

DEPARTMENT OF THE NAVY  
NAVAL FACILITIES ENGINEERING COMMAND  
WASHINGTON, D.C. 20340  
ATTENTION: RFA-2212

NNPJ:PER:dm  
3256 B2  
Ser 16  
20 Dec 77

U.S. Nuclear Regulatory Commission  
Division of Fuel Cycle and Material Safety  
Attn: Radioisotope Licensing Branch  
Washington, DC 20555

Gentlemen:

Amendment of U.S. Nuclear Regulatory Commission  
Materials License Number 45-16359-03

The Naval Facilities Engineering Command has arranged for the acquisition of four thermoelectric generators (one LCG-25B and three MW-3000), from Cameron Iron Works, Inc. of Houston, Texas.

Item 6A of License Number 45-16359-03 presently includes a LCG-25A thermoelectric generator. The internal structure of the LCG-25B generator is identical to that of the LCG-25A. The external structure of the LCG-25B is identical to that of the LCG-25A with the following minor exceptions:

- (a) Cooling fins of the LCG-25B are made of cast iron, whereas those of the LCG-25A are made of aluminum; fin designs give equivalent heat dissipation for the two generators.
- (b) Labeling on the external surface of the two generators is different to reflect different model designations.

Item 6C of License Number 45-16359-03 presently includes one MW-3000 generator.

It is requested that License Number 45-16359-03 be amended as follows for strontium 90:

- (a) Add: Strontium titanate contained in LCG-25B thermoelectric generator, 125,000 curies in one generator.

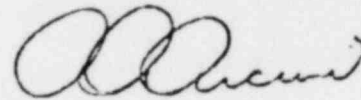
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- (b) Change: Strontium titanate contained in MW-3000 thermoelectric generator, 25,000 curies in each generator to read: Strontium titanate contained in MW-3000 thermoelectric generators, 100,000 curies total, not exceeding 25,000 curies in each generator.



A. A. ARCUNI  
CDR, CEC, USN  
Special Assistant for Nuclear Programs

Copy to:  
NNPU (2) (Code 70, Code 43)

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DEPARTMENT OF THE NAVY  
NAVAL FACILITIES ENGINEERING COMMAND  
200 STOVALL STREET  
ALEXANDRIA, VA 22332

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Ser 135

90 MAY 1975

U. S. Nuclear Regulatory Commission  
Office of Materials and Fuel Cycle Facility Licensing  
Materials Branch  
Washington, D. C. 20555

Gentlemen:

We request that attached application for renewal of Byproduct Material License No. 45-15632-03 be considered timely filed. The application does not include four previously licensed radioisotope power generators (LCG-25B, Millitracs-100A, Ripple III, and SNAP 7D) because these generators were transferred to authorized licensees and are no longer possessed by the Navy.

Sincerely,

*G. W. Zimmer*  
G. W. ZIMMER  
By Direction

Copy to:

NAVNUWRU, Ft. Belvoir (Code 70 and Code 40)

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## APPLICATION FOR BYPRODUCT MATERIAL LICENSE

**INSTRUCTIONS** - Complete items 1 through 16 if this is an initial application or an application for renewal of a license. Information contained in previous applications filed with the Commission with respect to items 6 through 15 may be incorporated by reference provided references are clear and specific. Use supplemental sheets where necessary. Item 16 must be completed on all applications. Mail two copies to: U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention: Materials Branch, Directorate of Licensing. Upon approval of this application, the applicant will receive an AEC Byproduct Material License. An AEC Byproduct Material License is issued in accordance with the general requirements contained in Title 10, Code of Federal Regulations, Part 30, and the licensee is subject to Title 10, Code of Federal Regulations, Part 20, and the license fee provisions of Title 10, Code of Federal Regulations, Part 170. The license fee category should be stated in item 16 and the appropriate fee enclosed. (See Note in Instruction Sheet).

|                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. (a) NAME AND STREET ADDRESS OF APPLICANT. (Institution, firm, hospital, person, etc. Include ZIP Code and telephone number.)</p> <p>Naval Facilities Engineering Command<br/>200 Stovall Street - Hoffman Building II<br/>Alexandria, VA 22332</p>                                                                                                               | <p>(b) STREET ADDRESS(ES) AT WHICH BYPRODUCT MATERIAL WILL BE USED. (If different from 1(a), include ZIP Code.)</p> <p>The United States of America, its Territories and Possessions, International Waters, and Antarctica, and any location under the jurisdiction of the Nuclear Regulatory Commission</p>                                                                                                                               |
| <p>2. DEPARTMENT FOR USE BYPRODUCT MATERIAL</p> <p>U. S. Navy</p>                                                                                                                                                                                                                                                                                                      | <p>3. PREVIOUS LICENSE NUMBER(S). (If this is an application for renewal of a license, please indicate and give number.)</p> <p>8-11817-13<br/>15-16359-03 (renewal)</p>                                                                                                                                                                                                                                                                   |
| <p>4. INDIVIDUAL USER(S). (Name and title of individual(s) who will use or directly supervise use of byproduct material. Give training and experience in items 8 and 9.)</p> <p>Authorized Users as defined in Encl. (3)</p>                                                                                                                                           | <p>5. RADIATION PROTECTION OFFICER. (Name of person designated as radiation protection officer if other than individual user. Attach resume of his training and experience as in items 8 and 9.)</p> <p>William J. Morris<br/>Qualifications - Encl. (4)</p>                                                                                                                                                                               |
| <p>6. BYPRODUCT MATERIAL. (Elements and approximate amount of each.)</p> <p>See supplementary sheets: Enclosure (2)</p>                                                                                                                                                                                                                                                | <p>(b) CHEMICAL AND/OR PHYSICAL FORM AND MAXIMUM NUMBER OF MULTICOPIES OF EACH CHEMICAL AND/OR PHYSICAL FORM THAT YOU WILL POSSESS AT ANY ONE TIME. (If sealed source(s), also state name of manufacturer, model number, number of sources and maximum activity per source.)</p> <p>Details of encapsulation, construction, and performance have been previously supplied to the NRC. Specific references are listed in enclosure (3).</p> |
| <p>7. SOURCE PURPOSE FOR WHICH BYPRODUCT MATERIAL WILL BE USED. (If byproduct material is for "human use," supplement A (Form AEC-313a) must be completed in lieu of this item. If byproduct material is in the form of a sealed source, include the make and model number of the storage container and/or device in which the source will be stored and/or used.)</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                            |

To receive, store, install, operate, service, and deliver to a carrier for transport radioisotope power generators identified in 6a and 6b above for the purpose of RDT&E or operation of apparatus, equipment, and systems.

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## TRAINING AND EXPERIENCE

## OF EACH INDIVIDUAL NAMED IN ITEM 4

(Use supplemental sheets if necessary)

| TYPE OF TRAINING                                                                       | WHERE TRAINED     | DURATION OF TRAINING | ON THE JOB<br>(Circle answer) | FORMAL COURSE<br>(Circle answer) |
|----------------------------------------------------------------------------------------|-------------------|----------------------|-------------------------------|----------------------------------|
| a. Principles and practices of radiation protection                                    | See Enclosure (1) |                      | Yes No                        | Yes No                           |
| b. Radioactivity measurement standardization and monitoring techniques and instruments |                   |                      | Yes No                        | Yes No                           |
| c. Mathematics and calculations basic to the use and measurement of radioactivity      |                   |                      | Yes No                        | Yes No                           |
| d. Biological effects of radiation                                                     |                   |                      | Yes No                        | Yes No                           |

## EXPERIENCE WITH RADIATION (Actual use of radiosopes or equivalent experience)

| TYPE | APPROXIMATE ADJUT | WHERE EXPERIENCE WAS GAINED | DURATION OF EXPERIENCE | TYPE OF USE |
|------|-------------------|-----------------------------|------------------------|-------------|
|      |                   | See Enclosure (1)           |                        |             |

## RADIATION DETECTION INSTRUMENTS (Use supplemental sheets if necessary)

| TYPE OF INSTRUMENTS<br>(List make and model number of each)                                                                                                                                                                                                     | NUMBER AVAILABLE | RADIATION DETECTED | SENSITIVITY RANGE<br>(mR/hr) | WINDOW THICKNESS<br>(mg/cm <sup>2</sup> ) | USE<br>(Monitoring, surveying, measuring) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------|------------------------------|-------------------------------------------|-------------------------------------------|
| Navy instruments for monitoring $\alpha$ , $\beta$ , $\gamma$ , N, are available through and will be maintained and calibrated by the Naval Electronics Systems Command. Commercial instruments will be maintained and calibrated by Naval Research Laboratory. |                  |                    |                              |                                           |                                           |

## METHOD, FREQUENCY, AND STANDARDS USED IN CALIBRATING INSTRUMENTS LISTED ABOVE

Performed by Naval Electronics Systems Command Reference NRC License No. S-00036-12

## FILM EXPOSURE, DEVELOPMENT, AND DOSE ASSAY PROCEDURES USED (For film badge, specify method of developing and processing, or name of supplier)

Use of film badges and dosimeters are bioassay procedures will be performed in accordance with NAVMFD P-5655 Radiation Health Protection Manual.

## INFORMATION TO BE SUBMITTED ON ADDITIONAL SHEETS IN DUPLICATE

|                                                                                                                                                                                                                                                                                                                                                                                             |  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 1. FACILITIES AND EQUIPMENT: Describe laboratory facilities and remote handling equipment, storage containers, shielding, fume hoods, etc. Explanatory sketch of facility is attached. (Circle a yes) Yes No                                                                                                                                                                                |  |
| 2. RADIATION PROTECTION PROGRAM: Describe the radiation protection program including control measures. If application covers sealed sources, submit leak testing procedures where applicable, name, training, and experience of person to perform leak tests, and arrangements for performing initial radiation survey, servicing, maintenance, and repair of the source. See Enclosure (1) |  |
| 3. WASTE DISPOSAL: If a commercial waste disposal service is employed, specify name of company. Otherwise, submit detailed description of methods which will be used for disposing of radioactive wastes and estimates of the type and amount of activity involved. Disposal to an NRC or agreement state licensed contractor                                                               |  |

## CERTIFICATE (This item must be completed by applicant)

THE APPLICANT AND ANY OFFICIAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE APPLICANT NAMED IN ITEM 1, CERTIFY THAT THIS APPLICATION IS PREPARED IN CONFORMITY WITH TITLE 10, CODE OF FEDERAL REGULATIONS, PART 30, AND THAT ALL INFORMATION CONTAINED HEREIN, INCLUDING ANY SUPPLEMENTS ATTACHED HERETO, IS TRUE AND CORRECT TO THE BEST OF OUR KNOWLEDGE AND BELIEF.

Naval Facilities Engineering Command  
200 Stovall Street  
Alexandria, Va. 22332

By: \_\_\_\_\_

By: \_\_\_\_\_

Announced in item 1

By: G. E. KRAUTER  
CDR, CEC, USN  
Director Nuclear Power Division

Title of certifying official

WARNING: U.S.C., Section 1001; Act of June 25, 1948, 62 Stat. 749, makes it a criminal offense to make a willfully false statement or representation to any department or agency of the United States as to any matter within its jurisdiction.



# RADIOLOGICAL SAFETY GUIDE

DEPARTMENT OF THE NAVY  
NAVAL FACILITIES ENGINEERING COMMAND  
ALEXANDRIA, VA 22332

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## Introduction

This document when approved by the U. S. Nuclear Regulatory Commission describes the Naval Facilities Engineering Command's broad license to receive, store, install, operate, service, and transport radioisotope power generators, which have been approved for transportation and delivery to a carrier pursuant to CFR Title 10, Part 71. The Naval Facilities Engineering Command has been assigned the responsibility by the Chief of Naval Operations for the development and use of radioisotope power generators for the entire Navy, therefore this license applies to all Navy uses. It is anticipated that additional radioisotope power generators will be added to the broad license by amendment. Radioisotope power generators will be removed from the broad license by transferring them to other authorized licensees. All shipments will be made in conformance with applicable DOT and NRC regulations. The Naval Facilities Engineering Command will have a Radiological Safety Committee which will review applications for use of the radioisotope power generators. The Radiological Safety Committee shall be responsible for the radiological safety review of all radioisotope power generators for the U. S. Navy with the exception of Naval Nuclear Propulsion Plants in ships or at the ship prototype sites.

## I. Responsibilities

### A. Responsibility of the NAVFAC Special Assistant for Nuclear Programs

1. Responsibility as assigned by OPNAVINST 11310.2 dated 30 August 1966, Appendix (1), quoted in part as follows:

"Commander, Naval Facilities Engineering Command. Provide program and technical coordination for the development and use of radioisotope power devices. In the development of these devices utilize Navy capability to maximum extent; cooperate with all DOD activities; and take advantage of developments achieved by the Atomic Energy Commission, its contractors and its commercial licensees. Coordinate personnel requirements with the Chief of Naval personnel; and, in training personnel for the operation and maintenance of such devices, cooperate with the Army and Air Force in utilizing established training facilities. Issue and promulgate instructions as required in carrying out assigned responsibilities and delegate authority assigned as necessary for efficient and safe operation. When NRC licenses are required, coordinate the acquisition for the Naval Material Command (NMC)."

2. Assuring at least annually that facilities utilizing radioisotope power generators are conforming to procedures and regulations applicable to RPGs.

3. Securing the concurrence of the State Department for each use in international waters and/or territories.

### B. Radiological Safety Committee Membership

1. The Special Assistant for Nuclear Programs appoints the Radiological Safety Committee members, alternate members, and designates the Chairman.

2. Persons appointed to the NAVFAC Radiological Safety Committee must be senior engineers or scientists who have been actively engaged in or associated with nuclear operations and the radiological safety aspects of nuclear operations for a minimum of three years. Committee members must have experience in the control of radioisotopes, utilization of radioactive material, and shielding. Committee members must also have a thorough knowledge of radiation control procedures, measuring techniques and procedures resulting from formalized training and/or experience.

The Committee must be selected so that diversified professional skill will be available to review any proposed use of Radioisotope Power Generators. This review shall cover radiological safety and the nuclear, electronic-electrical, chemical, metallurgical, and mechanical engineering principles involved in the use of the generator. Any possible physical or chemical reactions between materials used in the RPG or in its use will also be reviewed.

The Committee will be qualified to evaluate the placement, utilization, control, and recovery of radioisotope power generators.

The NAVFAC Radiological Safety Officer will be a member of the NAVFAC Radiological Safety Committee and shall, in addition, act as liaison between the Committee and the NAVFAC Special Assistant for Nuclear Programs and the field activities for licensing and safety reviews.

3. Alternate members will be appointed for each committee position and shall be equally competent in their field. The alternate committee members will sit as full members of the Radiological Safety Committee in the absence of the regular member for whom they are the alternate.

4. The Radiological Safety Committee will consist of at least four members whose qualifications and experience are applicable to the proposed application. NAVFAC management shall be represented at all Committee meetings.

5. Members or alternate members of the Radiological Safety Committee may not sit as committee members when they have personally prepared any portion of the work which is to be reviewed.

#### C. Radiological Safety Committee Authority and Responsibilities

1. The Radiological Safety Committee acts as an advisory committee to the Special Assistant for Nuclear Programs. Their final recommendations with respect to the safety of the device and its use will be made to the Special Assistant for Nuclear Programs.

2. The review of proposed Radioisotope Power Generators (RPG) applications shall include but not necessarily be limited to the:

a. Safety analysis of the Radioisotope Power Generator, including consideration of possible accidents.

b. The effect of the location and surroundings on the Radioisotope Power Generator and the effect of the RPG on the location and surroundings. For example, such things as the effect of the climate and environmental conditions on the RPG regarding corrosion, pressure, strains, etc., and the effect of the RPG on the location and the environment of the surroundings.

c. Safeguards employed to limit exposure of handling personnel and the public during transportation, use and servicing.

d. The control exercised by the user to insure that the generator when located in isolated places has not been moved, or tampered with, and the control exercised by the user if the RPG fails. This would include any methods of signaling and the monitoring of the signal at acceptable periods of time.

e. Procedures used in the placement and retrieval of RPGs at the location in which they are to be used.

f. Procedures to be utilized in handling the RPG when in use.

g. Compliance with applicable NRC and other federal regulations.

3. The Radiological Safety Committee is responsible for assessing the qualifications of individuals desiring to use and/or service RPGs to assure that the users and personnel servicing the RPG have sufficient education, training and/or experience to assure the safety of operations.

4. The Radiological Safety Committee can request the assistance of specialists in appropriate fields on a consulting basis prior to recommending the approval or disapproval of the use of any RPG.

5. The Radiological Safety Committee will prepare records of all actions taken by the Radiological Safety Committee regarding the use of any RPG. These records including the safety analysis, personnel qualifications and all pertinent data associated with the committee's actions will be maintained by the NAVFAC Radiological Safety Officer and open for inspection by the NRC.

D. Radiological Safety Officer - The Radiological Safety Officer is appointed by the Special Assistant for Nuclear Programs. The Radiological Safety Officer is responsible for:

1. Devising and implementing an adequate radiation safety program for all radioisotope power generators as well as all sources of ionizing radiation used by the Naval Facilities Engineering Command and its field activities.

2. Establishing the basic guides for radiation protection and control of radiation hazards.

3. Acting as the liaison between the NAVFAC Radiological Safety Committee, the Special Assistant for Nuclear Programs, and the field activities for licensing and safety reviews.

4. Maintaining NRC licenses. Preparing license application, amendments, renewals and reports as required by the NRC or other authority.

5. The following action in case of a loss or theft of radioactive material

- a. Initiate an investigation to locate the material

- b. Fulfill the reporting requirements to the NRC

- c. Advise when the search for material may be concluded

E. Naval Nuclear Power Unit. NAVFAC Instruction 5450.62D, Appendix (3) assigns tasks and functions in support of Naval nuclear shore system including radioisotope power generators (RPGs). Under the tasking of this instruction, the Naval Nuclear Power Unit is responsible for:

1. Providing health physics services to RPG users

2. Controlling the shipment, transfer, and inventory of radioactive material

3. Maintaining a status of all Navy RPGs including current location and condition.



F. Installation Commanders. Installation Commanders are responsible for assuring the radiological safety of personnel working under their jurisdiction. Their responsibilities include:

1. Obtaining NAVFAC approval prior to unreviewed or modified use in order to prevent undue exposure of personnel or to prevent loss of control over the Radioisotope Power Generator (RPG).

2. Assuring that Radioisotope Power Generators are used only by individuals who are knowledgeable and observant of radiation safety regulations, and who have been approved by the Special Assistant for Nuclear Programs as indicated in the request for safety review.

3. Assuring the use of proper articles of protective clothing, remote handling equipment, shielding materials, waste containers, survey instruments, and personnel monitoring devices for work involving Radioisotope Power Generators.

4. Notifying NAVFAC Special Assistant for Nuclear Programs promptly of any accidents damaging a RPG or any unexplained circumstances involving an RPG.

5. Acquiring appropriate approvals before receiving, possessing, using or transferring radioactive materials

6. Controlling access to radiation control areas, in accordance with Title 10 CFR Part 20.

G. Employees. The individual employee is responsible for:

1. Knowing and observing procedures and radiological safety regulations.

2. Reporting to his supervisor and/or the installation commander or his designated accidents and incidents involving radioactive material.

3. Performing all work with Radioisotope Power Generators in such a manner as to minimize the exposure to himself and his coworkers, consistent with the exposure limits given in Section VI.



## II. Administrative Control Procedures

General - Administrative control implies a system of checks and balances to furnish assurance that work with radioisotope power generators is initiated and performed with due consideration for radiological safety. Written approval must be obtained from NAVFAC for procurement, use, and changes in previously approved operations or procedures involving radioisotope power generators. This approval is obtained by submitting a Request for Safety Review (RSR), Appendix 2, with the appropriate information.

The radiological safety committee evaluates the RSR and makes recommendations on it to the Special Assistant for Nuclear Programs. The Special Assistant for Nuclear Programs approves the RSR with his signature.

### A. Procurement and Support of Radioisotope Power Generators (RPGs)

1. All installations must submit an RSR to NAVFAC prior to procurement or use of an RPG. The RSR will be processed by NAVFAC and the initiator advised of the action taken.

2. Installations having a qualified staff for handling, service, use, and radiological safety may perform their own health physics and service work.

3. Installations desiring to utilize RPGs that do not have qualified personnel for handling, service, use, and radiological safety should request such services from NAVFAC.

### B. Users and Custodians

1. An authorized user is a person who has been approved by NAVFAC to use, or directly supervise the use of, a Radioisotope Power Generator for a specific function(s). In requesting that a person be approved as an authorized user, the Installation Commander provides NAVFAC information on the individual's technical background and experience in Radiological Safety matters. The proposed user must be fully cognizant of and must comply with all applicable procedures and regulations.

2. The custodian is an authorized user (as defined above) who has been designated by his Installation Commander to assume the additional responsibility of accountability for a specific Radioisotope Power Generator(s). The custodian has the responsibility and authority to assure that a Radioisotope Power Generator under his custodianship is used only by its authorized user(s). At the request of the NAVFAC Radiological Safety Officer, the custodian, or an alternate custodian, must participate in inventory actions.

3. An authorized user may be specifically designated by an Installation Commander as alternate custodian to have the full responsibility and authority of the custodian when the custodian is not available.

#### C. Changes of Custodian, Users, Use, or Location

Approval from NAVFAC must be obtained prior to change of Custodian, Users, Use, or Location of a Radioisotope Power Generator.

1. Change of Custodian. In cases involving transfer of custodianship (either on a temporary or permanent basis), the proposed new custodian shall initiate an RSR which is to be signed by his Installation Commander and by the current custodian, and forwarded for approval by NAVFAC. After such approval is obtained, the newly authorized custodian shall sign a NAVFAC Health Physics inventory receipt for the device involved. At the time such transfer is effective, the new custodian will furnish such receipt as is requested by the previous custodian.

a. Should a custodian's employment terminate an alternate custodian or the Installation Commander is responsible for the Radioisotope Power Generators.

2. Change of User. The custodian of the source involved shall initiate an RSR which is to be signed by his Installation Commander, and forwarded to NAVFAC for approval.

3. Change of Use or Location. Prior to a change from an approved use or location, the custodian of a source shall submit an RSR to NAVFAC for approval.

4. Transfer of Source from One Authorized Location to Another. The actual transfer of a source from one authorized location to another must be monitored by qualified personnel.

5. Removal of Radioactive Material to Other than Naval Activities.

Shipments to other activities requires a formal application in advance to NAVFAC on an RSR accompanied by a verification that the receiver is eligible under NRC license, contract agreement, or agreement state license to receive the shipment. This shipment must be packaged to conform to DOT or other applicable shipping regulations.

6. Shipment to other Activities for Use by Naval Personnel. Should it become necessary to utilize a Radioisotope Power Generator at some other installation than was authorized on an approved RSR, the following conditions must be met:

a. An RSR must be submitted to NAVFAC for approval.

b. A written statement must be obtained from the appropriate official of the proposed temporary site-of-use affirming that naval personnel shall be permitted to use the subject Radioisotope Power Generator at said location.

12. Modifications of Radioisotope Power Generator (RPGs)

All modifications of RPGs shall receive approval by the NAVFAC prior to actual modification. Anticipated modifications shall not include the handling of the source capsules but may include the changing of ancillary equipments, such as thermoelectrics or power conditioning equipment.

### III. Incoming Shipments

#### A. Receiving Procedures

1. Installations receiving Radioisotope Power Generators (RPGs) are responsible for assuring that qualified personnel monitor the carrier's vehicle and the RPG prior to removing the RPG from the vehicle. The carrier vehicle shall be monitored again following the removal of the RPG, and prior to the vehicle's release from the area, the contamination free state of the vehicle will be certified by qualified personnel.

2. Any vehicle found to be contaminated with radioactive material shall be detained until decontamination can be accomplished and decontamination certified.

B. Storage. If the Radioisotope Power Generator is not to be used immediately, it must be stored in a place and manner approved by NAVFAC. The Installation Commander shall be responsible for assuring that the required radiation signs and/or labels are utilized and that qualified personnel monitor the storage area and its environs as necessary. All stored radioactive materials must be secured against unauthorized removal from the place of storage.

C. Initial Use. Use of the Radioisotope Power Generator shall be confined to the purpose(s) and location(s) stated in the RSR and subject to the conditions imposed therein by NAVFAC.

#### IV. Inventory and Leak-Testing of Radioisotope Power Generators

A. Procedures and Records. The custodian or his designated alternate shall participate with qualified personnel in carrying out inventories, in sighting sources for leak-test, and in maintaining such records as are required.

B. Discrepancy or Source Leakage. An inventory discrepancy or the detection of a source leakage in excess of 0.005 microcuries shall be reported to the NAVFAC by telephone and priority message as soon as the discrepancy or leakage is known or suspected.

C. Loss or Theft of a Radioisotope Power Generator (RPG). The custodian of an RPG shall inform the NAVFAC of loss or theft immediately after such an occurrence is suspected or known. In the case of a loss or theft, the NAVFAC Radiological Safety Officer shall immediately:

1. Initiate an investigation to locate the device;
2. Fulfill the reporting requirements to the NRC, as stated in Title 10 CFR Part 20.

Under the direction of the NAVFAC Radiological Safety Officer, the custodian of the RPG, or other qualified personnel from the installation or from the Naval Nuclear Power Unit as requested, shall continue the search for the missing RPG. The NAVFAC Radiological Safety Officer shall advise the NAVFAC Special Assistant for Nuclear Programs when the search may be concluded.



## V. Radiation Exposure Control

General. Radiation exposure is effectively controlled by personnel monitoring which measures radiation doses, and by monitoring which determines the location, type, and dose rate of radiation.

### A. Personnel Monitoring

1. Required Use. Personnel monitoring devices, i.e. film badges or thermoluminescent dosimeters (TLD) shall be worn by all "user" personnel in a radiation control area, or the vicinity of a Radioisotope Power Generator, and by other persons as deemed necessary the NAVFAC Radiological Safety Officer.

2. Issue. Film badges/TLD are issued by the cognizant installation. Each radiation worker is assigned a film badge/TLD. Lost badges/TLD shall be reported to the NAVFAC Radiological Safety Officer. Personnel monitoring devices/services are available from the Naval Nuclear Power Unit, Ft. Belvoir.

3. Storage. When not in use, the badge/TLD shall be kept on a board with a control badge/TLD. Each worker assigned a badge/TLD shall pick up his badge/TLD at the beginning of the workday and deposit it when he leaves.

4. Wearing. Film badges/TLD shall be worn on the part of the body expected to receive the greatest exposure to radiation. The film badge is never placed inside a pocket behind other obstructions except when necessary to prevent the badge from being contaminated with radioactive material or drenched with liquids. TLD may be worn in a pocket.

5. Processing. Film badges/TLD will be collected periodically by the individual designated with this responsibility by the Installation Commander. The film badges will be processed according to standard Navy procedures contained in NAVFAC P-5055 Radiation Health Protection Manual, accepted by the NRC on previous license applications. Thermoluminescent dosimeters should be returned to Naval Nuclear Power Unit for processing.

B. Pocket Dosimeters. In addition to film badges, pocket dosimeters may be used for radiation dosimetry. The pocket dosimeters should be stored on the film badge rack at the end of a workday. Pocket dosimeters are to be read and re-charged routinely by the cognizant personnel.



C. Visitor Monitoring. Persons who must enter a radiation control area or who are in the vicinity of a Radioisotope Power Generator and who are not routinely issued a personnel monitoring device, are "visitors" even though they may be employees. When the visitor enters a radiation control area, or the vicinity of a radioisotope power generator, he is issued a film badge or pocket dosimeter and a record maintained. Group tours may utilize a single film badge or pocket dosimeter. As the visitor(s) leave, the monitoring device(s) are turned in at the point of issuance.

1. Off-Site Personnel Monitoring. Arrangements may be made with the Naval Nuclear Power Unit to provide the necessary personnel monitoring services to personnel on official duty in places where Radioisotope Power Generators are located.

D. Medical Examination, Personnel Monitoring and Exposure Records. Medical examination, personnel monitoring, and exposure records will be performed and/or maintained in accordance with the Navy Radiation Health Protection Manual, NAVMED P-5055.

E. Radiological Safety Training. All personnel who use or work with Radioisotope Power Generators will receive a complete orientation and indoctrination in radiological safety. All personnel must be aware of the potential radiological hazards involved in the work, the radiological safeguards, procedures and regulations and their responsibilities with regard to radiological safety.

F. Pre-Planning for Operations. The most important pre-requisite for safely working with Radioisotope Power Generators is a carefully thought out and prepared plan of action. Such planning will reduce exposure of personnel and control the spread of contamination should an accident occur.

1. Formal Written Procedures. Activities which intend to utilize Radioisotope Power Generators must submit an RSR written procedures describing the handling, use, and control of the device. The NAVFAC Radiological Safety Committee reviews such procedures.

## 2. Example of Pre-Planning Check List

- \_\_\_\_\_ Radiological administrative procedures complied with?
- \_\_\_\_\_ Personnel know detailed handling procedures?
- \_\_\_\_\_ Personnel know emergency plans, use of emergency equipment and the potential hazards of the radioisotope power generator.
- \_\_\_\_\_ All persons using radioisotope power generators are approved qualified users?
- \_\_\_\_\_ Practice runs performed for remote handling operations?
- \_\_\_\_\_ Personal tools and excess equipment removed from areas where contamination is possible?
- \_\_\_\_\_ Clean-up equipment and methods considered?
- \_\_\_\_\_ Radiac equipment available?

G. Radiation Control Area Signs. All radiation control areas as defined in the standards section of this manual will be posted with a magenta (purple) and yellow sign bearing the standard radiation symbol as defined in CFR Title 10, Part 20, and appropriate legend to indicate the potential hazards involved. Posting of such areas is the responsibility of the personnel designated by the Installation Commander.

H. Radiation Labels. All Radioisotope Power Generators and/or their containers must be clearly labeled with the appropriate radiation label. The label shows the standard radiation symbol and appropriate legend to identify the source. The label will state the kind of material, the quantity of material and the date of measurement of these quantities.

## VI. Radiation Protection Standards

General. This section establishes the technical standards for radiation protection.

Basis for Standards. Basic regulations for radiation protection are promulgated by the Nuclear Regulatory Commission in Title 10 of the Code of Federal Regulations, by the Navy in NAVMED P-5055 and by various Federal Agencies. The standards presented herein are based upon these regulations.

### Exposure Limits for personnel

1. Limits for Exposure to External Radiation. Individuals shall not receive in any one calendar quarter-year a radiation dose in excess of that specified in the following table:

TABLE I  
REMS PER CALENDAR QUARTER

|                                                                                           |        |
|-------------------------------------------------------------------------------------------|--------|
| a. Whole body; head and trunk; all the blood-forming organs; lens of eyes; or gonads..... | 1-1/4  |
| b. Hands and forearms; feet and ankles.....                                               | 18-3/4 |
| c. Skin of whole body.....                                                                | 7-1/2  |

With specific authorization by the Radiological Safety Officer an individual may be allowed to receive a dose to the whole body greater than that stated in Table I above. Such specific authorization will be based on the requirements of 10 CFR 20.101 which allows an increase in exposure limits based on past exposure record, age or other considerations. Minors may receive no exposure in excess of 10% of the Table I limits.

2. Limits for Airborne Concentrations of Radioactive Materials. Exposure of personnel shall not exceed limits specified in paragraph 20.103, 10 CFR 20.

3. Limits for Skin Contamination. Permissible levels for skin contamination are listed in Table II below. When it is suspected that these levels are exceeded the NAVFAC Radiological Safety Officer must be notified and corrective action taken.

TABLE II

| Location                                                          | PERMISSIBLE CONTAMINATION LEVELS |                                                    |
|-------------------------------------------------------------------|----------------------------------|----------------------------------------------------|
|                                                                   | Alpha                            | Beta-Gamma                                         |
| BODY                                                              | 0.1 dpm/cm <sup>2</sup>          | 1 dpm/cm <sup>2</sup> or<br>0.1 mrem/hr<br>at 1 cm |
| HANDS ONLY<br>(Approx. 200 cm <sup>2</sup> in<br>area - one side) | 0.1 dpm/cm <sup>2</sup>          | 2 dpm/cm <sup>2</sup> or<br>0.2 mrem/hr<br>at 1 cm |
| WOUNDS                                                            | None Permitted                   | None Permitted                                     |

#### Radiation Control Areas.

1. Radioactive Materials Areas. Each area or room in which radioactive materials is used or stored in quantities as specified in Section 20.203 (e) (1) and (2) of 10 CFR 20 is designated a "Radioactive Materials Area."

2. Radiation Area. Each area where radiation levels are such that a major portion of the body could receive a dose in excess of 2 millirem but less than 100 millirem in any one hour, and 100 millirem in any seven consecutive days.

3. High Radiation Area. Each area where radiation levels are such that a major portion of the body could receive a dose in excess of 100 millirem in any one hour.

4. Airborne Radioactivity Area. The concentration of airborne radioactive material in any occupied Radiation Control Area may not exceed the amount specified in Appendix B, Table 1, Column 1 of 10 CFR 20. The concentration of airborne radioactive material in any unoccupied Radiation Control Area is limited only by the external radiation caused by such airborne activity at the outside boundaries of that area.

Surface Contamination Limits. Limits for surface radioactive contamination in Radiation Control Areas are as follows:

TABLE III

| AREA        | PERMISSIBLE CONTAMINATION LIMITS                          |                              |                               |
|-------------|-----------------------------------------------------------|------------------------------|-------------------------------|
|             | FIXED<br>(Portable Survey Instrument)<br>Alpha-Beta-Gamma | REMOVABLE                    |                               |
|             |                                                           | (Wipe Samples)               |                               |
|             |                                                           | Alpha                        | Beta-Gamma                    |
| "Cold" Area | $< .1 \text{ mR/hr at 1 cm}$                              | $< 20 \text{ dpm/100 cm}^2$  | $< 200 \text{ dpm/100 cm}^2$  |
| "Warm" Area | $< 2 \text{ mR/hr at 1 cm}$                               | $< 200 \text{ dpm/100 cm}^2$ | $< 2000 \text{ dpm/100 cm}^2$ |
| "Hot" Area  | $> 2 \text{ mR/hr at 1 cm}$                               | $> 200 \text{ dpm/100 cm}^2$ | $> 2000 \text{ dpm/100 cm}^2$ |

Unrestricted Area Limits. Areas not classified as Radiation Control Areas are considered unrestricted areas.

1. External Radiation Limit. External radiation levels must not exceed 2 mR/hr and 100 millirem in any seven consecutive days.

2. Airborne Contamination Limits. The concentrations of radioactive airborne materials in unrestricted areas may not exceed those specified in Appendix B, Table II, Column 1, of 10 CFR 20.

3. Surface Contamination Limits.

a. Surface contamination in unrestricted areas shall not exceed those listed in Table III, above, for "cold" areas.

b. Vehicles used for the transport of Radioisotope Power Generators should be considered to be free of contamination if the smear test does not exceed the limits of a "Warm" area as listed in Table III above, and providing the radiation dose rate is less than 0.5 millirem per hour at any accessible surface.



DEPARTMENT OF THE NAVY  
OFFICE OF THE CHIEF OF NAVAL OPERATIONS  
WASHINGTON 25, D. C.

IN REPLY REFER TO

OPNAVINST 11310.2  
OP-755  
Ser 154P75  
30 August 1966

OPNAV INSTRUCTION 11310.2

From: Chief of Naval Operations  
To: Distribution List

Subj: Radioisotope Energy Applications

Ref: (a) NAVMED P-5055, Radiation Health Protection  
Manual (NOTAL)  
(b) Title 20, Code of Federal Regulations, Parts  
30, 50 and 70 (NOTAL)  
(c) OPNAVINST 11310.1

1. Purpose and Scope. This Instruction establishes policies and assigns responsibilities for the coordination of design, execution, technical training and safety in connection with radioisotope energy power sources for naval applications. This Instruction does not apply to naval nuclear propulsion plants in ships or at their prototype sites.

2. Discussion

a. Radioisotope energy power devices for naval applications require careful control and monitoring because of the potential radiological hazards and the special technology involved in their use. Authority to use and handle radioactive material and devices must be limited to those personnel who are qualified and have experience with radioactive material and radioisotope devices.

b. Reference (a) provides guidance for the control of radioactive materials. Naval activities may be required to obtain an Atomic Energy Commission byproduct, Source, or Special Nuclear Material License prior to obtaining such materials unless exempted as provided in reference (b). Naval activities desiring to obtain these materials may obtain assistance from the Naval Facilities Engineering Command.

c. In view of the special problems associated with radioactive materials and radioisotope devices, usage may necessitate supervision by an Officer-in-Charge, an officer of the line or staff, who will be fully qualified and certified in the operational and safety aspects of these materials.

d. Reference (c) assigned to the Commander, Naval Facilities Engineering Command the responsibility for the design, operation, maintenance, safety and technical training of personnel for nuclear shore power plants for Naval application. Radioisotope power devices require similar technical control and coordination.

e. Military command will be exercised through established channels.

### 3. Action

a. Commander, Naval Facilities Engineering Command. Provide program and technical coordination for the development and use of radioisotope power devices. In the development of these devices utilize Navy capability to maximum extent; cooperate with all DoD Activities; and take advantage of developments achieved by the Atomic Energy Commission, its contractors and its commercial licensees. Coordinate personnel requirements with the Chief of Naval Personnel; and, in training personnel for the operation and maintenance of such devices, cooperate with the Army and Air Force in utilizing established training facilities. Issue and promulgate instructions as required in carrying out assigned responsibilities and delegate authority assigned as necessary for efficient and safe operation. When AEC licenses are required, coordinate the acquisition for the Naval Material Command (NMC).

b. Other NMC User Activities. Provide data, requirements, operational performance, and otherwise coordinate with the Naval Facilities Engineering Command to assure successful evaluation and operation of Navy radioisotope energy power devices.

c. Chief of Naval Personnel. Provide educational training for personnel assigned to the radioisotope program, and coordinate and effect officer and enlisted personnel assignments for radioisotope devices in accordance with requirements established by the Commander, Naval Facilities Engineering Command.

d. Chief, Bureau of Medicine and Surgery. Insure that station/base medical personnel are properly qualified in radiological health procedures.

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30 AUG 1966

c. Commanding Officers and Officers-in-Charge of Naval Installations, Activities or Facilities. Comply with technical guidance provided by the Commander, Naval Facilities Engineering Command. Indoctrinate site personnel in the radiobiological aspects of radioisotope energy devices and radioactive materials.

  
JAMES G. WHITAKER  
By direction

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1. Title:

2. TO:

Naval Facilities Engineering Command, Nuclear Engineering Division, Code 042

(Check appropriate items)

3. Instrument of Radioisotope Power Device From:

4. a. Location b. User c. Use d. Location

DESCRIPTION OF DEVICE/SOURCE

5. Isotope, Fuel Form, Total Activity, Model Number(s), Serial Number(s), Quantity, Operating Voltage, etc.

6. Proposed use of Device(s)/Source(s), include Experimental Setup

7. Device will be stored at (Describe)

8. Check appropriate item(s).

9. Attention on file with Naval Facilities Engineering Command

10. Narrative statement showing radiological training and/or experience of proposed user(s) on attached sheets.

11. Submitted by  
(Signature & Date)

12. Custodian  
(Signature & Date)

13. Request approved  
(Installation Commander  
and Date)

NAVFAC HEADQUARTERS PERMITS SURVEY

Based on a review, the Health Physics Staff recommends that the Request be

- ☐ Approved
- ☐ Approved, subject to the Condition(s) listed below
- ☐ Disapproved, for the Reason(s) listed below

\_\_\_\_\_  
Health Physics Staff (Signature and Date)

NAVFAC RADIOLOGICAL SAFETY COMMITTEE ACTION

Based on the Radiological Safety Committee recommendation that the Request be

- ☐ Approved
- ☐ Approved, subject to the Condition(s) specified above, and with the Additional Condition(s) (if any) listed below
- ☐ Disapproved, for the Reason(s) stated above and/or for the Additional Reason(s) (if any) listed below

|                                                    |                                                    |
|----------------------------------------------------|----------------------------------------------------|
| _____<br>Radiological Safety Committee Member/Date | _____<br>Radiological Safety Officer/Date          |
| _____<br>Radiological Safety Committee Member/Date | _____<br>Radiological Safety Committee Member/Date |
| _____<br>Radiological Safety Committee Member/Date | _____<br>Radiological Safety Committee Member/Date |

NAVFAC, NUCLEAR ENGINEERING DIVISION DIRECTOR ACTION

- ☐ Approved
  - ☐ Approved, subject to the Conditions specified above
  - ☐ Disapproved for the reasons stated above
- \_\_\_\_\_  
Director, Nuclear Engineering Division/Date

56635



Material (Element  
and mass number)

Chemical and/or physical  
form

N  
r

T. Uranium, depleted  
in isotope Uranium 235

T. Metal shielding contained  
in Model UTRIS-8 radioisotopic  
thermoelectric generators

T

U. Strontium 90

U. Strontium titanate contained  
in Model SNAP-23A  
radioisotopic thermoelectric  
generator

U

V. Uranium, depleted  
in isotope Uranium 235

V. Metal shielding contained  
in Model SNAP-23A  
radioisotopic thermoelectric  
generator

V

| Material (Element and mass number)             | Chemical and/or physical form                                                                | Maximum amount of radioactivity                                           |
|------------------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| K. Uranium depleted in the isotope Uranium 235 | K. Metal shielding contained in SNAP-21 thermoelectric generators                            | K. 2,700 pounds total, with 270 pounds in each generator                  |
| L. Strontium 90                                | L. Strontium titanate contained in MILITRACS-101A thermoelectric generators                  | L. 10,800 curies total, not exceeding 2,800 curies in each generator      |
| M. Uranium depleted in the isotope Uranium 235 | M. Metal shielding contained in MILITRACS-101A thermoelectric generators                     | M. 1,500 pounds total, not exceeding 250 pounds in each generator         |
| N. Strontium 90                                | N. Strontium titanate contained in SNAP 7F thermoelectric generator                          | N. 31,000 curies in each generator                                        |
| O. Strontium 90                                | O. Strontium titanate contained in Sentinel-55F thermoelectric generators                    | O. 2,500,000 curies total, not exceeding 125,000 curies in each generator |
| P. Strontium 90                                | P. Strontium titanate contained in Sentinel 100F thermoelectric generators                   | P. 3,700,000 curies total, not exceeding 370,000 curies in each generator |
| Q. Strontium 90                                | Q. Strontium titanate contained in SNAP 7F thermoelectric generators                         | Q. 83,000 curies total, not exceeding 8,300 curies in each generator      |
| R. Uranium depleted in the isotope Uranium 235 | R. Metal shielding contained in Model UT-PS 8A, 8B radioisotopic thermoelectric generators   | R. 1,800 pounds total, with approximately 180 pounds in each generator    |
| S. Strontium 90                                | S. Strontium titanate contained in Model UT-PS 8A, 8B radioisotopic thermoelectric generator | S. 227,400 curies total, not exceeding 56,850 curies in each generator    |

| Material (Element and mass number)          | Chemical and/or physical form                                                            | Maximum amount of radioactivity                                        |
|---------------------------------------------|------------------------------------------------------------------------------------------|------------------------------------------------------------------------|
| T. Uranium, depleted in isotope Uranium 235 | T. Metal shielding contained in Model URIP-8 radioisotopic thermoelectric generators     | T. 1880 pounds total, with approximately 470 lbs. in each generator    |
| U. Strontium 90                             | U. Strontium titanate contained in Model SNAP-23A radioisotopic thermoelectric generator | U. 165,000 curies total, not exceeding 165,000 curies in one generator |
| V. Uranium, depleted in isotope Uranium 235 | V. Metal shielding contained in Model SNAP-23A radioisotopic thermoelectric generator    | V. 950 pounds total, with approximately 640 lbs. in each generator     |