



# UNITED STATES MARINE CORPS

MARINE RESERVE FORCE, FMF, USMCR  
4400 DAUPHINE STREET  
NEW ORLEANS, LOUISIANA 70146-5400

ForO P5100.1  
4ORD  
3 NOV 1992

## ORIGINAL

### FORCE ORDER P5100.1

From: Commanding General  
To: Distribution List

Subj: STANDING OPERATING PROCEDURES FOR THE RADIOLOGICAL AFFAIRS  
SUPPORT PROGRAM (SHORT TITLE: RASP SOP)

Ref: (a) MCO 4400.105C  
(b) TI 5104-15/2A

Encl: (1) LOCATOR SHEET

1. Purpose. To establish standing operating procedures for the operation and administration of a Radiological Affairs Support Program (RASP) within the Marine Reserve Force.
2. Scope. This Manual is applicable to all personnel and units of the Marine Reserve Force and in conjunction with references (a) and (b) will serve as the basis for the handling, security and storage of subject equipment.
3. Action. Commanding Officers and Inspector-Instructors will ensure compliance with this Manual and issue amplifying instructions as necessary to implement its contents.
4. Recommendations. Recommendations concerning the contents of this Manual are invited. Such recommendations will be forwarded to the Commanding General, Marine Reserve Force (Code 4ORD) via the appropriate chain of command.
5. Reserve Applicability. This Manual is applicable to the Marine Corps Reserve.
6. Certification. Reviewed and approved this date.

  
M. A. SEXTON  
Chief of Staff

DISTRIBUTION: B



**UNITED STATES MARINE CORPS**

MARINE FORCES RESERVE  
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ForO P5100.1 Ch 1  
4ORD  
APR 23 2002

FORCE ORDER P5100.1 Ch 1

From: Commander, Marine Forces Reserve  
To: Distribution list

Subj: STANDING OPERATING PROCEDURES FOR THE RADIOLOGICAL AFFAIRS  
SUPPORT PROGRAM (SHORT TITLE: RASP SOP)

1. Purpose. To make pen changes to the basic Order.
2. Action
  - a. Add "(c) NAVMED P-5055".
  - b. On page 6-3, paragraph 1(b) at the end of the sentence add "and reference (c)".
3. Filing Instructions. File this change transmittal immediately behind the signature page of the basic Order.

R. B. HARRIS  
By direction

DISTRIBUTION: B

3 NOV 1992

LOCATOR SHEET

Subj: STANDING OPERATING PROCEDURES FOR RADIOLOGICAL AFFAIRS  
SUPPORT PROGRAM (SHORT TITLE: RASP SOP)

Location: \_\_\_\_\_  
(Indicate the location(s) of the copy(ies) of this  
Manual.)

ENCLOSURE (1)



# RASP SOP

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CHAPTER 1

GENERAL

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CHAPTER 1

GENERAL

1000. DESCRIPTION AND PURPOSE

1. General. This Manual provides unit commanders with standardized guidance for the special handling of fire control instruments containing tritium (H-3) as an illuminating source.
2. Purpose. The purpose of this Manual is to provide unit commanders with essential instructions and guidance for the establishment and management of a unit RASP.
3. Procedures. Subordinate organizations will initiate procedures to conform with this Manual.

1001. APPLICABILITY

1. General. The provisions of this Manual are applicable to all elements of the Marine Reserve Force and all units which are attached to the Marine Reserve Force.
2. Applicability. The procedures and instructions set forth herein are applicable in garrison, to routine training deployments and to combat operations, unless subsequently modified to meet specific situations.
3. Exceptions. The RASP deals only with the industrial application of radiation sources including radiography, radiac (radiation detection, indication and computation), calibration and illumination. The use of nuclear material in medical-dental application, propulsion or weapons applications and their attendant safety requirements are not addressed in this Manual.

1002. RESPONSIBILITIES

1. Commanding Officer/Inspector-Instructors. The safety in operation, serviceability, periodic inspection, proper care, security, and maintenance of fire control instruments is an inherent responsibility of command. In the execution of these responsibilities, Commanding Officers/Inspector-Instructors will:
  - a. Appoint, in writing, an officer as the Unit Radiation Safety Office (RSO); provide this officer's name to the MARRESFOR Ordnance Officer, and report changes as they occur.

c. Supervising the storage, issue, operation, and disposal of radiation sources.

d. Providing for technical inspections of fire control instruments.

e. Providing technical training for personnel involved in the handling/use, storage, or shipment of radiological devices.

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CHAPTER 2

EQUIPMENT

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CHAPTER 2

EQUIPMENT

2000. MAINTENANCE

1. General

a. RASP equipment will be maintained in accordance with the instructions contained herein, applicable service policies, regulations and the current edition of ForO P4790.1.

b. Direct liaison is authorized between MARRESFOR units and Ordnance Maintenance Company, Force Service Support Group (FSSG) for maintenance support as applicable.

c. Priority of maintenance will be accorded to combat essential equipment as listed in the current MCBul 3000 series followed by all other non-combat essential equipment.

2. Operation

a. Commanding officers/inspector-instructors of using units are responsible for organizational maintenance, including proper operating techniques, and normal upkeep.

b. Using units will comply with the provisions of the current edition of ForO P4790.1 in reporting equipment under the Marine Corps Integrated Maintenance Management System (MIMMS).

c. General support maintenance units in support of the Marine Reserve Force will furnish the support requested with the objective of maintaining material readiness by continuing the service life of equipment in the hands of the units.

d. In cases where it is more expedient, maintenance support for RASP items may be obtained from other services or other Marine Corps Activities through interservice support agreements (ISA).

3. Maintenance Categories. Maintenance operations are grouped into the following three broad categories:

a. Organizational includes first and second echelon maintenance of organic equipment and is to be applied by the individual and/or the owning unit.

b. Intermediate includes third and fourth echelon maintenance. Third and fourth echelon support will normally be provided by FSSG.

c. Depot consists of fifth echelon maintenance, normally that which requires major overhaul and rebuild. The activities authorized to perform depot level maintenance on these devices are listed in appendix A to this Manual.

#### 4. Maintenance

a. Units are authorized to perform only that maintenance level as cited in their respective table of organization, within the scope indicated by the maintenance allocated charts in applicable Technical Manuals (TM's), Technical Instructions (TI's), Modification Instructions (MI's). The current edition of ForO P4790.1 provides instructions for requesting additional maintenance authorization.

b. RASP equipment maintenance will be accomplished at the lowest echelon of maintenance consistent with the scope of the unit's mission, capabilities of personnel, and the time available. Qualified personnel, at any echelon of maintenance, may perform work of a scope normally authorized at a lower echelon. As a matter of good maintenance practice, all lower echelon maintenance required will be completed prior to evacuation to the next higher echelon repair facility.

c. Maintenance facilities will report evidence of abuse or lack of organizational maintenance by using units to the MARRESFOR G-4 (Attn: 4ORD) and the commanding officer of the unit concerned.

d. Commanders will ensure that equipment requiring maintenance for other than normal wear and use (i.e., accidents and negligence) has been properly investigated and certified as such on the Equipment Repair Order (ERO), in accordance with TM 4700-15/1F. Equipment under investigation may be evacuated for Limited Technical Inspection (LTI) and cost estimate, but will not be repaired until released for repair by the convening authority.

e. Commanders will ensure the following guidelines are met when evacuating or receiving equipment to/from maintenance repair facilities:

(1) Items being returned to the owner will be inspected jointly by qualified individuals representing the unit commander and the supporting maintenance facility.

(2) Upon acceptance from a Marine Corps Maintenance Facilities, the unit representative will return his receipt (yellow copy of the ERO) and receive a completed copy of the ERO upon which all maintenance, repair, and cost data will be entered. This completed copy of the ERO will be retained by the receiving unit for a period of one year or until the equipment is disposed of.

(3) In cases where the maintenance facilities of another service is utilized, the standard work request of that service will be used. In addition, an ERO will be opened/closed and filed for record purposes.

f. Each unit will maintain those publications necessary to perform their authorized level of maintenance.

g. Units will establish programs to detect and correct incipient failures before they occur.

h. The SL 1-2 will be used by all echelons to determine supply and maintenance publications required.

i. Under no circumstances will attempts be made to remove radiological sources.

j. Prior to completion of maintenance on RASP items, radiation markings and safety configurations shall be restored.

k. Devices with broken sources will be processed for evacuation to depot maintenance for repair via Ordnance Maintenance Company, Maintenance Battalion, FSSG.

l. Presence of illumination shall be checked each time these devices are handled.

m. Depot level maintenance is only authorized at the activities listed in appendix A to this Manual.

5. Tritium Fire Control Instruments. Adverse climatic conditions and frequent use of tritium fire control instruments impose a requirement for optimum organizational maintenance. Because of the delicate and complex nature of fire control instruments, organizational maintenance is limited in scope. This makes it no less important, and continued operator and organizational maintenance is essential. The below listed procedures will be followed concerning fire control instruments:

a. When in use, the lenses of the instruments should be protected from the elements whenever possible. Lens tissue and camel hair brushes will be made available to remove dirt and fingerprints from the lenses of fire control equipment upon return of instruments to the unit armory.

b. When not in use, devices shall be stored in areas designated for radioactive material. The storage areas must be ventilated to allow for adequate air changes to take place in accordance with enclosure (2) of reference (b).

c. When transporting fire control instruments to and from maintenance support facilities and during normal training, every effort should be taken to preclude damage in transit. Fire control instruments will be protected by padding, stowed in locally constructed transport boxes/fixtures, and covered for protection against dust or rain. Those items of equipment with cases will be transported in those cases.

#### 6. Markings and Warnings

a. Storage areas shall be marked with signs that contain the following statement: "Caution - Radioactive Material - NRC License 12-00722-06 and reference (b) apply."

b. All control documents such as Material Release Orders (MROs), EROs, Equipment Custody Cards, Disposition Instructions, etc., shall be annotated by the preparer with the following statement: "Caution - Radioactive Material - NRC license 12-00722-06 and reference (b) apply."

c. ERO's for issued devices shall have one of the following statements, as applicable:

(1) "All sources verified to be illuminated."

(2) "Following sources not illuminated. (List Sources not Illuminated.)"

#### 2001. DISPOSAL

1. Organizations with unserviceable and nonrepairable (not listed in the controlled item header file) devices, such as the level vial, shall request disposition by speedletter or message from the Commandant of the Marine Corps (Code LMA-4).

2. Units with unserviceable and repairable (listed in the controlled item header file) devices, shall request disposition from the Commanding General, Marine Corps Logistics Base, Albany, Georgia (Code 800), via the chain of command in accordance with MCO P4400.82F. State in the remarks section of the WIR "Request disposition in accordance with reference (b)." If the device has broken sources, add the additional statement "Broken Radioactive Sources."

3. Instruments are labeled with an instruction decal that states: "If found, return to a military base and dispose of per AR-755-15."

Marine Corps units are to disregard the reference to AR-755 and dispose of as instructed herein.

4. The only authorized disposal addresses for these devices are the authorized U.S. Army depots listed in appendix A to this Manual.

#### 2002. PAINING INSTRUCTIONS FOR TRITIUM FIRE CONTROL INSTRUMENTS

1. Indiscriminate painting of these instruments inhibits proper preventive maintenance requirements. Painting is for preserving the outside non-operative surfaces of the material from which the protective finish has been removed by corrosion, wear, or other causes. Painting is also used to prevent light reflection from parts which have become shiny and for disruptive patterning for camouflage.

2. Repainting will be done only as necessary to preserve and protect the material. Repainting of the entire equipment, except during rebuild, will not be undertaken when spot painting will provide adequate protection. Repainting solely for appearance improvement is unnecessary and is prohibited.

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CHAPTER 3

TRAINING

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CHAPTER 3

TRAINING

3000. PERSONNEL TRAINING REQUIREMENTS. All personnel who work with tritium devices shall be made aware of the hazards, or potential hazards, that are introduced into their working environment by these radioactive commodities. Personnel shall be made aware of the contents of applicable directives and procedures which provide for safe-working conditions. Commanders and supervisors shall obtain and distribute copies of applicable directives, safety procedures, (e.g., Standard Operating Procedures (SOP)) and TM's for each particular operation, such as receipt, handling, warehousing, maintenance, inspection, and use.

1. Users. Users of these radioactive devices, including the field RSO, shall be trained to use the equipment in accordance with published TM's and reference (b). These publications appraise the user of the hazards associated with these devices and specify precautions that must be taken. This training shall continue throughout the entire life cycle of the equipment. The information contained in appendix B to this Manual is the minimum training that all users shall receive.

2. MARRESFOR RSO - Will have at a minimum the formal schooling identified in paragraph 10 f(2) of reference (b).

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CHAPTER 4

RADIOLOGICAL HAZARDS

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CHAPTER 4

RADIOLOGICAL HAZARDS

4000. RADIOLOGICAL HAZARD ANALYSIS. Tritium sources are evaluated in terms of the two basic aspects of potential radiological hazards: External and Internal.

1. External Hazards. The external hazard is concerned with the tritium sources outside a person's body. Tritium sources do not constitute an external hazard because of the extremely low energy level of their emissions. This radioactivity cannot penetrate the glass wall of the tube. There is no measurable external radiation associated with any instrument utilizing tritium sources providing the source remains intact; therefore, there is no limitation on the handling or use of serviceable fire control devices. The external hazard of broken sources is insignificant because the tritium rapidly dilutes into nonhazardous concentrations in ventilated areas.

2. Internal Hazards. The internal hazard is related to the amount of radioactive material that enters the body either through a cut, skin absorption, or by means of inhalation or ingestion and which will remain in the body long enough to significantly irradiate body tissue. One millicurie of tritium in the body as tritium oxide (Tritiated water) will produce an exposure to the whole body of approximately 0.075 REM.

a. The internal hazard for pure tritium gas is relatively small. Only 0.1 percent is absorbed by inhalation and absorption through the skin is negligible. However, depending upon conditions, varying amounts of tritium oxide (tritiated water) are formed (associated) with the release of any form of tritium. The remainder of the tritium is diluted harmlessly into the atmosphere. The anticipated amount of the tritium oxide formed is about 1 percent of the tritium released, except in the case of a fire where 100 percent tritium oxide formation should be assumed.

b. Tritium oxide is absorbed 100 percent into the skin and lung tissue. For this reason, the general practice is to use or store any form of tritium sources only in a well-ventilated area. It is expected that tritium will be released in two ways: Normal source leakage and source breakage. The procurement specifications for the sources permit a leakage rate of no more than 0.030 uCi/day per source. This will produce an airborne concentration of about 0.0003 uCi of tritium oxide per source, per day in storage areas. Source breakage will release all of the tritium in the source into the atmosphere and illumination will be lost. Unless exposed to a fire, this will produce about one percent of the source contents as tritium oxide.

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CHAPTER 5

RADIOLOGICAL INCIDENTS

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CHAPTER 5

RADIOLOGICAL INCIDENTS

5000. RADIOLOGICAL INCIDENTS. A radiological incident is any unplanned event which causes the loss of control of radioactive material. Contamination of personnel and property could be the end result. The release of tritium gas from a sealed source, as would occur in the event of accidental breakage, explosion, or fire, constitutes a radiological incident.

5001. INCIDENT REPORTING

1. All incidents will be reported to the field RSO immediately.
2. The field RSO shall submit, via the MARRESFOR RSO, a report by letter or message to the Commander, AMCCOM (DRSAR-SF), Rock Island Arsenal, Rock Island, Illinois 61299, with an information copy to the Commandant of the Marine Corps (LMA), within 5 working days.
3. The report shall contain the following information:
  - a. Type of incident: loss, theft, or breakage.
  - b. The NSN and quantity of devices(s) lost, stolen, or broken.
  - c. A description of the circumstances under which the loss, theft, or breakage occurred.
  - d. A statement of the disposition or probable disposition of the devices.
  - e. Medical officer's estimated or measured (state which) radiation exposure to individuals (including names and social security number) and the extent of possible hazard to personnel.
  - f. Actions which have been taken to recover the missing devices (if stolen or lost), or reference request for disposition (do not request disposition in the incident report).
  - g. Procedures of measures which have been or will be taken to prevent a recurrence or the loss, theft, or breakage.

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CHAPTER 6

INSTRUCTIONS FOR RASP CONTROL PROCEDURES

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CHAPTER 6

INSTRUCTIONS FOR RASP CONTROL PROCEDURES

6000. INSTRUCTIONS FOR THE RASP. The instructions contained in this chapter provide the field RSOs with specific instructions that apply to the identified aspects of the RASP. These instructions will be incorporated into control procedures for personnel handling these devices during use, shipment, inspection, storage, maintenance, and recovery for disposal operations. Ensuring compliance with the MARRESFOR RASP, field RSO's shall select those instructions that are appropriate for the kinds of operations to be conducted, and shall include directives and existing instructions which establish and direct the use of specific control procedures to ensure safe operations. The information included shall provide for notification of the MARRESFOR RSO of changes in operating conditions, unusual situations, and identification of kinds of operations involving tritium-containing devices and the specific controls required during those operations.

1. Radiation Health Protection Program

a. There is no requirement for preplacement, periodic, or termination medical examinations for personnel involved with these devices.

b. The local medical facility will be informed of the presence of tritium devices and the contents of appendixes B through E to this Manual.

2. Emergency Procedures. In the case of an incident involving radioactive materials, the senior person present shall take immediate steps to control the emergency and request assistance from the RSO and other personnel as required. To minimize personnel exposure to possible internal radiation hazards in the event of a source breakage, the immediate action procedures are as follows:

a. Sound the Alarm. Notify all persons in the immediate area of the incident.

b. Vacate the Area. To minimize exposure, all personnel will vacate the area (building) and move upwind, for at least 30 minutes. If in a building, open the windows and leave door open, except in the case of a fire.

c. Notify the RSO. The field RSO must be notified as soon as possible to ensure proper follow-up action and to receive permission to reenter the building.

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CHAPTER 7

TRANSPORTATION

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CHAPTER 7

TRANSPORTATION

7000. TRANSPORTATION OF DEVICES

1. Transportation of These Devices Shall be in Accordance With:
  - a. NRC Rules and Regulation (10 CFR 71).
  - b. Postal Regulation (39 CFR 124.3). These regulations are published in Postal Service Publication 6.
  - c. Department of Transportation Regulations for Commercial Rail, Highway, Air, and Water (49 CFR 171-179 and 390-397).
  - d. The current edition of MCO P4030.19E, Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft.
  - e. The current edition of NAVSUPINST 4621.1, Transportability Guidance for Safe Transportation of Radioactive Material aboard USN Ships and Craft.
2. Shipment Size Limitation. No single Marine Corps shipment shall exceed 1,000 curies or 2,264 sources, whichever is reached first.
3. Loading Restrictions. These devices will not be loaded into private vehicles for any reason.
4. On and Off Base Transportation via Military Vehicle
  - a. Serviceable devices, displaying approved radiation labels, shall be transported as accountable property without any particular restrictions.
  - b. Unserviceable tritium-containing fire control instruments, serviceable and unserviceable tritium illuminated subassemblies, and tritium waste will be moved locally within the installation under the supervision or direction of the field RSO and in accordance with instructions provided by the MARRESFOR RSO.
5. Off-Base Transportation of Devices (Shipments). All shipments of these devices shall be made by or through the local Traffic Management Officer (TMO).
6. Escort Requirements. No requirement for escort is imposed.
7. Proper Shipping Name. All transportation request for these devices shall include the proper shipping name "Radioactive Devices, N.O.S." or for military air "Radioactive Material Limited Quantity N.O.S."

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CHAPTER 8  
DEADLINE CRITERIA

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CHAPTER 8

DEADLINE CRITERIA

8000. DEADLINE OF COMBAT ESSENTIAL EQUIPMENT. The placement of combat essential equipment in either the mechanical/involuntary deadline or in the administrative deadline categories is covered in the current edition of the ForO P8000.2.

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APPENDIX A

ACTIVITIES AUTHORIZED TO PERFORM DEPOT LEVEL MAINTENANCE  
ON AND DISPOSAL OF DEVICES

1. The following facilities are designated as bulk storage and depot level maintenance facilities for the licensed material and are the only activities authorized to perform depot level maintenance on the devices and are the only activities authorized to dispose of the devices:

- a. Anniston Army Depot, Anniston, Alabama.
- b. Red River Army Depot, Texarkana, Texas.
- c. Letterkenny Army Depot, Chambersburg, Pennsylvania.
- d. Tooele Army Depot, Tooele, Utah.

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## APPENDIX B

### MINIMUM INDIVIDUAL TRAINING

1. All personnel that operate, handle, and/or maintain these devices must be familiar with the contents of this appendix in addition to the instructions provided in appropriate technical manuals, local SOP's and/or safety directives.

#### 2. Information

a. General. The radioactive material used in these tritium-containing sources is tritium gas (H-3) sealed in pyrex tubes. These sources are used to illuminate fire control devices for night operations. There is no external or internal radiation hazards as long as the source remains intact, therefore, there is no time limit for personnel handling serviceable devices. Breakage of a source would release the tritium gas. Released tritium gas will immediately dissipate into the atmosphere; however, tritium oxide could be formed and this could be fully absorbed through the lung and skin tissue. The primary means for identifying a leaking tritium-containing source will be by the loss of illumination.

b. Federal Law. Tampering with or removal of the sources is prohibited by Federal law (CFR-10).

c. Identification. Tritium-containing fire control devices that contain self-luminous sources are identified by means of radioactive warning labels.

d. Safety Precautions. Be aware that:

(1) Tritium-containing devices are potentially hazardous when broken.

(2) Glass from broken sources must be handled as radioactive waste.

(3) A maximum of 1,000 curies or 2,264 sources will be handled in any one operation.

(4) All operations must take place in a well-ventilated area.

#### 3. Instructions

a. In case of source breakage, brightness decay or loss of brightness occurring during any type of operation, inform the RSO immediately.

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APPENDIX C

TRITIUM STORAGE LIMITATIONS ASSESSMENT

1. The tritium containing source's procurement specifications, permit a leak rate of 0.030 uCi per day, per source.
2. The maximum permissible concentration (MPC) for tritium for unrestricted areas is 2 by (10 to the minus 7th) uCi/ml (microcuries per milliliter) of air. (Refer to Title 10, CFR, Part 20.)
3. Air changes taking place under average conditions, exclusive of air provided for ventilation in a room with no windows or exterior doors, is onefold the total air change per hours (12 air changes per a 24-hour day). 1/
4. The allowed number of sources per 1,000 cubic feet of unrestricted area is determined by the following formula:  
  
(MPC by (conversion factor for ml/cubic ft) by (number of air changes/day) divided by the (permissible leak rate/source/day) equals (2 by 10 to the minus 7th uCi/ml by (2.83 by 10 to the minus 7th ml/1,000 cubic feet) by (12 air changes/day) divided by (0.03 uCi/sourceday) equals 2,264 sources/1,000 cubic feet.
5. It is unlikely that this limit will ever be exceeded because of the physical size of the instruments and packages that the sources are mounted or boxed in.

1/ ASHRAE Guide and Data Book, "Fundamentals and Equipment American Society of Heating, Refrigerating, and Air-Conditioning Engineers," 1963, Page 432.

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APPENDIX D

HAZARD ASSESSMENT OF A FIRE INVOLVING  
BREAKAGE OF TRITIUM GAS SOURCES

1. The most credible accident that could occur would involve a storage area fire and result in the release of all the tritium in a short period of time. An estimate of the hazard may be developed using Sutton's equation.

2. At any distance from the point of release, the ground level concentration will be a maximum when the center line of the plume is at ground level,  $Y=0$ . Assuming that the release occurs at ground level, and neglecting the effects of heated air, Sutton's equation becomes:

$$\bar{X}(X,0) = \frac{2Q}{c u X^{2-n}}$$

X = range in meters (see paragraph 3).

$\bar{X}$  = volumetric concentration of the contaminant in mCi per cubic meter (M).

x,o - coordinates of point of measurement from point of release in M.

Q = emission rate mCi/sec. Assume that 1,000 curies of tritium gas is released during 1 hour. Thus  $Q = 1,000 \text{ Ci}/60\text{min} = 277.8 \text{ mCi}/\text{sec}$ .

C = virtual diffusion coefficients in lateral and vertical directions = 0.4. 1/

n = dimensionless parameter determined by the atmospheric stability - 0.24. 1/

3. Assuming a mean wind speed of 10m/min, the resulting concentration of tritium at ranges of 100, 500, and 1,000 meters would be as follows:

<u>Range (Meters)</u>	<u>Concentration of H-3</u> <u>(uCi/Cubic M)</u>
100	2,000
500	120
1,000	30

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APPENDIX E

HAZARD ASSESSMENT OF ACCIDENTAL BREAKAGE  
OF ONE OR MORE TRITIUM SOURCES

1. Postulated Accident. The accidental breakage of three of the larger H-3 sources simultaneously by a user is as follows:

- a. Three 9-curie sources for a total of 27 curies H-3.
- b. Less than 1 percent of H-3 is converted to tritium oxide; therefore, 0.27 curies tritium oxide is released in 1 minute.
- c. Average man/woman breathes 20 liters per minute.
- d. Maximum permissible body burden = 2,000 uCi.
- e. Ten-minute exposure time.

2. Assumption. The concentration of tritium gas following the breakage, is of the form of a time dependent gradient with respect to distance from the source. Assume the average concentration a user is exposed to is equivalent to having the activity uniformly dispersed in spherical volume of radius 10 feet, i.e., concentration = 2.27 uCi/liter.

3. Exposure. Assuming even an unlikely 10 -minute exposure, a man would inhale and retain the following amounts of tritiated water:

Intake = 2.27 uCi by 20 liters/minute by 10 minutes.

= 454 uCi tritiated water.

= Less than 1/4 maximum permissible body burden for continuous exposure.

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APPENDIX F

GLOSSARY OF TERMS AND PREFIXES

- BETA PARTICLE- CHARGED PARTICLE EMITTED FROM THE NUCLEUS  
BEHAVIORALLY IDENTICAL TO AN ELECTRON
- CURIE (Ci)- UNIT OF RADIOACTIVE DECAY ( $3.7 \times 10^{10}$  DPS)
- ERGS- UNIT OF WORK ( $.7376 \text{ FTLB} \times 10^{-7}$  )
- KEV- THOUSAND ELECTRON VOLTS -  $1 \text{ EV} = 1.6 \times 10^{12}$  ERGS
- N.O.S.- NOT OTHERWISE SPECIFIED, USED IN TRANSPORTATION  
LABELING OF SMALL AMOUNT OF LOW LEVEL EMITTING  
RADIONUCLIDES
- MPBB- THE AMT OF RADIOACTIVITY OF A TYPE IN THE WHOLE BODY  
RESULTING IN THE SAFE DOSE LIMIT TO ANY SINGLE ORGAN.
- SOURCE- TRITIUM SEALED IN A PYREX TUBE (94% PURE) AT 2.5'  
ATMOSPHERES (37 PSI APPROX). COMES IN VARIOUS SIZES  
AND SHAPES.
- TRITIUM (H-3)- RADIOACTIVE ISOTOPE OF HYDROGEN
- TRITIUM OXIDE- TRITIATED WATER. ( $\text{H}_3\text{O}$ )

LIST OF PREFIXES

d	deci	(= $10^{-1}$ )	da	deka	(= $10^1$ )
c	centi	(= $10^{-2}$ )	h	hecto	(= $10^2$ )
m	milli	(= $10^{-3}$ )	k	kilo	(= $10^3$ )
u	micro	(= $10^{-6}$ )	m	mega	(= $10^6$ )
n	nano	(= $10^{-9}$ )	g	giga	(= $10^9$ )
p	pico	(= $10^{-12}$ )	t	tera	(= $10^{12}$ )
f	femto	(= $10^{-15}$ )	a	atto	(= $10^{-18}$ )

DUMMY LAYOUT

1. FRONT PAGES ARE ALWAYS ODD NUMBERED.
2. ATTACH THIS TO DD-844

FORM 75100.1

SIDE	PAGES										PAPER COLOR	# OF COPIES	
	1	Encl (1)	I	III	1-1	1-3	1-5	2-1					
ADJ	FRONT	1											
	BACK	X	X	X	X	X	X	X	X				
	FRONT	2-3	2-5	2-7	3-1	3-3	4-1	4-3	5-1				
	BACK	2-4	2-6	X	X	X	X	4-4	X				
	FRONT	5-3	6-1	6-3	7-1	7-3	8-1	8-3	A-1				
	BACK	X	X	6-4	X	X	X	X	X				
	FRONT	B-1	C-1	D-1	E-1	F-1							
	BACK	B-2	X	D-2	X								
	FRONT												
	BACK												
	FRONT												
	BACK												
	FRONT												
	BACK												

ADDITIONAL INSTRUCTIONS:

34. 3

- COLLATE
- STAPLE
- DRILL