personnel who are being considered for routine or occasional assignment to duties or occupations requiring exposure to ionizing radiation or the handling of radioactive materials shall be given a medical examination prior to assignment or transfer to those duties or occupations. This examination shall be performed to ensure that a prospective occupational worker is physically qualified for occupational exposure to ionizing radiation. Personnel who are not routinely exposed to ionizing radiation during their normal occupation and who are not likely to exceed 0.5 rem per year or 0.125 rem per quarter (i.e., visitors, including messengers, maintenance or delivery personnel, and certain crew members or employees whose exposure is truly sporadic) are not required to have preplacement medical examinations. (R)

b. Reexaminations (RE). Personnel who are exposed to ionizing radiation in the course of usual duty or employment shall be reexamined every three years. This examination is required to ensure that individuals receiving occupational exposures above the limits permitted the general population continue to meet physical standards. Individuals who receive less than 0.5 rem each year are exempt from reexamination.

c. Situational Examinations (SE). A special medical examination shall be given to any individual who has exceeded the radiation protection standards for occupational exposure, or has possibly ingested or inhaled a significant amount of radioactive material, or as deemed necessary by the Radiological Safety Officer. Guidelines for accomplishing a situational radiation physical examination as well as providing recommendations for necessary medical follow-up will be provided by the Chief, Bureau of Medicine and Surgery, on an individual basis. (R)

d. Termination Examinations (TE). All persons who have received greater than 0.5 rem in any one calendar year shall be given a radiation physical examination at the termination of their employment. This examination is required in order to verify the physical status of an occupational worker at the end of employment. Upon transfer from duties as a radiation worker, the following entry shall be made on Standard Form 88: "Termination radiation physical examination required prior to release or retirement."

2. Film Dosimeter Reports. One copy of all film dosimetry reports will be forwarded to the Radiological Safety Officer for information and retention.

CHAPTER VII
ACCIDENTS AND EMERGENCIES

1. Notification

a. Radiation or Contamination:

Safety Office: Ext. 6857/6458/6459

b. Fire: Ext. 6333

c. Injuries: Ext. 6601

Command Duty Officer: Ext. 7347

2. Fire in Areas Containing Radioactivity. Evacuate area immediately. Notify fire department, specifically stating that the fire involves radioactive material. Initial reentry into the area shall be made only by fire fighting or Safety Office personnel.

3. Area Contamination. Evacuate the contaminated area and minimize the movement of personnel into other clean areas so as to control the spread of contamination, and notify the Radiological Safety Officer. Reentry into the accident area and subsequent decontamination measures will be contingent upon recommendations of the Radiological Safety Officer.

(A)

15 August 1980

CHAPTER VIII

RECORDS AND REPORTS

1. Administrative Records. The following records shall be maintained by the Radiological Safety Officer in a permanent record available on request:

(D)

- a. Results of area surveys taken pursuant to the use and storage of radioactive materials.
- b. Leak tests of radiation surveys.
- c. Inventory and location of sealed sources and counting standards.
- d. NRC licenses.

2. User Records. Users shall maintain permanent records, available for inspection, of the inventory of radioactive materials for which they are responsible, of each reading taken from personal pocket dosimeters that they have used, and of all radiation surveys performed by the user.

(A)

3. Required Reports

- a. An unusually high reading on a pocket dosimeter (more than 100 mrem in any week).
- b. The misplacement or loss of any radioactive material.
- c. The spill or inadvertent release of any radioactive material to the environment.
- d. The inability to decontaminate any item.
- e. Any skin or clothing contamination.
- f. Any other incident which may have effect on health or safety of individuals.

APPENDIX A

RADIONUCLIDE USE APPLICATION/APPROVAL

From:

To: Chairman, Ionizing Radiation Control Committee (Code 013)

1. It is requested that the following information be reviewed and that approval be granted for the use of the following radionuclide:

Radionuclide	Chemical Form	Quantity
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Dates of Use	Location of Use
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Authorized Users and Custodian (names and codes - attach experience resumes)

Program Description (short title)

Statement of procedures for storage, use, transportation, and disposal

Description of safety devices, instruments, shielding, and contamination control measures and a copy of the program standard operating procedures (SOP)

Submitted by _____
Signature

Date

1. Based on a review, the Safety Office recommends that the request be:

_____ Approved.

_____ Approved, subject to the conditions listed below.

_____ Disapproved, for the reasons listed below.

Signature

Date

2. Based on a review, the IRCC recommends that the request be:

_____ Approved.

_____ Approved, subject to the conditions specified above and with the additional conditions, if any, listed below.

_____ Disapproved, for the reasons stated above and/or below.

IRCC Member/Date

IRCC Member/Date

IRCC Member/Date

IRCC Member/Date

IRCC Member/Date

IRCC Member/Date

Signature, Chairman, IRCC

Date