



DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
WASHINGTON, D. C. 20380

URGENT

TI-5104-15/2A
9 Nov 1981

U . S . MARINE CORPS TECHNICAL INSTRUCTION

SPECIAL HANDLING CONSIDERATIONS

TRITIUM FIRE CONTROL INSTRUMENTS INFANTRY AND ARTILLERY
MARINE CORPS RASP (RADIOLOGICAL AFFAIRS SUPPORT PROGRAM)

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- Encl: (1) Identification of Tritium-Containing Devices
(2) Tritium Storage Limitation Assessment
(3) Hazard Assessment of a Fire Involving Breakage of Tritium Gas Sources
(4) Hazard Assessment of Accidental Breakage of One or More Tritium Sources
(5) Minimum Individual Training
(6) Activities Authorized To Perform Depot Level Maintenance On and Disposal of Devices
(7) Shipping Data Requirements for Selected Tritium-Containing Devices
(8) Guidance for Preparing Shipping Documents to Comply with 49 CFR
(9) Guidance for Preparing Form DD-1387-2 (Special Handle Data/ Certificates for Military Air Shipments)
(10) Guidance for Shipments by Mail

1. Purpose. To direct special handling considerations for tritium-containing devices (hereafter referred to as devices) for infantry and artillery as required in NRC (Nuclear Regulatory Commission) license for byproduct material No. BML 12-00722-06 issued to the Commander, ARRCOM, Rock Island arsenal.

2. Cancellation. TI-5104-15/2.

3. Applicability. This TI applies to the radiological special handling requirements and considerations of the devices identified herein and is in addition to any other requirements and considerations imposed. Although requirements are oriented to a garrison environment, principles apply to field situations.

4. Time Compliance Period. The requirements herein shall be implemented upon receipt of these devices.

5. Information

a. General. The Marine Corps is procuring weapon systems utilizing self-illuminating tritium radioactive sources in the fire control equipment and separate items, such as the collimator, which uses a tritium radioactive source. These devices are identified in paragraphs 7, 8, and 9a, following. Enclosure (1) provides additional information to aid in identification and application. The sources are controlled by the NRC and their possession requires an NRC license. The license, which this instruction implements, provides for the safe handling and proper disposal of the sources.

PCN 167-511981-00

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AND ARE DENOTED BY A BAR (■) SYMBOL



b. Overview of Requirements. An overview of the requirements of this TI are:

(1) The appointment of a radiation safety officer, at the activity on which the devices are located, and at each level of command in the organization in which they are authorized.

(2) Formal standing operating procedures.

(3) Medical support when a source is broken,

(4) Reporting of radiological incidents.

(5) Minimum training of personnel.

(6) Transportation of these devices in accordance with Federal law and military directives.

(7) Shipping documents must contain specific information.

(8) All devices containing these sources must be treated as controlled items and will require special disposition regardless of item condition code when they are replaced.

(9) Storage and quantity limitation are imposed; however, it is unlikely that such limitation could be exceeded because of the physical size of the devices involved.

(10) Removal or replacement of the sources by Marine Corps maintenance organizations is prohibited. Depot level maintenance is limited to specific activities listed herein.

(11) Specific markings and warnings are required.

c. Definitions

(1) Biological Half-Life. The time required for the body to eliminate half of a specific radioactive material it takes in. Tritium has approximately a 14-day biological half-life.

(2) CFR (Code of Federal Regulation). The CFR is a codification of the general and permanent rules published in the Federal Register by the executive department and agencies of the Federal Government. The code is divided into 50 titles which represent broad areas subject to Federal regulation. Each chapter is further subdivided into parts covering specific regulatory areas. Normal practice is to identify by citations "Title Number," "CFR," and "Part Number"; for example 10 CFR 71.

(3) Ci (Curie). A measure of the rate at which radioactive material emits particles or decays; a unit of source strength or activity. Other units are: mCi (millicurie) and uCi (microcurie)

(4) Ev (Electron Volt). A unit of measure of the energy level at which radiation is emitted from a source. Other units are: thousand (kilo) Kev (electron volt), and mega (million) Mev (electron volt).

(5) Radioactive Devices. This term includes manufactured articles such as the howitzers, mortars, fire control instruments, repair parts or apparatus, or similar devices having as a component part radioactive materials (other than liquids) in a nondispersable form as a component part. For radioactive games, the requirement for the radioactive material to be in a nondispersable form does not apply. All of the devices identified by this TI are classified as "radioactive devices, n.o.s." (not otherwise specified).



(6) Radioactive Half-Life. The time required for a source's activity to decrease to half its value or lose half its strength. Tritium has a 12-year radioactive half-life.

(7) MPC (Maximum Permissible Concentration). The maximum concentration of a radioactive material in air or water (food) to which a worker may be exposed assuming a 40-hour workweek. The MPC of air for tritium in an unrestricted area is 2 times 10 to the minus 7th uCi/ml (microcuries per milliliter). (Refer to 10 CFR 20.)

(8) Maximum Permissible Body Burden. The amount of a radioactive material which, if maintained at a constant level in the body, would not cause appreciable damage to the critical organ (the organ of the body receiving the material that results in the greatest damage to the body). For tritium, the critical organ is the entire body and the maximum permissible body burden is 2000 uCi.

(9) RSO (Radiation Safety Officer). An individual who shall be appointed, by the unit commander, to provide consultation and advice regarding the implementation of controls for hazards associated with radiation sources and the effectiveness of these measures and be responsible for radiation safety training of personnel. This individual shall be responsible to the unit commander for promulgating and supervising the radiological safety program. The RSO is directly responsible for the adequate and effective controls which prevent spread of contamination and for decontamination techniques and procedures. The RSO shall be technically qualified by virtue of education, military training, and/or professional experience to supervise the storage, issue, operation, and disposal of radiation sources and shall have a thorough knowledge of applicable regulations pertaining to the control of radioactivity, prior to appointment. The term "officer" is not intended to denote commissioned status. The terms RSO (radiological safety officer), RCO (radiological control officer), RPO (radiological protection officer), and RRO (radiation protection officer) are all interchangeable; however, in the Marine Corps, the term RSO (radiation safety officer) is preferred. The "base RSO" is the individual at the post or station who is a school trained RSO and is responsible for supervision of the base RASP (Radiological Affairs Support Program), which includes all radioactive devices physically on the base. The "field RSO," although not necessarily school trained, is the individual responsible for the using unit RASP and ensures compliance with the program established by the base RSO. The duty of an RSO is normally assigned as a secondary duty.

(10) Transportation Group. Radionuclides are listed in transport groups I through VII (most to least harmful) according to their radiotoxicity and relative potential hazard in transportation. These devices contain tritium H-3 as a gas which is transportation group VII (least harmful).

(11) Tritium (H-3). The only radioactive isotope of hydrogen, tritium emits a relatively low-level energy (average 6 Kev) beta particle.

d. Source Description. The self-illuminated devices, containing tritium as the active element, consist of sealed pyrex glass tubes of various sizes and shapes coated with a phosphor and filled with 94 percent pure tritium gas at an internal pressure of 2.5 atmospheres (about 37 pounds per square inch). The beta particles emitted by the tritium interact with the phosphor creating illumination. After a period of 6 years, the phosphor loses most of its ability to emit light; therefore, the effective life or shelf life of the source is 6 years. The sources themselves are glued with acrylic or silicone plastic cement to holders, which are fitted or glued inside the instrument. Federal law prohibits Marine Corps personnel from removing and replacing the sources.



e. 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 remain 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 of the very small amount of tritium involved and because the escaping gas 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 inhaling 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; 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 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 1 percent of the source contents as tritium oxide.

f. Internal Hazard Control. Control of internal hazards is accomplished by measures that are designed to keep radioactive material from gaining entrance into the body by inhalation, ingestion, cuts, or by absorption through the skin. Storage limitations are established to prevent unsafe airborne concentrations of tritium oxide, due to leakage, in storage areas and to limit the amount of tritium oxide formed if all the sources were broken in a catastrophe such as a fire. See enclosures (2) and (3). Assembled instruments and modules will not pose a hazard during handling, stowage, and maintenance operations. Unusual circumstances or accidental crushing might damage the mechanical operational aspects and could release the gaseous tritium. The tritium that will be released into the air, based on a credible accident in which several tritium sources are presumed to be crushed at the same time, and calculations based on this case, indicate that a person remaining in the immediate area for 10 minutes will receive only one-quarter the maximum permissible internal exposure to tritium. See enclosure (4).

g. Radiation Detection Instruments. Tritium emits a low energy (6 Kev) beta particle. This beta radiation can only be detected and measured using specialized low energy counting systems. There is no requirement for these specialized radiation detection instruments for this application.



h. 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.

(1) The release of tritium gas from a sealed source as would occur in the event of accidental breakage, explosion, or fire, would constitute a radiological incident.

(2) Lost or stolen tritium devices would pose a potential hazard and constitute a radiological incident.

6. Technical Manuals Affected. TM-9-1010-223-10, TM-9-1010-223-20&P, TM-9-1010-223-34&P, TM-9-1025-211-10, TM-9-1025-211-20&P, TM-9-1025-211-34, TM-9-1025-211-34P, TM-9-1240-324-34&P, TM-9-1240-375-34, TM-9-1240-375-34P, TM-9-1240-3S6-34&P, TM-9-1290-200-14&P, TM-9-2350-217-10N, TM-9-2350-217-20N, and TM-55-1025-211-14.

7. Major Items Affected. The following items are tritium-containing radioactive devices which have a TAMCN (table of authorized control number), an I.D. No. (item designator number), and USN (national stock number) assigned. see enclosure (1) for identification of radioactive assemblies, subassemblies, and repair parts.

<u>Description</u>	<u>NSN</u>	<u>TAM No.</u>	<u>I.D. No.</u>
COLLIMATOR, Infinity, Aiming Reference (Radioactive), M1A1	1240-00-332-1780	E0205	04914B
HOWITZER Medium, Self-Propelled, 155mm, M109A3	2350-01-031-8851	E0663	03069C
HOWITZER, Medium, Towed, 155mm, M198	1025-01-026-6648	E0665	08198A
MORTAR, 60mm, Lightweight Company, M224	1010-01-020-5626	E1065	08206A
QUADRANT, Fire Control (Gunnery) (Radioactive), W/E, M1A2	1290-00-169-1937	E1 260	02193B

e. Components Affected. The following components are tritium-containing radioactive devices which have an I.D. No. and NSN assigned. See enclosure (1) for and Item application and identification of radioactive subassemblies and repair parts.

<u>Description</u>	<u>NSN</u>	<u>I.D. No.</u>
QUADRANT, Fire Control, M18	1290-01-037-7289	87858B
TELESCOPE, Elbow, M138	1240-01-030-0530	87859B
TELESCOPE, Panoramic, M137	1240-01-038-0531	87857B
MOUNT, Telescope and Quadrant, M171	1240-01-039-7273	87606B
COUNTER BOX ASSEMBLY	1240-01-044-6915	87866B
MOUNT, Telescope/M64	1240-01-050-5588	88129B
TELESCOPE, Elbow, Optical Device, P/O M64 Sight Unit	1240-01-051-3657	80130B
MOUNT TELESCOPE	1240-01-201 -8299	88129C



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<u>Description</u>	<u>NSN</u>	<u>I.D. No.</u>
SCALE, Indicating Body	1240-01-053-3354	88131B
BODY ASSEMBLY	1240-01-062-8264	82870B
OUADRANT, FIRE Control, M17	1290-01-037-3883	87860B
LEVEL ASSEMBLY, Fire Control	1290-01-048-0193	88480B
CELL ASSEMBLY, Reticle	1240-01-048-0779	87868B

9. Materiel Affected

1. Materiel Retained. The following materiel are tritium-containing radioactive devices which have only an NSN assigned. See enclosure (1) for end item application and identification of radioactive subassemblies and repair parts.

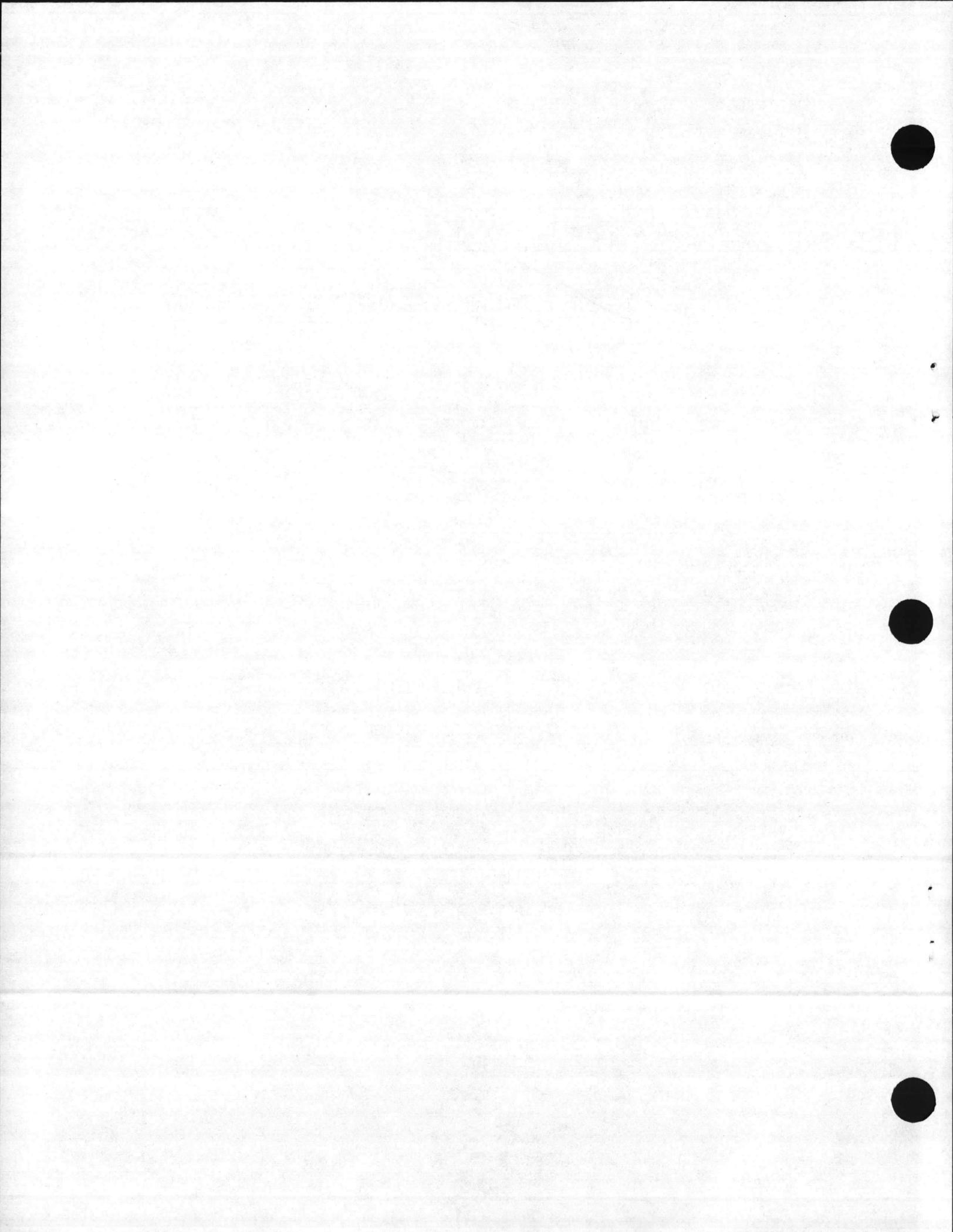
<u>Description</u>	<u>NSN</u>
HANDLE AND FIRING ASSEMBLY/M225	1010-01-043-2050
RANGE INDICATOR	1010-01-046-9398
OBJECTIVE AND RETICLE ASSEMBLY	1240-01-043-9463
DELETED	
LAMP UNIT, Radioluminous	1240-01-051-8472
CELL ASSEMBLY, Collimator Reticle	1240-01-079-5453
LEVEL Fire Control Level Potted Assembly	1240-01-057-0112
LIGHT, Aiming Poet, M58	1290-00-169-1934
LIGHT, Aiming Poet, M59	1290-00-169-1935
VIAL, Level	1290-00-257-2769
LEVEL ASSEMBLY	1290-01-046-3687
ALIGNMENT DEVICE, M140	4931-00-341-5119
ALIGNMENT DEVICE, M139	4931-01-048-5834
DIAL CONTROL	5355-01-053-6448
INDEX, Nuclear	6260-01-053-3356
LAMP, Nuclear Radioluminous	6260-01-056-2883

b. Materiel Required. The following materiel is recommended for use to satisfy requirements of this instructions

<u>Description</u>	<u>NSN</u>
BAG, Plastic	8105-00-837-7753
BAG. Plastic. 20 X 25 In.	0105-00-269-4662

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Change 3



<u>Description</u>	<u>NSN</u>
GLOVES , Plastic	8415-00-248-3228
TAPE, Pressure Sensitive	7510-00-059-9062

10. Instructions for the RASP. The instructions contained in this paragraph provide the base and field RSO's with specific instructions that apply to the identified aspects of the RASP. These instructions shall 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 base and parent command RASP's, the field RSO 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 base RSO of changes in operating conditions and unusual situations and identification of kinds of operations involving tritium-containing devices and the specific controls required during those operations.

a. Radiation Health Protection Program

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

(2) The local medical facility will be informed of the presence of tritium devices and the contents of enclosures (2), (3), and (4).

(3) The applicable portions of this paragraph will be coordinated with the local medical officer.

(4) All personnel exposed to tritium gas shall be referred to the medical officer for the determination of the need for a radiochemical urinalysis.

(5) If deemed necessary by the medical officer, a radiochemical urinalysis shall be obtained. The procedure for obtaining a radiochemical urinalysis is contained in NAVMED P-5055, chapter 3.

b. 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:

(1) Sound the Alarm. Notify all persons in the immediate area of the incident.

(2) Vacate the Area. To minimize exposure, all personnel will vacate the area (building) and move upwind, for at least 0.5 hour. If in a building, open windows and leave door open, except in the case of a fire.

(3) Notify the RSO. The field RSO must be notified as soon as possible to ensure proper followup action and to receive permission to reenter the building.

c. Contamination Control. To prevent body contact with contaminated surfaces that could occur if a source is broken:

(1) Plastic gloves shall be used to handle devices with broken sources and any resulting residue. If handling jagged edged materiel, wear heavy plastic gloves or cotton gloves over the light plastic gloves identified herein to prevent contact with contaminated material due to cut gloves.



(2) Devices with broker sources and any resulting residue are to be doubly wrapped in two plastic bags and sealed with tape.

(3) A fire or explosion might release tritium gas from tritium devices. The tritium will be dissipated into the air and will flow along with the smoke. To minimize exposure, firefighters should not take places downwind to fight the fire unless absolutely necessary. See enclosure (3).

d. Personnel Decontamination. The primary method of tritium decontamination is by flushing with copious amounts of water and thorough washing with a nonabrasive, mild soap. Special attention should be given to the areas between fingers, around the nail, and the outer edges of the hands. The waste water should be disposed of into the base sewage system. In all cases of personnel contamination, the base RSO shall be notified and consulted. Organic solvents such as gasoline, alcohol, or acetone must be avoided, since contamination can enter the body by means of skin absorption.

e. Incident Reporting

(1) All incidents will be reported to the field RSO immediately.

(2) The field RSO shall submit, via the base RSO, a report via letter or message to the Commander, ARRCOM (DRSAR-SF), Rock Island Arsenal, Rock Island, Illinois 61299, with an information copy to Commandant of the Marine Corps (Code 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 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 or measures which have been or will be taken to prevent a recurrence of the loss, theft, or breakage.

f. Personnel Training Requirements. All personnel who work with these tritium devices shall be made aware of the hazards, or potential hazards, that are introduced into their working environment by inclusion of these radioactive commodities. Personnel shall be made aware of the contents of applicable directives and procedures which provide for safe-working conditions. Commanders or supervisors shall obtain and distribute copies of applicable directives and safety procedures (e.g., SOP's (standard operating procedures), and technical manuals) 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 technical manuals and this TI. These publications apprise the user of the hazards associated with these devices and specify precautions that must be



taken. This training is sufficiently broad in scope to cover the use of the devices throughout the entire life cycle. The publications, other than this TX, that provide the required training are listed in paragraph 5, preceding. The information contained in enclosure (5) is the minimum training that all users shall receive.

(2) Base RSO. Posts and stations on which these devices are physically located and the Commanding General, 4th Marine Division are required to appoint a base RSO.

(a) The base RSO will have, as a minimum, 80 hours formal training in the following areas:

- 1 Principles and practices of radiation protection.
- 2 Radioactivity measurement standardization and monitoring techniques and instruments.
- 3 Mathematics and calculations basic to the use and measurement of radioactivity.
- 4 Biological effects of radiation.

(b) Successful completion of one of the following courses is the only authorized training to satisfy this requirement:

1 U.S. Army Radiological Safety Course (7K-F3) at the U.S. Army Chemical School, Fort McClellan, Alabama 36205, or

2 U.S. Navy Radiation Safety Training Course at the Naval Nuclear Power Unit (Code 60), Port Hueneme, California 93043.

(c) Request for assistance in obtaining quotas for RSO courses should be submitted to the Commandant of the Marine Corps (Code TRI).

g. Transportation of Devices

(1) Transportation of These Devices Shall be in Accordance With

- (a) 10 CFR 71, NRC Rules and Regulations
- (b) 39 CFR 124.3, Postal Regulations. These regulations are published in Postal Service Publication 6.
- (c) 49 CFR 171-179 and 390-397, Department of Transportation Regulations for Commercial Rail, Highway, Air, and Water.
- (d) The current edition of MCO P4030.19, Packaging and Handling of Dangerous Materials for Transportation by Military Aircraft.
- (e) 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 Post 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 illuminatd subassemblies, and tritium waste will be moved locally within tune installation under the supervision. or direction of the field RSO and in accordance with instructions of the base RSO.

(5) Off-Post Transportation of Devices (Shipments). All shipments of these devices shall be made by or through the local TMO (traffic management officer) .

(6) Escort Requirements. No requirement for escort is imposed.

(7) Proper Shipping Name. All transportation requests 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."

h. Shipping and Receiving Activity Responsibilities

(1) These devices shall be consigned only to U.S. Marine Corps and U.S. Army addressees. Shipment to any other addressees shall require the specific written permission of the Commandant of the Marine Corps (Code LMA-4).

(2) Shipping data for radioactive shipments of selected devices is provided in enclosure (7).

(3) Guidance on preparing shipping documents in accordance with 49 CFR is provided in enclosure (8).

(4) Guidance on preparing form DD-1387-2 is provided in l nclosure (9).

(5) Guidance for shipments by mail is provided in enclosure (10).

(6) Prior to shipment and upon receipt, packages will be inspected for damage. If package damage is evident, leakage may be determined by checking for the presence of illumination. In the event that leakage is discovered (loss of illumination), the device shall be handled in accordance with paragraph 10c, and reported in accordance with paragraph 10e, preceding.

i. Packaging

(1) Serviceable fire control instruments issued to using units shall be packaged in transit cases as specified in the applicable TM (technical manual).

(2) Unserviceable devices, due to a broken source, that are wrapped in accordance with paragraph 10c, preceding, may be handled for packaging the same as serviceable devices.

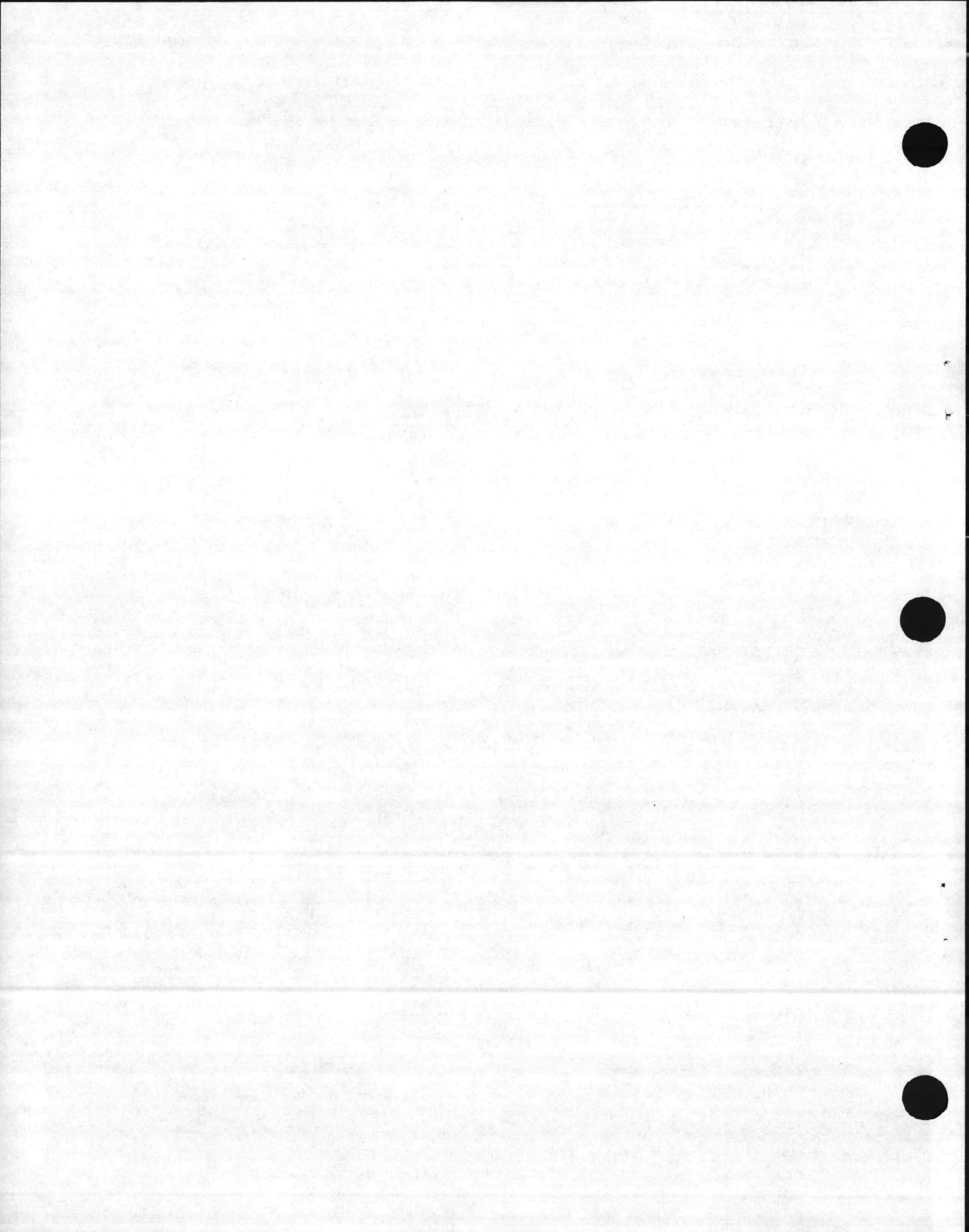
(3) Defective devices shall be packed in the shipping container from which the replacement was taken, if possible.

(4) Radioactive devices not l xceeding 25 curies per device (see enclosure (1) for number of curies per device) and 200 curies per package in transportation group VII are exempted from the labeling, marking, and specification packing requirements of:

(a) 49 CFR, except for the proper shipping name: "Radioactive Devices, N.O.S."

(b) The current edition of MCO P4030.19, except for the completion of form DD-1387-2, see enclosure (9).

(5) The smallest outside dimension of packages containing radioactive devices shall be 4 inches or greater.



j. Storage Areas

(1) A maximum of 1,000 curies of 2,264 sources, whichever is reached first, shall be stored in any one storage area. See enclosure (1) for number of curies and sources per NSN.

(2) Separate storage areas, the sum of which exceed 1,000 curies, shall be separated by firewalls or be sufficient distance apart that a fire in one storage area cannot possibly spread to another storage area in which tritium-containing devices are stored.

(3) The minimum size of any storage area shall be a minimum volume of 1,000 cubic feet.

(4) Because lost Or stolen sources are a potential hazard, these items must be stored in marked containers and must be secured against unauthorized removal.

(5) The storage area must be ventilated such that the air is changed at least 12 times per 24 hours, see enclosure (2). Open storage is recommended in order to provide required ventilation, if all other requirements can be satisfied.

k. Inventory of Devices at Supply Facilities and Stocking Activities

(1) Physical inventories shall be conducted every 6 months to ensure accuracy of inventory records. Containers need not be opened for this purpose.

(2) Devices in stock with a date of manufacture older than 6 years shall be assigned Condition Code F. These items shall be sent to an authorized Army depot for replacement of the tritium sources.

(3) Inventory losses of devices shall be reported as a radiological incident in accordance with paragraph 9e, preceding.

l. Control of Storage and Warehouse Areas

(1) These devices shall be stored in storage areas designated for radioactive material.

(2) Personnel access to these areas shall be controlled to ensure physical security of these items.

m. Maintenance

(1) Only authorized maintenance shall be performed, as indicated by the maintenance allocation charts in the applicable TM.

(2) Under no circumstances will attempts be made to remove the sources.

(3) Prior to completion of maintenance on these devices, radiation markings and safety configurations shall be restored.

(4) Devices with broken sources will be processed for evacuation to depot maintenance for repair in accordance with the instructions in paragraph 100, following.

(5) Presence of illumination shall be checked each time these devices are handled.

(6) Depot level maintenance is only authorized at the activities listed in enclosure (6).



n. Markings and Warnings

(1) Storage areas shall be marked with signs that contain the following statement in English and the local language, if applicable:
"Caution-Radioactive Material-NRC License 12-00722-06 and USMC TI-5104-15/2 Apply."

(2) All control documents such as MRO's (material release orders), equipment repair orders, 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 USMC TI-5104-15/2 Apply."

(3) Equipment repair orders for issued devices shall have one of the following statements whichever is applicable:

(a) "All Sources Verified To Be Illuminated."

(b) "Following Sources Not Illuminated: (List sources not illuminated.)"

(4) MRO's for other than U.S. Marine Corps and U.S. Army addressees shall cite the Commandant of the Marine Corps (code LMA-4) message or letter which authorized the shipment.

o. Disposal

(1) Organizations with unserviceable devices shall request disposition instructions from the Commanding General (830), Marine Corps Logistics Base, Albany, Georgia 31704. State in the remarks "Request disposition in accordance with USMC TI-5104-15/2." If the device has broken sources, add the additional statement "Broken Radioactive Sources."

(2) The Commanding General, Marine Corps Logistics Base, Albany, will issue disposition instructions for unserviceable devices as follows:

(a) Repairable. Comply with the current interservice support agreement for these items.

(b) Nonrepairables. Accumulate at the Marine Corps Logistics Base nearest the requester and at least annually, prior to 1 September; request disposition from the Commander, ARRCOM (DRSAR-MML-L), Rock Island Arsenal, Rock Island, Illinois 61299. Provide an information copy to the Commandant of the Marine Corps (Code LMA).

(3) The items identified herein are labeled with an instruction decal that "If found, return to a military base, dispose of per ARR 755-15." Marine Corps organizations shall disregard the reference to AR 755-15 and dispose of as instructed herein."

11. Action

a. Posts and Stations and the Commanding General, 4th Marine Division. Commanders of posts and stations which have the devices identified in paragraphs 7, 8, and 9a, preceding, physically present on the post or station and the Commanding General, 4th Marine Division, shall:

(1) Appoint a base RSO who has had, as a minimum, the training specified in paragraph 10f, preceding.

(2) Publish directive that ensure compliance with paragraph 10, preceding, by all organizations on the base that use or handle the devices identified herein.

(3) The base RSO shall provide any necessary field RSO training for all organizations on the base that use or handle the devices identified herein. The final determination of the need for and content of this training shall be determined by the base RSO.



(4) The base RSO for the 4th Marine Division will provide the base RSO function to the units of the division which do not have access to a local base RSO.

b. Parent Units. Commanders of parent commands of organizations that use or handle the radioactive devices identified in paragraphs 7, 8, and 9a, preceding, shall:

(1) Appoint a field RSO for the command.

(2) Publish directives that ensure compliance with paragraph 10, preceding, and the directives of the post or station at which these devices are located.

c. Organizations That Use or Handle the Radioactive Devices Identified Herein

(1) Appoint a field RSO.

(2) Establish and implement directives in accordance with the instructions of paragraph 9, preceding.

(3) Report radiological incidents, in accordance with paragraph 10e, preceding, within 5 days of the incident.

(4) Advise the base fire chief of the cautions contained in paragraphs 5f, 10c(3), and 10j, preceding, in addition to what devices the unit has and where they are located to ensure proper building prefire planning as required by the current edition of MCO P11000.11.

(5) Small units that are geographically isolated from posts and stations and normally have only a small quantity of the devices, shall request base RSO support from the local area military commander, through their normal chain of command.

* d. Commanding General, Marine Corps Logistics Base, Albany

(1) Assign to the NSN's listed in paragraphs 7, 8, and 9a, preceding, phrase code "R" and list the following control documents:

(a) TI-5104-15/2.

(b) NRS License 12-00722-06.

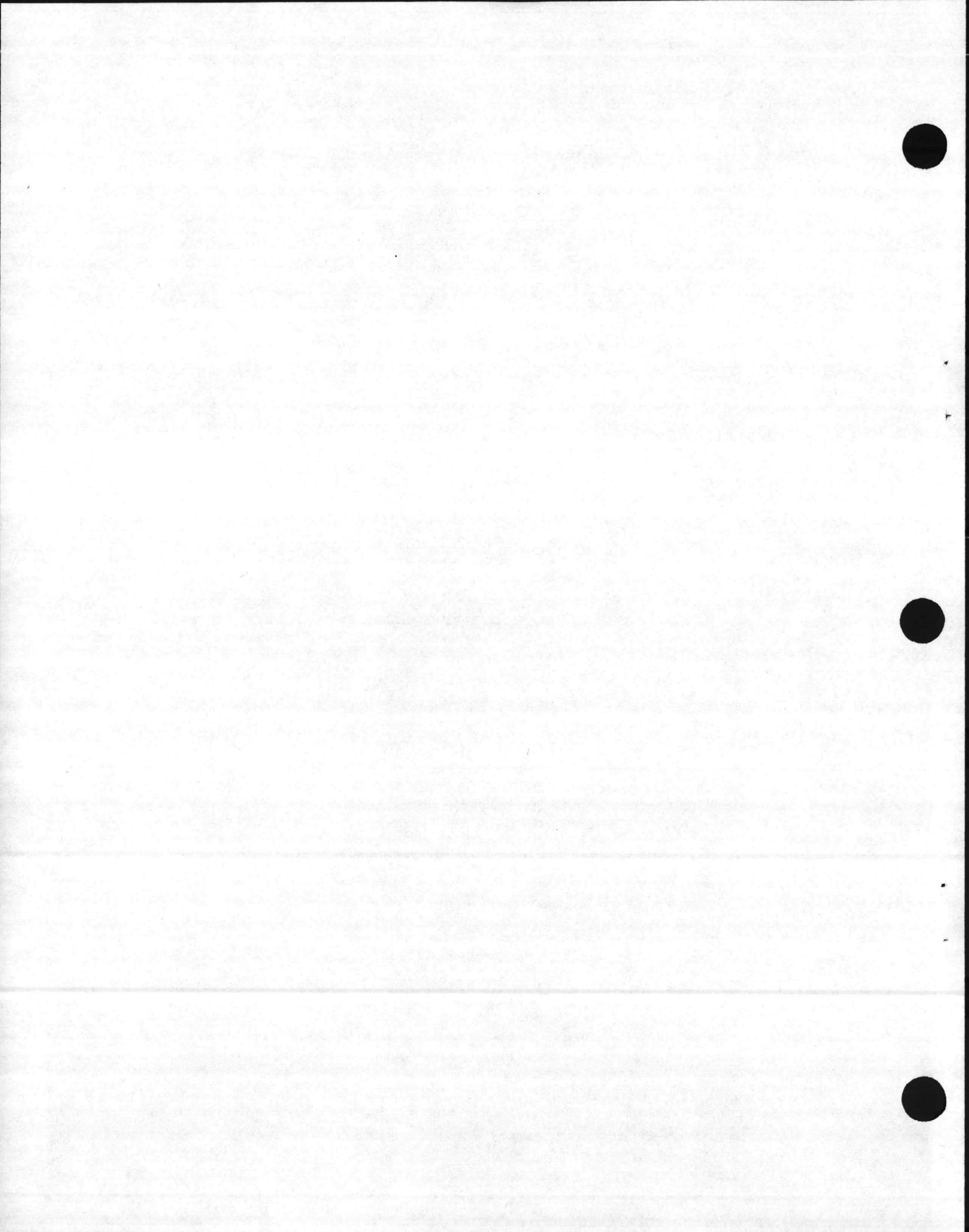
(2) Issue disposition instructions and dispose of accumulated devices in accordance with paragraph 10o, preceding.

e. Commandant of the Marine Corps (Code LMA)

(1) Authorize, upon request, the following:

(a) The surveillance of Marine Corps activities, which use, store, or maintain the devices identified herein, by the ARRCOM radiological protection officer.

(b) The shipment of the devices identified herein to other than U.S. Marine Corps or U.S. Army addressees.



TI-5104-15/2A

(2) Provide policy and technical direction for implement NRC
License No. BML-24-00722-06 within the Marine Corps.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

OFFICIAL

L. CHAKER
Head, Materiel Acquisition Support Branch
Materiel Division
Installations and Logistics Department

* DISTRIBUTION: E plus 7256038, 087, 090/7734 (1)

Copy to: 7000161 (45)
Commander (DRSAR-SF), ARRCOM, Rock Island, Illinois 61299/Commander
(112N), NAVFACENGCMD, 200 Stovall Street, Alexandria, VA 22332/OIC
(113T/RASO), NEESA, Port Hueneme, CA 93043 (2)





DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
WASHINGTON, D.C. 20380-0001

NORMAL

TI-5104-15/2A Ch 4
30 Jun 1994

U.S. MARINE CORPS TECHNICAL INSTRUCTION

SPECIAL HANDLING CONSIDERATIONS

TRITIUM FIRE CONTROL INSTRUMENTS INFANTRY AND ARTILLERY
MARINE CORPS RASP (RADIOLOGICAL AFFAIRS SUPPORT PROGRAM)

-
-
1. Purpose. To direct pen changes to the basic Technical Instruction (TI).
 2. Action. On page 5, paragraph 8, add the following item:
MOUNT TELESCOPE 1240-01-201-8299 88129C

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

OFFICIAL

R. W. PRICE
Deputy Commander
for Logistics Operations
Marine Corps Logistics Bases
Albany, Georgia

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16751198104



TI-5104-15/2A

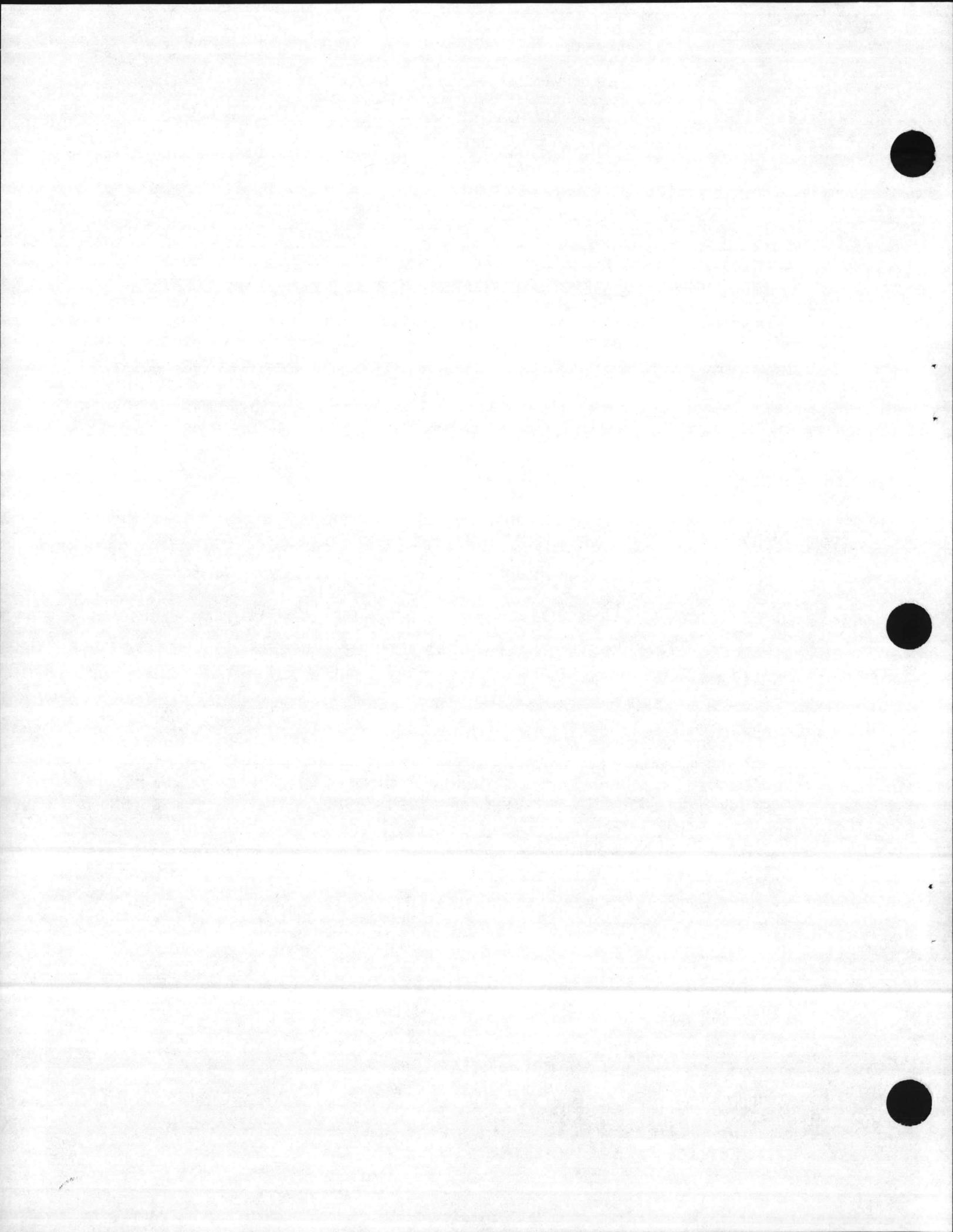
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PCN 167 511981 04





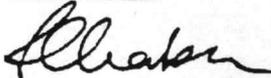




h. On page 1 of enclosure (2) , paragraph 4, line 3, change the words "2 by 10" and "2.63 by 10" to read "2 times 10" and "2.83 times 10", also on line 4, change the words "cubic feet by (12 etc." to read "cubic feet) times (12 etc.".

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

OFFICIAL



L. CHAKER
Head, Materiel Acquisition Support Branch
Materiel Division
Installations and Logistics Department

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(113T/RASO), NEESA, Port Hueneme, CA 93043 (2)





DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
WASHINGTON D.C. 20380

URGENT

TI-5104-15/2A Ch 2
28 Feb 1983

U.S. MARINE CORPS TECHNICAL INSTRUCTION

SPECIAL HANDLING CONSIDERATIONS

TRITIUM FIRE CONTROL INSTRUMENTS INFANTRY AND ARTILLERY
MARINE CORPS RASP (RADIOLOGICAL AFFAIRS SUPPORT PROGRAM)

Encl: (1) New page inserts to TI-5104-15/2A

1. Purpose. To transmit new page inserts to the basic TI.
2. Action. Remove and destroy the present pages 7, 8, 11, 12, 13, and 14 of the basic TI and replace them with the corresponding pages contained in the enclosure hereto.
3. Change Notation. Paragraphs in the enclosure denoted by an asterisk (*) symbol contain changes not previously published.

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

OFFICIAL

L. CHAKER
Head, Materiel Acquisition Support Branch
Materiel Division
Installations and Logistics Department

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Commander (112N), NAVFACENGCMD, 200 Stovall Street, Alexandria,
VA 22332/OIC (113T/RASO), NEESA, Port Hueneme, CA 93043 (2)









DEPARTMENT OF THE NAVY
HEADQUARTERS UNITED STATES MARINE CORPS
WASHINGTON D. C. 20380

URGENT

TI-5104-15/2A Ch 1
7 Apr 1982

U.S. MARINE CORPS TECHNICAL INSTRUCTION

SPECIAL HANDLING CONSIDERATIONS

TRITIUM FIRE CONTROL INSTRUMENTS INFANTRY AND ARTILLERY
MARINE CORPS RASP (RADIOLOGICAL AFFAIRS SUPPORT PROGRAM)

1. Purpose. To direct a pen change to the basic TI.
2. Action. On page 6, paragraph 9a, under the "NSN" column change NSN "1240-01-157-0112" to read "1240-01-057-0112."

BY DIRECTION OF THE COMMANDANT OF THE MARINE CORPS

OFFICIAL

A handwritten signature in cursive script, appearing to read "L. Chaker".

L. CHAKER
Head, Materiel Acquisition Support Branch
Materiel Division
Installations and Logistics Department

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Commander (DRSAR-SP), ARRCOM, Rock Island,
Illinois 61299/Commander (112N), NAVPACENGCOM,
200 Stovall Street, Alexandria, VA 22332/OIC
(113T/RASO), NEESA, Port Hueneme, CA 93043 (2)







IDENTIFICATION OF TRITIUM-CONTAINING RADIOACTIVE DEVICES

INTRODUCTION

Enclosure (1) is organized as follows:

1. Section I lists the major items identified in paragraph 7, preceding, and provides the following information about each:
 - a. The total curies of tritium in each major item.
 - b. The total number of radioactive sources in each major item.
 - c. Radioactive assemblies each major item contains.
 - d. The source, maintenance, and recoverability code (SMRC) for each radioactive assembly.
2. Section IX lists the radioactive assemblies identified in section I in NSN sequence and provides the following information about each:
 - a. The total curies of tritium in each radioactive assembly.
 - b. The total number of radioactive sources in each radioactive assembly.
 - c. The "Part of" column relates the radioactive assembly back to the major item listed in section I.
 - d. Radioactive subassemblies of the radioactive assembly.
 - e. The SMRC for each radioactive subassembly.
3. Section III lists the radioactive subassemblies identified in section II, lists the radioactive repair parts identified in section III in NSN sequence, and provides the following information about each:
 - a. The total curies of tritium in each radioactive subassembly.
 - b. The total number of radioactive sources in each radioactive subassembly.
 - c. The "Part of" column relates the radioactive subassembly or radioactive repair part back to the radioactive assembly identified in section II or the radioactive subassembly listed elsewhere in section 111.
 - d. Radioactive repair parts of the radioactive subassembly. These radioactive repair parts are also listed in section 111 rather than create a section IV.
 - e. The SMRC for each radioactive repair part.

ENCLOSURE (1)



Section I: Major Items With Radioactive Assemblies

<u>NSN</u>	<u>Major Item Nomenclature</u>	<u>Total Curies Per Item</u>	<u>Number of Sources Per Item</u>	<u>SMRC</u>	<u>Radioactive Assemblies</u>
1010-01-020-5626	MORTAR, 60mm, Lightweight, Company, M224	36.89	19		
1010-01-043-2050				PCOFA	HANDLE AND FIRING ASSEMBLY/M225
1240-01-050-5588				PCOHL	MOUNT, Telescope/M64
1240-01-051-3657				PCOZA	TELESCOPE, Elbow/M64
1290-00-169-1934				PCOZA	M58 (2 Each Per M224)
1290-00-169-1935				PCOZA	M59
<hr/>					
1025-01-026-6648	HOWITZER, Medium, Towed, 155mm, M198	34.485	28		
1240-01-038-0530				PCOLL	M138
1240-01-038-0531				PCOLL	M137
1240-01-039-7273				PCFLL	M171
1290-00-169-1934				PCOZA	M58
1290-00-169-1935				PCOZA	M59
1290-01-037-3883				PCOLL	M17
1290-01-037-7289				PCOLL	M18
4931-01-048-5834				PCOZA	M139
<hr/>					
1240-00-332-1780	COLLIMATOR, Infinity Aiming Reference (Radioactive), M1A1	10	1		
1240-01-079-545J				PCOZA	RETICLE CELL ASSEMBLY



<u>NSN</u>	<u>Major Item Nomenclature</u>	<u>Total Curies Per Item</u>	<u>Number of Sources Per Item</u>	<u>SMRC</u>	<u>Radioactive Assemblies</u>
1290-00-169-1937	QUADRANT, Fire Control (Gunners), W/E, M1A2	0.075	1		
1290-00-257-2769				PCOZA	VIAL, Level
2350-01-031-8851	HOWITZER, Medium, Self-Propelled, 155mm, M109A3	3	1		
5931-00-341-5119				PCOZA	M140

ENCLOSURE (1)
3

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Section 11: Radioactive Assemblies and Their Radioactive Subassemblies

<u>NSN</u>	<u>Radioactive Assembly Nomenclature</u>	<u>Total Curies Per Assembly</u>	<u>Total Sources Per Assembly</u>	<u>Part of</u>	<u>SMRC</u>	<u>Radioactive Subassemblies</u>
1010-01-043-2050	HANDLE AND FIRING ASSEMBLY/M225	3.2	4	M224		
1010-01-046-8398					PCDZA	RANGE INDICATOR
1240-01-038-0530	TELESCOPE, Elbow, M138	4.4	2	M198		
1240-01-048-0779					PCDLL	CELL ASSEMBLY, Reticle
1240-01-038-0531	TELESCOPE, Panoramic, M137	5.1	10	M198		
1240-01-062-8264					PCHLL	BODY ASSEMBLY
1240-01-144-6915					PCHLL	COUNTER BOX ASSEMBLY
1240-01-039-7273	MOUNT, Telescope and Quadrant, M171	0.15	2	M198		
1290-00-257-2769					PCHZA	VIAL, Level
1240-01-050-5588	MOUNT, Telescope/M64	5.06	9	M224		
1240-01-053-3354					PCHDL	SCALE, Indicating
1240-01-057-0112					PCHDA	LEVEL, Fire Control Potted Assembly (2 each)
6260-01-053-3356					PCDDL	INDEX, Nuclear
1240-01-051-8472					PCHDL	LAMP UNIT, Radioluminous
6260-01-056-2883					PCDLL	LAMP, Nuclear Radioluminous
5355-01-051-6448					PCHDL	DIAL CONTROL

4 ENCLOSURE (1)

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<u>NSN</u>	<u>Radioactive Assembly Nomenclature</u>	<u>Total Curies Per Assembly</u>	<u>Total Sources Per Assembly</u>	<u>Part of</u>	<u>SMRC</u>	<u>Radioactive Subassemblies</u>
1240-01-051-3657	TELESCOPE, Elbow, M64	1.6	2	M224		No Marine Corps replaceable radioactive subassemblies
1290-00-169-1934	LIGHT, Aiming Post, M58	9	1	M198 and M224		No Marine Corps replaceable radioactive subassemblies
1290-00-169-1935	LIGHT, Aiming Post, M59	9	1	M198 and M224		No Marine Corps replaceable radioactive subassemblies
1290-01-037-3883	QUADRANT, Fire Control, M17	1.875	5	M198		
1290-01-048-0193					PCHLL	LEVEL ASSEMBLY
1290-01-043-8209					PCDZA	LAMP ASSEMBLY (4 Each)
1290-01-037-7289	Quadrant, Fire Control, M18	1.95	6	M198		
1290-01-046-3687					PCHLL	LEVEL ASSEMBLY
1290-01-048-0193					PCHLL	LEVEL ASSEMBLY
1290-01-043-8209					PCDZA	LAMP ASSEMBLY
4931-00-341-5119	ALIGNMENT DEVICE, M140	3	1	M109A3		No Marine Corps replaceable radioactive subassemblies
4931-01-048-5834	ALIGNMENT DEVICE, M139	3	1	M198		No Marine Corps replaceable radioactive subassemblies

ENCLOSURE (1)

5

Change 3

TI-5104-15/2A



Section III: Radioactive Subassemblies and Their Radioactive Repair Parts

<u>NSN</u>	<u>Radioactive Subassemblies Nomenclature</u>	<u>Total Curies Per Sub-Assembly</u>	<u>Total Sources Per Sub-Assembly</u>	<u>Part of</u>	<u>SMRC</u>	<u>Radioactive Repair Part</u>
1240-01-079-5453	RETICLE CELL ASSEMBLY	10	1	M1A1		No Marine Corps replaceable radioactive subassemblies
1010-01-046-8398	RANGE INDICATOR HANDLE AND FIRING ASSEMBLY	3.2	4	M225		No Marine Corps replaceable radioactive repair part
1240-01-043-9463	OBJECTIVE AND RETICLE ASSEMBLY	2.4	4	Body Assembly/ M137		
6260-01-051-9606					PCDZA	LAMP, Nuclear
1240-01-048-0779	CELL ASSEMBLY, RETICLE	4.4	2	M138		
6260-01-048-0694					PCDZA	LAMP, Nuclear (2 each)
1240-01-051-8472	LAMP UNIT, Radioluminous	0.70	1	MOUNT, Telescope/ M64		No Marine Corps replaceable radioactive repair part
1240-01-053-3354	SCALE, Indicating	1.2	1	MOUNT, Telescope/ M64		No Marine Corps replaceable radioactive repair part
1240-01-057-0112	LEVEL, Fire Control Potted Assembly	0.05	1	MOUNT, Telescope/ M64		No Marine Corps replaceable radioactive repair part
1240-01-062-8264	BODY ASSEMBLY	2.4	4	M137		
1240-01-043-9463					PCDLL	OBJECTIVE AND RETICLE



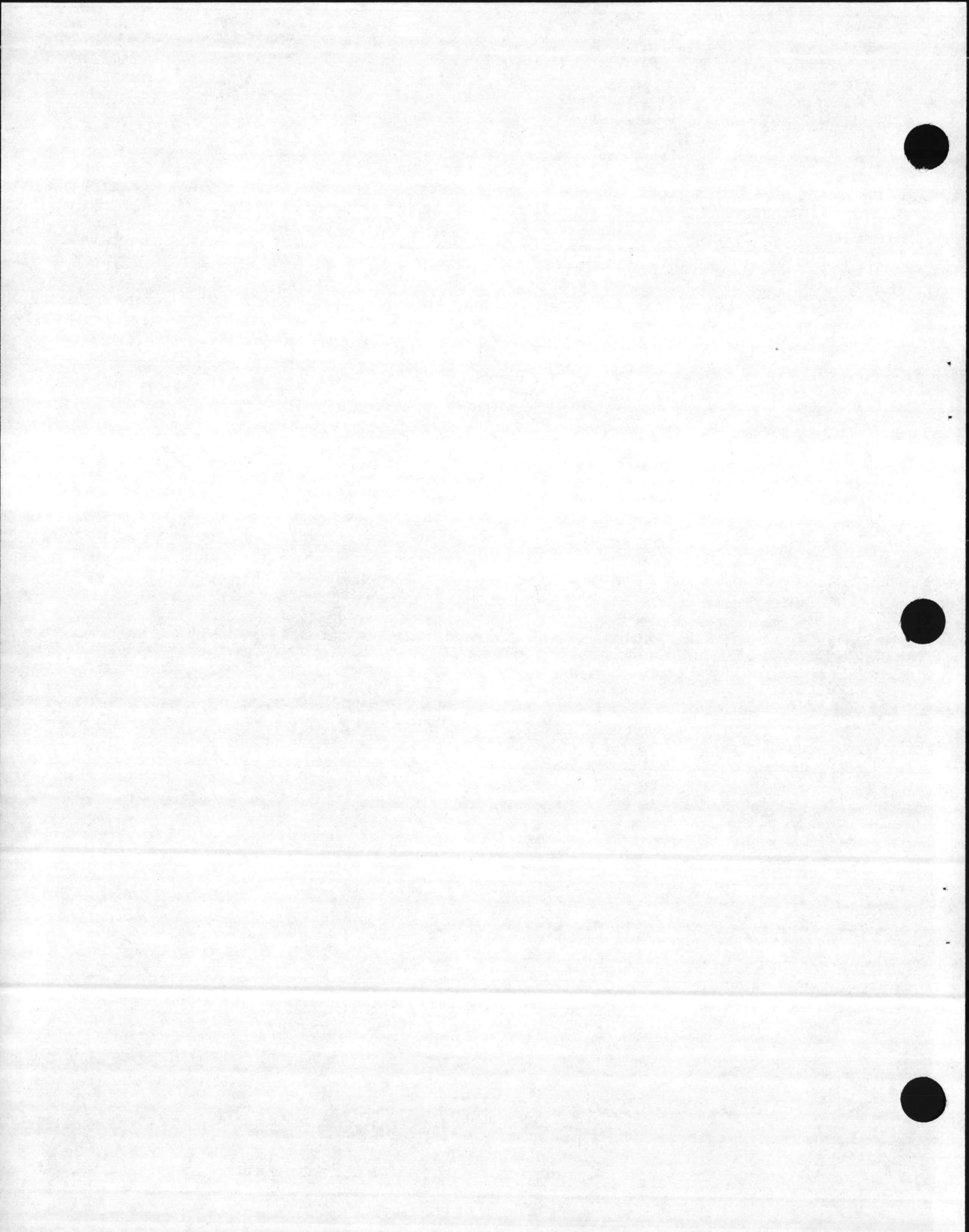
<u>NSN</u>	<u>Radioactive Subassemblies Nomenclature</u>	<u>Total Curies Per Sub-Assembly</u>	<u>Total Sources Per Sub-Assembly</u>	<u>Part of</u>	<u>SMRC</u>	<u>Radioactive Repair Part</u>
1240-01-144-6915	COUNTER BOX ASSEMBLY	2.7	6	M137		
1290-01-043-8209					PCDZA	LAMP, Nuclear Assembly (6 Each)
1290-00-257-2769	VIAL, Level, Potted 1/ MIA2 - M171 (2 each) LEVEL ASSEMBLY (NSN 1290-01-048-0193)/M17&M18 LEVEL ASSEMBLY (NSN 1290-01-046-3687)/M18	0.075	1	1/		No Marine Corps replaceable radioactive repair parts
1290-01-046-3687	LEVEL ASSEMBLY	0.075	1	M18		
1290-00-257-2769	PCHZA VIAL, level					
1290-01-048-0193	LEVEL ASSEMBLY	0.075	1	M17 and M18		
1290-00-257-2769					PCHZA	VIAL, Level
5355-01-053-6448	DIAL CONTROL	2.0	2	MOUNT, Telescope/M64		No Marine Corps replaceable radioactive repair parts
6260-01-053-3356	INDEX, Nuclear	0.03	1	MOUNT, Telescope/M64		No Marine Corps replaceable radioactive repair parts
6260-01-056-2883	LAMP, Nuclear Radioluminous	1.0	1	MOUNT, Telescope/M64		No Marine Corps replaceable radioactive repair parts

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ENCLOSURE (1)

TI-5104-15/2A







TRITIUM STORAGE LIMITATION ASSESSMENT

1. The tritium containing source's procurement specifications, permit a leak rate of 0.030 uCi per day per source.
2. The MPC (maximum permissible concentration) for tritium for unrestricted areas is 2 times 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 one-half 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:

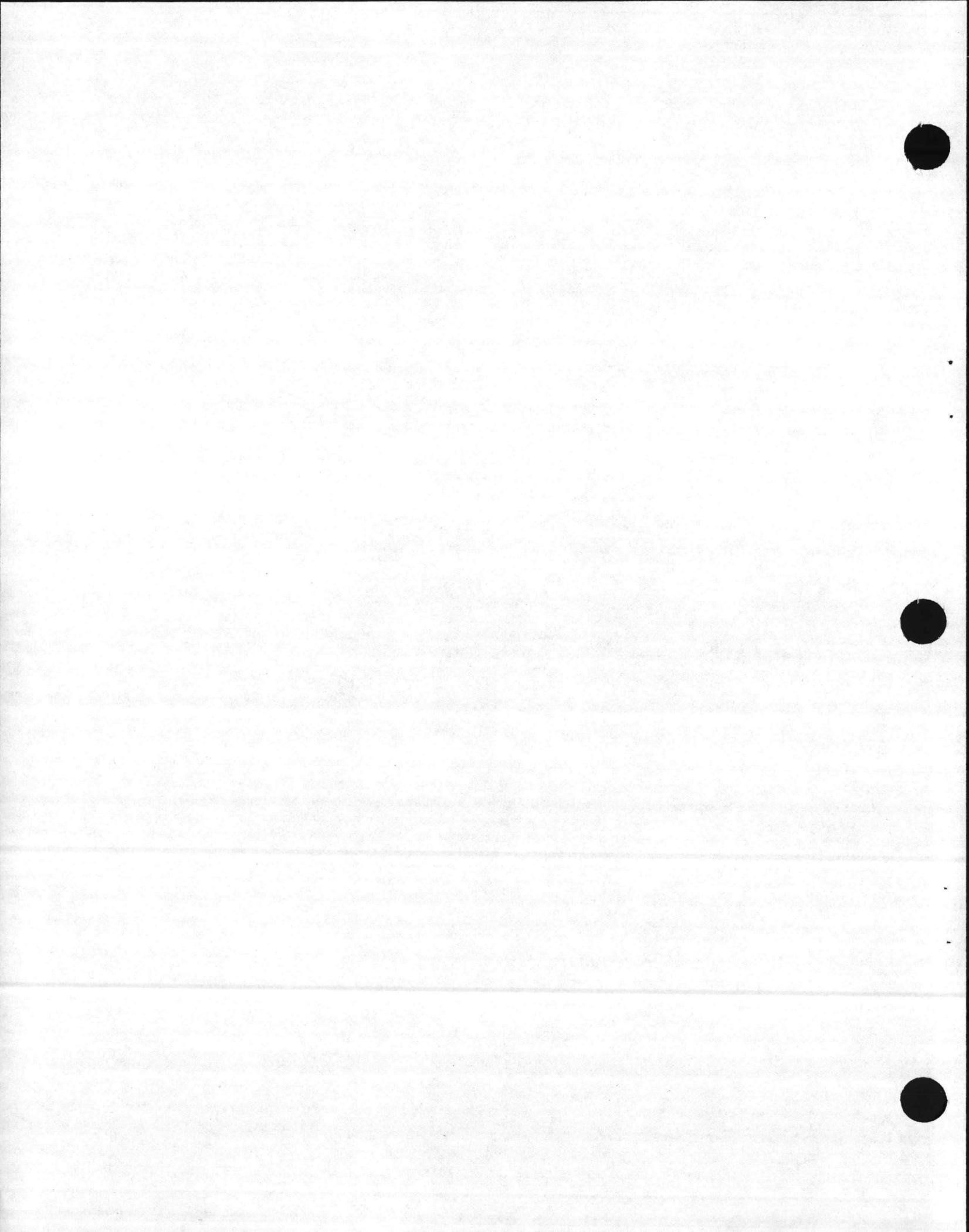
$$\frac{\text{(MPC)} \times \text{(conversion factor for ml/cubic ft)} \times \text{(number of air changes/day)}}{\text{(permissible leak rate/source/day)}} = \frac{(2 \times 10^{-7} \text{ uCi/ml}) \times (2.83 \times 10^{-3} \text{ ml/1,000 cubic feet}) \times (12 \text{ air changes/day})}{(0.03 \text{ uCi/source/day})} = 2,264 \text{ sources/1,000 cubic feet.}$$
5. It is unlikely that this limit will ever be exceeded because of the physical size of the instrument 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.

ENCLOSURE (2)

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Change 3







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:

$$\bar{X}(x,0) = \frac{Q}{(3.14)c \sqrt{x}^{2-n}}$$

x = Range in meters (see paragraph 3).

\bar{X} = Volumetric concentration of the contaminant in uCi per cubic M (meter).

$x,0$ = 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 $Q = 1,000 \text{ Ci}/60 \text{ min} = 16.67 \text{ Ci}/\text{min} = 277.0 \text{ mCi}/\text{sec}$.

c = Virtual diffusion coefficients in lateral and vertical directions = $0.4 \frac{1}{\text{sec}}$

n = dimensionless parameter determined by the atmospheric stability = $0.24 \frac{1}{\text{sec}}$

3. Assuming a mean wind speed of 10 m/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 (uCi/Cubic M)</u>
100	2,000
500	120
1,000	30

4. The maximum hazard to man would result only in the event of the fire converting all of the tritium to tritium oxide. The average man, while



TI-5104-15/2A

performing lightwork, breathes 1,200 liters (1.2 cubic meters) of air per hour, thus the maximum tritium intake at the above ranges for a 1-hour stay time would be as follows:

<u>Range (Meters)</u>	<u>H-3 Intake for a Standard Man in uCi for a 1 Hour Stay Time</u>
100	2,400 <u>2/</u>
500	140
1,000	40

5. Therefore it shall be standard practice for all Marine Corps activities to require evacuation of personnel to an upwind area in case of fire involving tritium illuminated devices

6. Based on the preceding calculations, the maximum quantity of tritium, permitted in any Marine Corps storage area, will be 1,000 curies or 2,264 sources, whichever is reached first.

- 1/ For a lapse metrological condition, refer to M.E. Smith and I.A. Singer. , An Ind Hyg. Assoc., Quart. 18, 319 (1957).
- 2/ This exceeds the maximum permissible body burden for tritium oxide which is 2,000 uCi.

ENCLOSURE (3)



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 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/women 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 a 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:

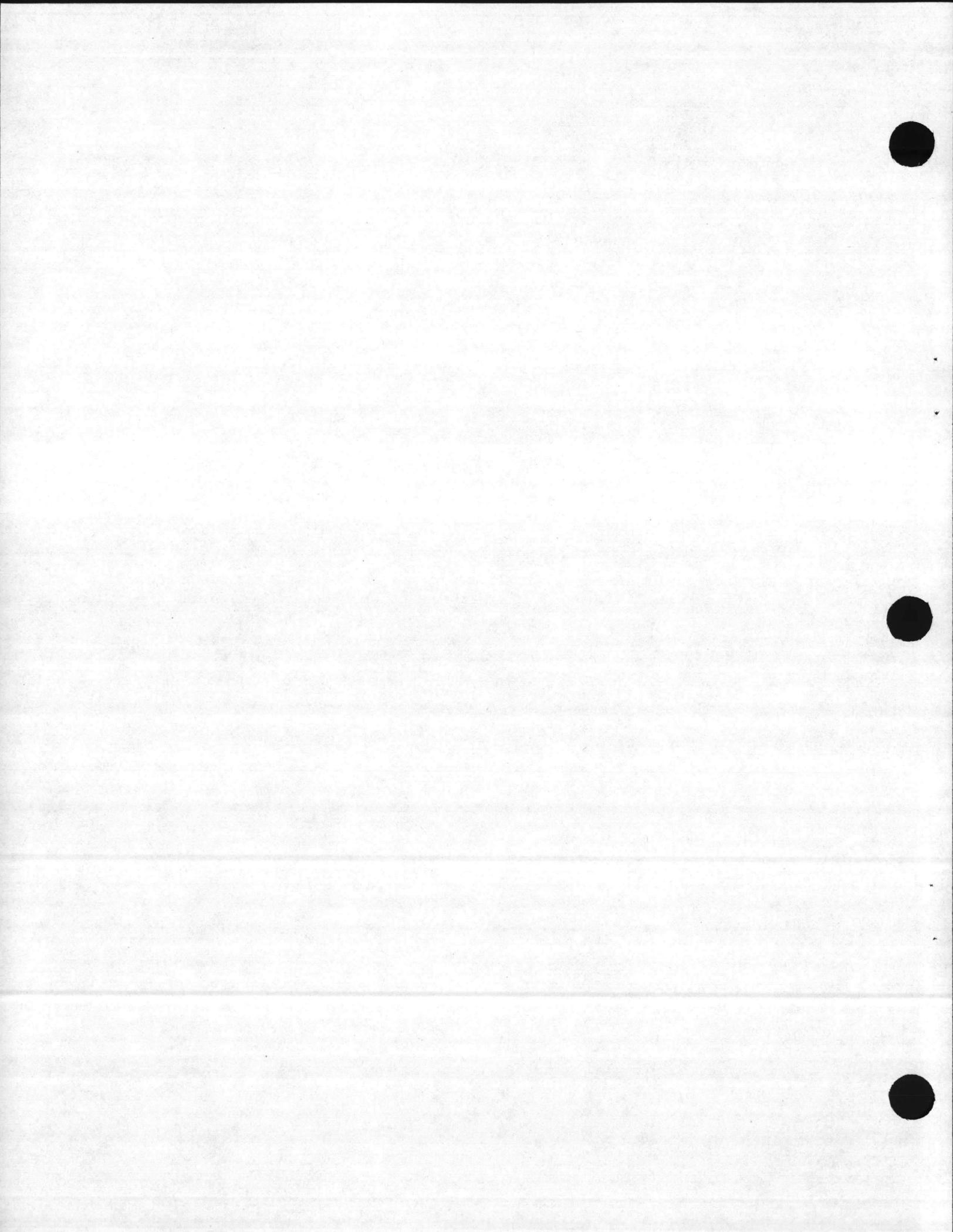
Intake = 2.27 uCi by 20 liters/minute by 10 minutes
= 454 uCi tritiated water.
= Less than 1/4 maximum permissible body burden
for continuous exposure.

ENCLOSURE (4)

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MINIMUM INDIVIDUAL TRAINING

1. All personnel that operate, handle, and/or maintain these devices must be familiar with the contents of this enclosure 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 leas of illumination.

b. Federal Law. Tampering with or removal of the sources is prohibited by Federal law.

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

d. Safety Precaution. 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.

2. Instructions

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

b. If you are cut by glass from a broken source, seek first aid from qualified medical personnel immediately and report the accident to the RSO as soon as possible.

c. Do not attempt to remove or replace sources.

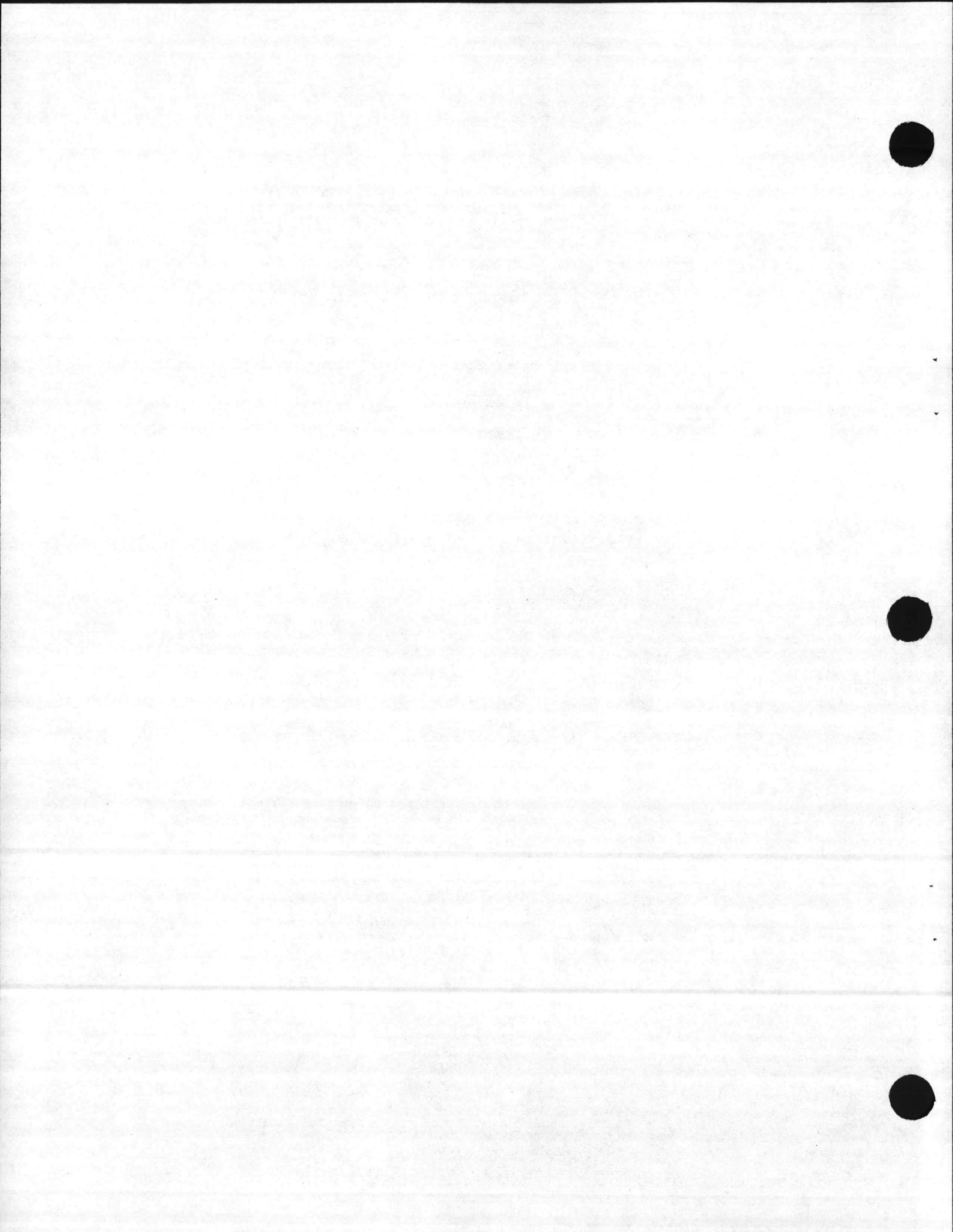
d. If skin contact is made with any area suspected to be contaminated with tritium, immediately wash with nonabrasive mild soap and water.

e. If a tritium-containing source is broken, open doors or windows (if inside) and evacuate the room or area for 1/2 hour.

f. Double wrap defective devices in two plastic bags as soon as possible and pack in the shipping container from which the replacement was taken before evacuation to a higher echelon.

g. Devices with defective sources shall be evacuated to depot level maintenance for repair and decontamination.

ENCLOSURE (5)



h. Do not deface or remove radioactive warning labels. Replace them immediately when necessary.

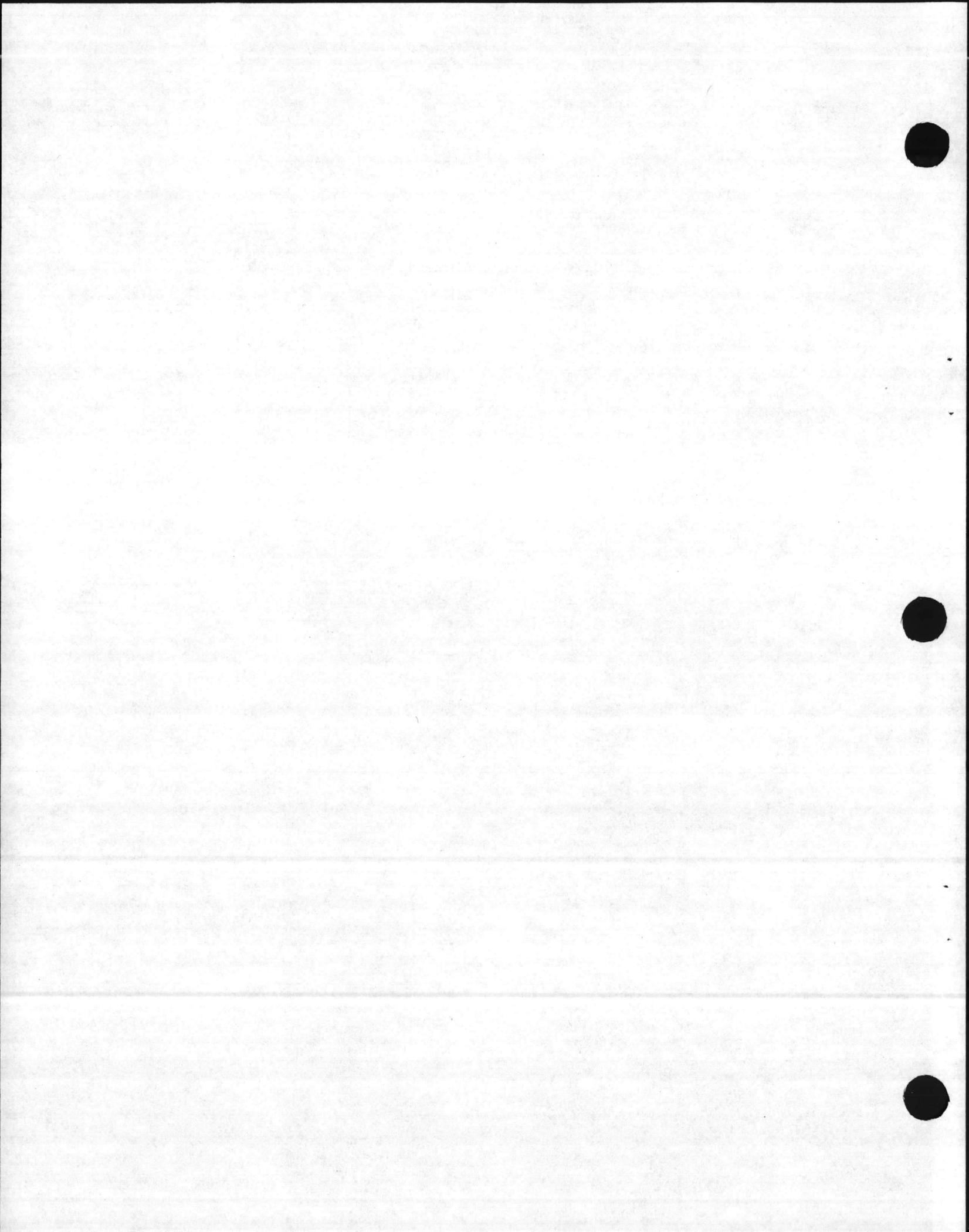
i. Follow safety procedures for your operation in accordance with this TI and local regulations.

3. Responsibilities. Individual Marines and civilian Marine Corps employees who work with or around ionizing sources are responsible for:

a. Knowing and following procedures, rules, and special instructions as set forth in this TI and applicable technical manuals.

b. Using safety equipment properly.

c. Reporting to the supervisor any incident, personnel injury however slight, suspected overexposure, and/or suspected internal deposition, as soon as possible after the occurrence.



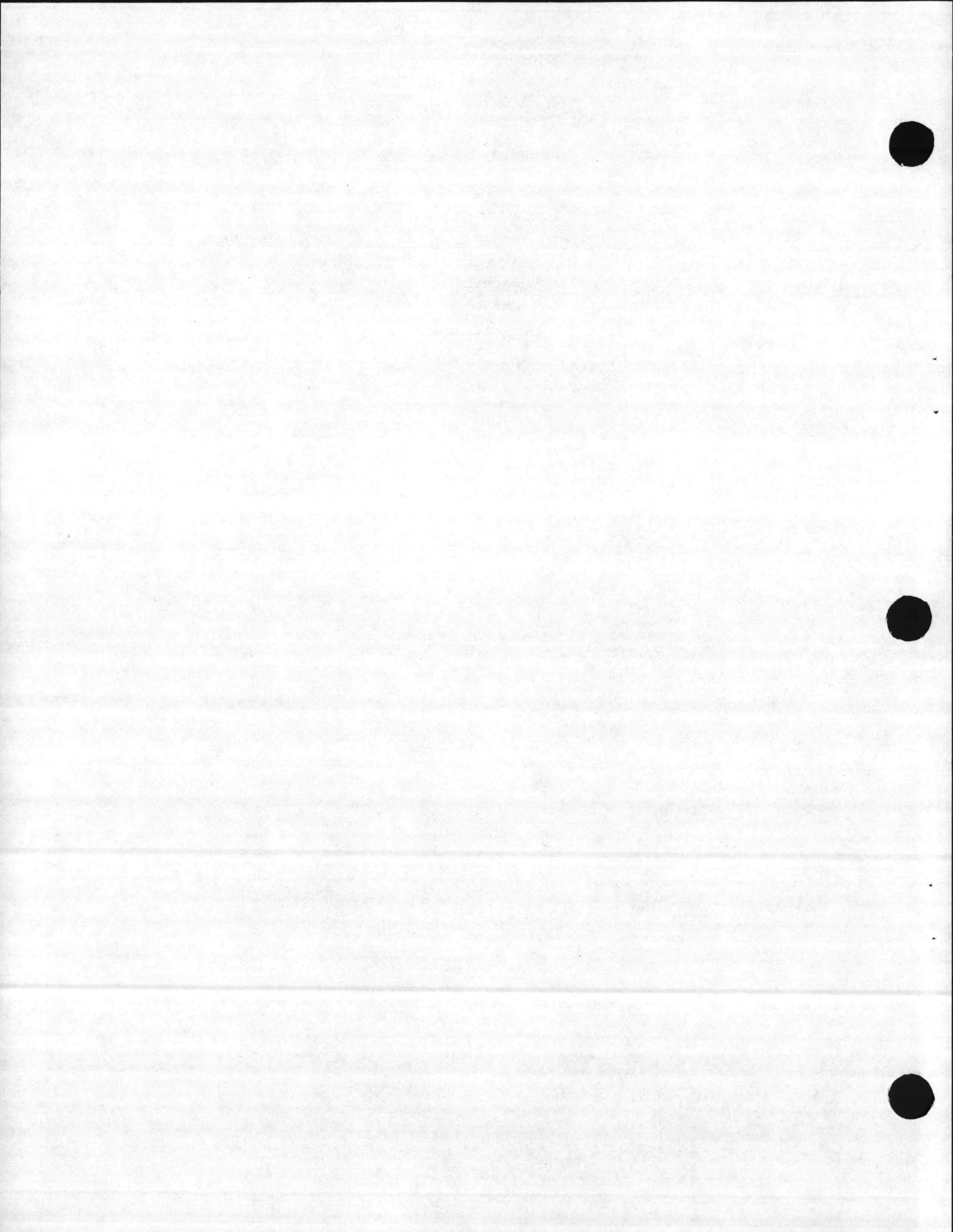
ACTIVITIES AUTHORIZED TO PERFORM DEPOT LEVEL
MAINTENANCE ON AND DISPOSAL OF DEVICES

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.

ENCLOSURE (6)

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SHIPPING DATA REQUIREMENTS FOR SELECTED TRITIUM-CONTAINING DEVICES

1. Section I contains the guide sheet which explains the line numbers listed on the data sheets.
2. Section II contains the data sheets, which are in NSN sequence.

Section 1: Guide Sheet of Data Requirements for Radioactive Shipments

<u>Line No.</u>	<u>Data Information Provided</u>
1	Proper shipping name (49 CFR 172.101).
2	Hazard classification (49 CFR 172.101).
3	Pieces, weight, cube (49 CFR 172.202).
4	Type Of packaging (49 CFR 172.202).
5	Name of radioactive material as listed in 49 CFR 173.390 (49 CFR 172.303).
6	Description of chemical and physical form (49 CFR 172.203).
7	Specific activity (curies, millicuries or microcuries) (49 CFR 172.203).
8	Type label (49 CFR 172.203).
9	Transport index: radioactive yellow II or yellow III labels (49 CFR 172.203).
10	"Fissile exempt" in accordance with 49 CFR 173.396 (if applicable) (49 CFR 172.203).
11	Fissile class I, II, or III (if applicable) (49 CFR 172.203).
	NOTES : The following additional markings on the shipping papers for fissile classes II and III are required. See 49 CFR 172.203 [VI(c) (d)].
	U.S. Nuclear Regulatory Commission Packaging approval (if applicable) (49 CFR 172.203).
	IAEA (International Atomic Energy Agency) Certificate (if applicable) (49 CFR 172.203).
12	Department of Transportation exemption (if applicable) (49 CFR 172.203).
13	Indicate "IMCO Class 7" (MILSTAMP requirement).
14	Transport group MSC (Military Sealift Command) requirement.
15	Nuclear Regulatory Commission license number (if applicable) (MSC requirement).
16	Net weight of radioactive materiel (MSC requirement).

ENCLOSURE, (7)

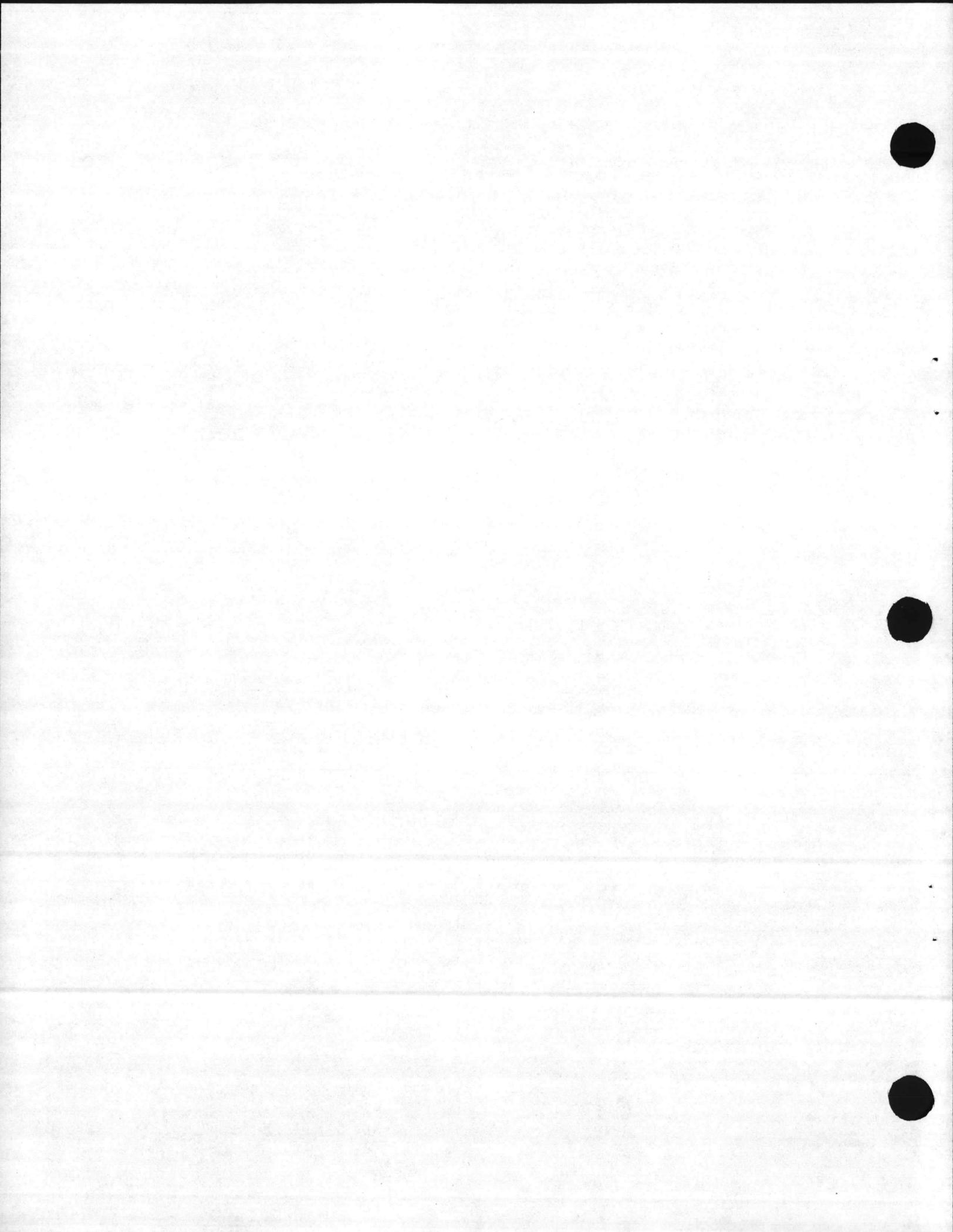


Line No.

Data Information on Provided

- 17 Level of radiation at sur face of package (MSC requirement)
- 16 Level of radiation at one meter from package (MSO requirement) .
- 19 Common commodity name of end item which contains radioactive material; e.g. , radio tube, compass, electronic instrument, timepiece etc. (MSO requirement).

ENCLOSURE (7)



Section II: Data Requirement for Radioactive Shipments

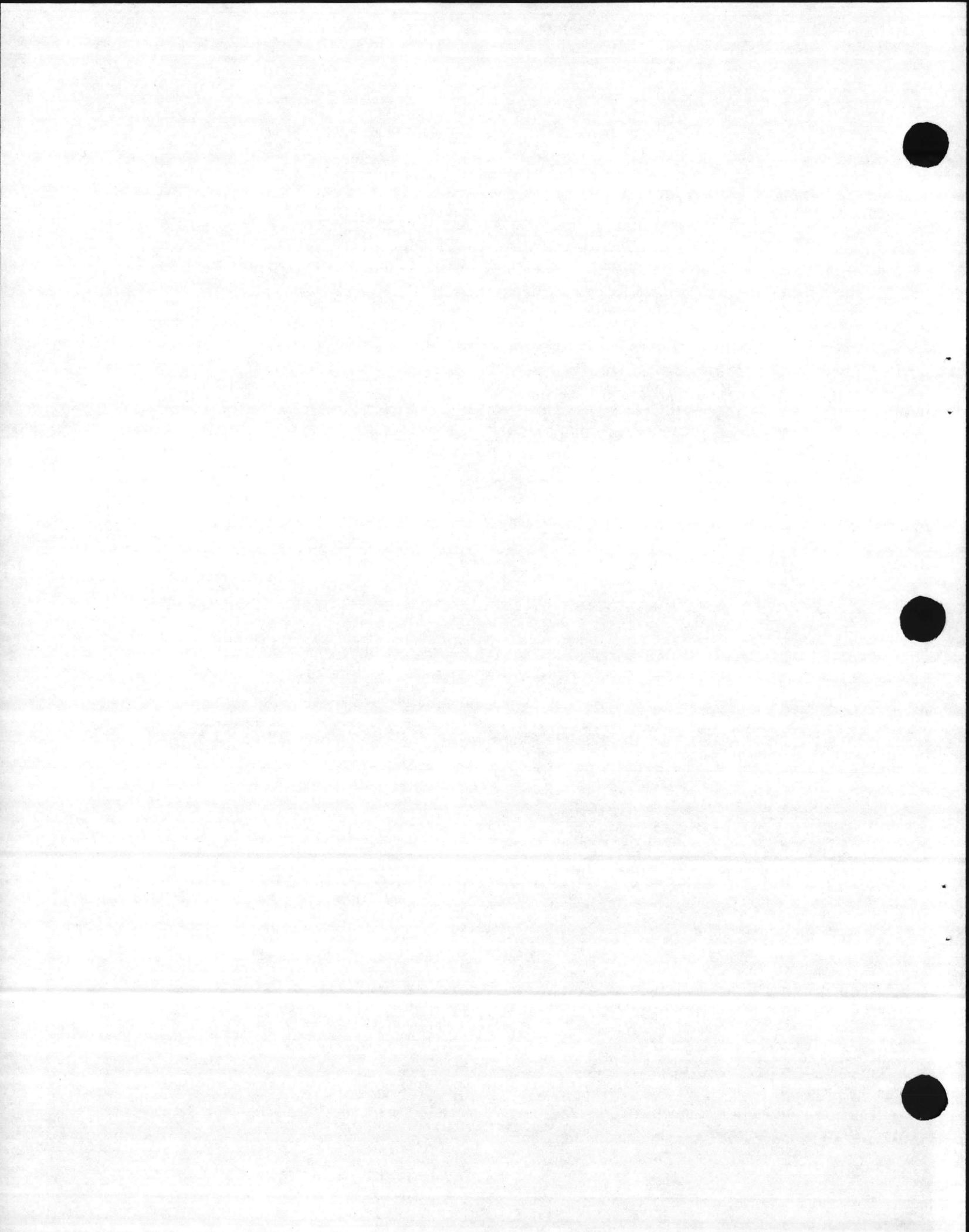
Item name: Range Indicator Handle Assembly (NSN 1010-01-043-2050)

1. Radioactive device, n.o.s.
2. Radioactive material.
3. Dimensions approximately 10 inches by 2 inches by 1/2 inch. Radioactive material composed of four sources for a total activity of 3.2 curies.
4. Fiberboard container with cushioned interior.
5. H-3.
6. Gas sealed in pyrex glass containers.
7. 3.2 curies total (four sources).
8. Shipment of individual item requires no label per 49 CFR 173.391(b). More than 62 items shipped as one package will require a radioactive white I label.
9. through 13. N/A (not applicable).
14. VII.
15. BML 12-00722-06.
16. N/A.
17. 0.
18. 0.
19. Mortar, M224.

Item name: Infinity collimator, M1A1 (NSN 1240-00-332-1780)

1. Radioactive device, n.o.s.
2. Radioactive material.
3. Dimensions approximately 30 inches by 9 inches in diameter. Radioactive material composed of one source of 10 curie activity.
4. Metal case contained in fiberboard container.
5. H-3 .
6. Gas sealed in pyrex glass ampoule.
7. 10.0 curies (one source).
8. Shipment of individual item requires no label per 49 CFR 173.391(b). Here than 20 items shipped as one package will require a radioactive white I label.
9. through 13. N/A.

ENCLOSURE (7)



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14. VII.
15. BMI 12-00722-06.
16. N/A.
17. 0.
18. 0.
19. Separate TAM item used with towed and self-propelled artillery.

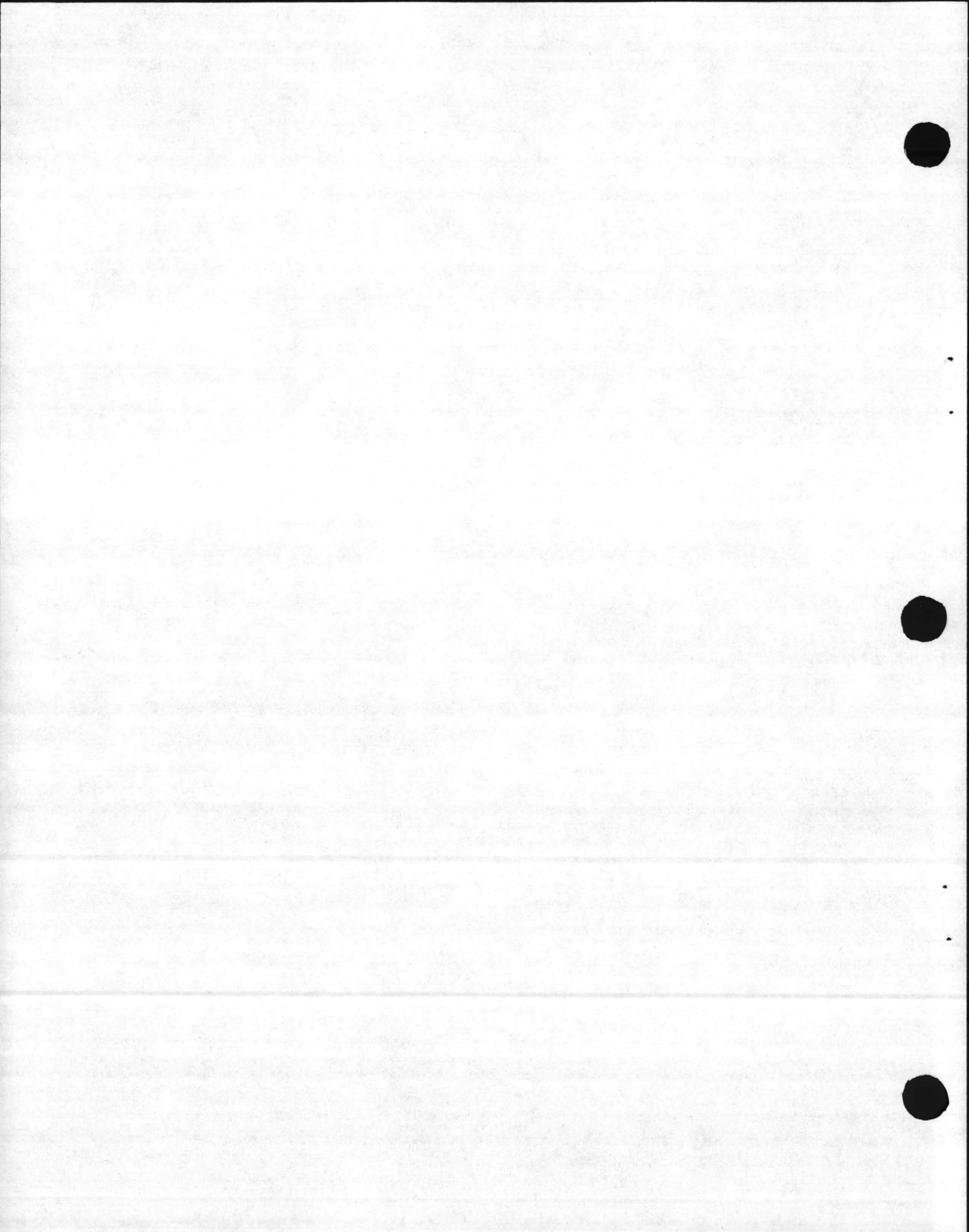
Item name: Elbow Telescope, M138 (NSN 1240-01-038-0530)

1. Radioactive device, n.o.s.
2. Radioactive material.
3. Dimensions approximately 15-1/4 inches by 7-3/4 inches by 7-3/4 inches: weight is 8 pounds. Radioactive material composed of two sources of 4.4 curies activity.
4. Fiberboard container with cushioned interior.
5. H-3.
6. Gas sealed in pyrex glass ampoule.
7. 4.4 curies (two sources): 2.2 curies each.
8. Shipment of individual item requires no label per 49 CFR 173.391(b). More than 45 items shipped as one package will require a radioactive white I label.
9. through 13. N/A
14. VII.
15. BML 12-00722-06.
16. N/A.
17. 0.
18. 0.
19. M198 Howitzer.

Item name: Panoramic Telescope, M137 (NSN 1240-01-038-0531)

1. Radioactive device, n.o.s.
2. Radioactive material.
3. Dimensions are approximately 10 inches by 8-1/2 inches by 16-3/4 inches: weight is 16-5/8 pounds. Radioactive material Composed of 10 sources with a total activity of 5.1 curies.
4. Fiberboard container with cushioned interior.

ENCLOSURE (7)

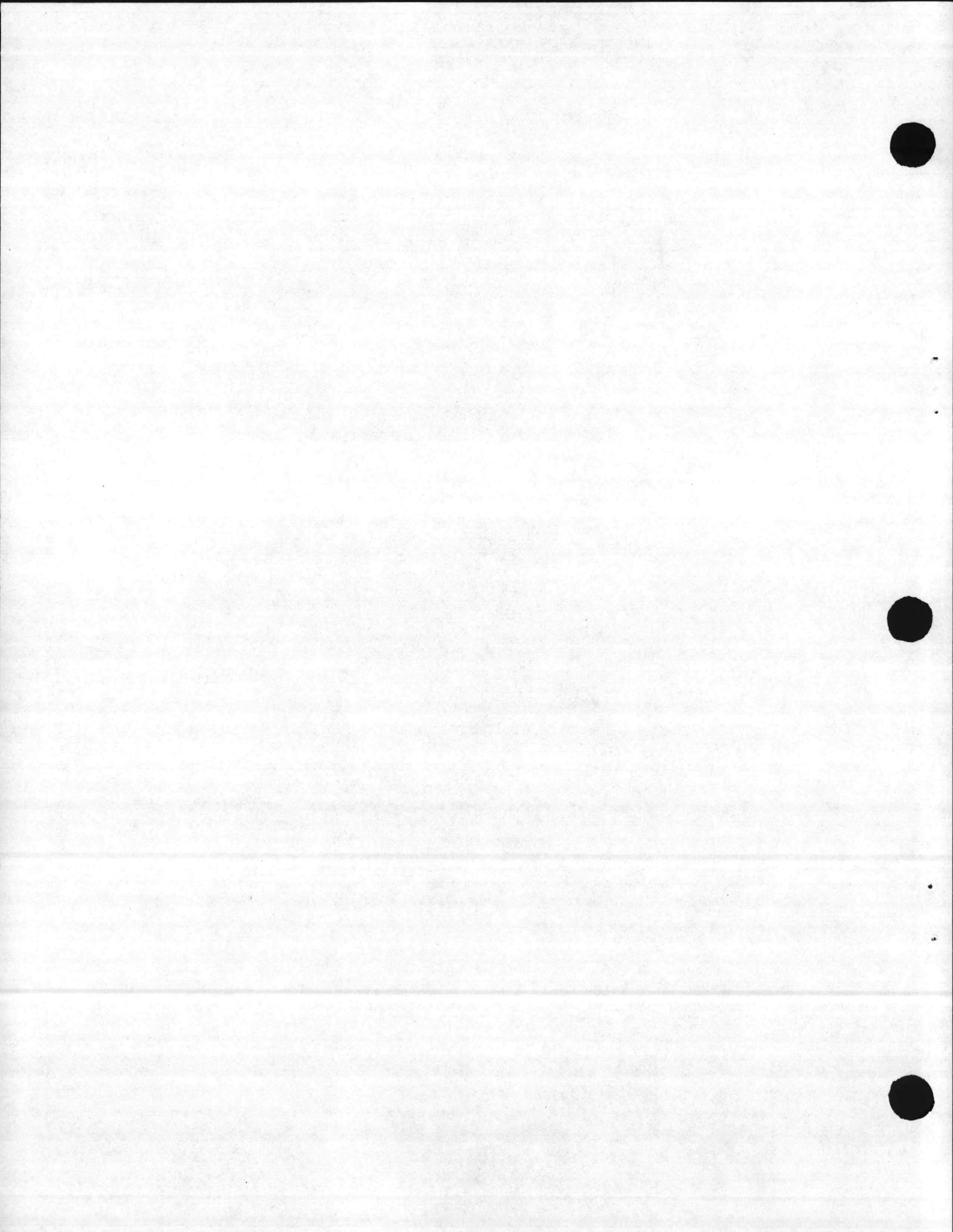


5. H-3.
6. Gas sealed in pyrex glass ampoule.
7. 5.1 curies total (10 sources): 6-0.45 curies each, 4-0.6 curies each.
8. shipment of individual item requires no label per 49 CFR 173.391(b). More than 39 items shipped as one package will require a radioactive white I label.
9. through 13. N/A.
14. VII.
15. BML 12-00722-06.
16. N/A.
17. O.
18. O.
19. M198 Howitzer.

Item name: Mount Telescope, M171 (NSN 1240-01-039-7273)

1. Radioactive device, n.o.s.
2. Radioactive material.
3. Dimensions approximately 12-1/4 inches by 11-3/8 inches by 24-1/8 inches: weight is 75 pounds. Radioactive material composed of two sources with a total activity of 0.15 curies.
4. Fiberboard container with cushioned interior.
5. H-3.
6. Gas sealed in pyrex glass containers.
7. 0.15 curie total (two sources): 0.075 curie each.
8. Shipment of individual item requires no label per 49 CFR 173.391(b). More than 1,333 items shipped as one package will require a radioactive white I label.
9. through 13. N/A.
14. VII.
15. BML 12-00722-06.
16. N/A.
17. O.
18. O.
19. M198 Howitzer.

ENCLOSURE (7)



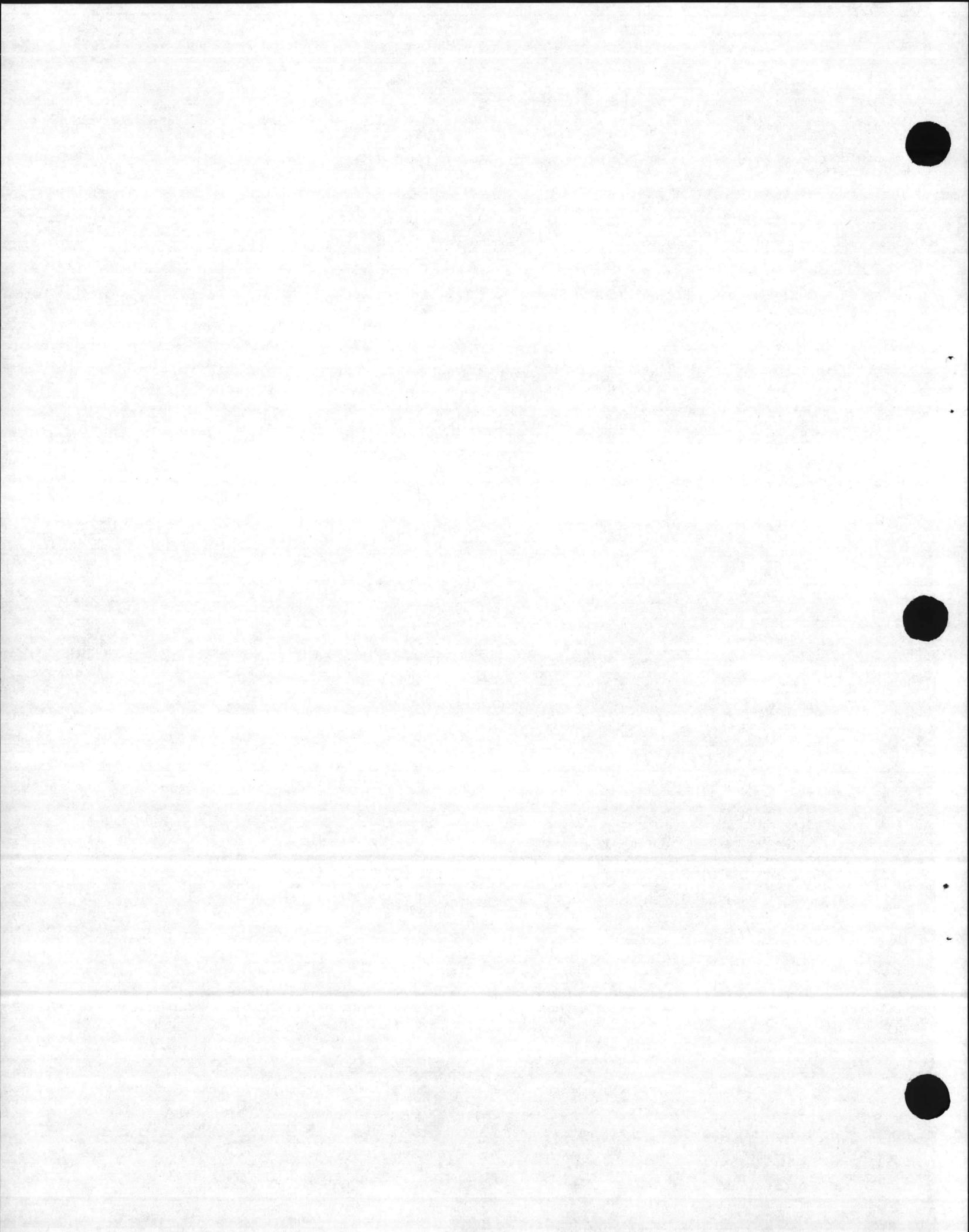
Item Name: Sight Unit, M64: PN (Part number) 11741726, consists of:
Mount, Telescope, M64 (NSN 1240-01-050-5508)
Telescope, Elbow, M64 (NSS 1240-01-051-8657)

1. Radioactive device, n.o.s.
2. Radioactive material.
3. Dimensions approximately 12 inches by 12 inches by 15 inches; weight is 2 - 1/2 pounds. Radioactive material composed of 12 sources for total activity of 6.69 curies.
4. Fiberboard container with cushioned interior.
5. H-3.
6. Gas sealed in pyrex glass containers.
7. 6.69 curies total (12 sources): 1-1.2 curie, 3-1 curie, 1-0.7 curie, 3-0.03 curie, 2-0.05 curie, 2-0.0 curie each.
8. Shipment of individual item requires no label per 49 CFR 173.391(b). More than 29 items shipped as one package will require a radioactive white I label.
9. through 13. N/A.
14. VII.
15. BML 12-00722-06.
16. N/A.
17. 0.
18. 0.
19. Mortar, M224.

Item Name: Light, Aiming Post, M58 (NSN 1290-00-169-1934)
Light, Aiming Post, M59 (NSN 1290-00-169-1935)

1. Radioactive device. n.o.s.
2. Radioactive material.
3. Dimensions are approximately 6 inches by 2 inches by 2 inches. Radioactive material composed of one source of nine curie activity.
4. Cloth bag contained in fiberboard container.
5. H-3.
6. Gas sealed in pyrex glass ampoules.
7. 9 curie (one source).
8. Shipment of individual item requires no label per 49 CFR 173.391(b). Here than 21 items shipped as one package will require 1 radioactive white I label.

ENCLOSURE (7)



9. through 13. N/A.
14. VII.
15. BML 12-00722-06.
16. N/A.
17. O.
18. O.
19. Component item for M198 Howitzer and M224 Mortar.

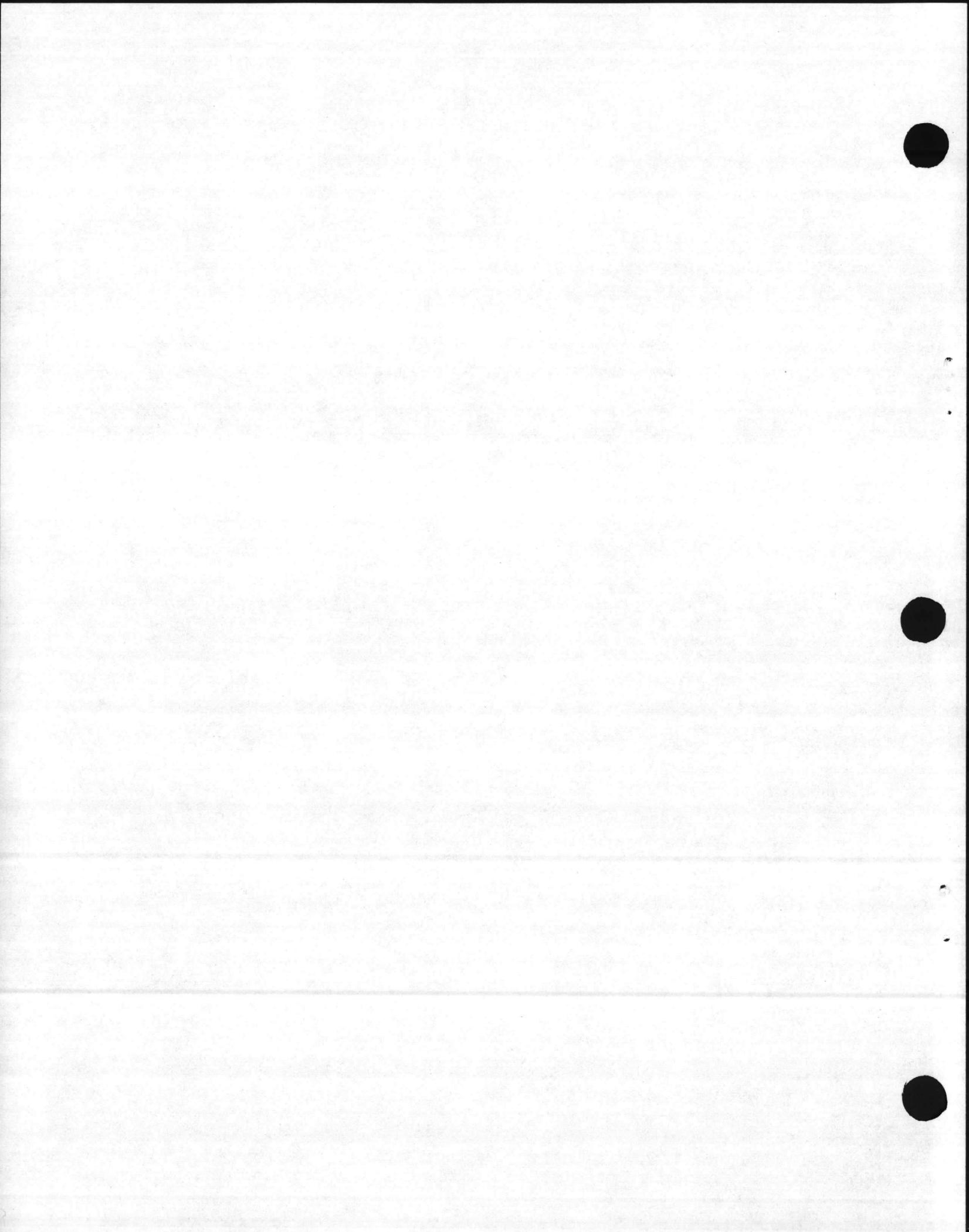
Item Name: Gunners Quadrant, M1A2 (NSN 1290-00-169-1937)

1. Radioactive device, n.o.s.
2. Radioactive material.
3. Dimensions are approximately 10 inches by 8 inches by 2 inches. Radioactive material composed on one source of 0.075 curie activity.
4. Fiberboard container with cushioned material.
5. H-3.
6. Gas sealed in pyrex glass ampoules.
7. 0.075 curie (one source).
8. Shipment of individual item requires no label per 49 CFR 173.391(b). More than 2,666 items shipped as one package will require a radioactive white I label.
9. through 13. N/A.
14. VII.
15. BW 12-00722-06.
16. N/A.
17. O.
18. O.
19. Separate TAM item used with artillery.

Item Name: Quadrant, Fire Control, M17 (NSN 1290-01-037-3803)

1. Radioactive device, n.o.s.
2. Radioactive material.
3. Dimensions approximately 8-1/4 inches by 4 inches by 6-5/8 inches; weight is 7.5 pounds. Radioactive material composed of five sources with a total activity of 1.875 curies.

ENCLOSURE (7)



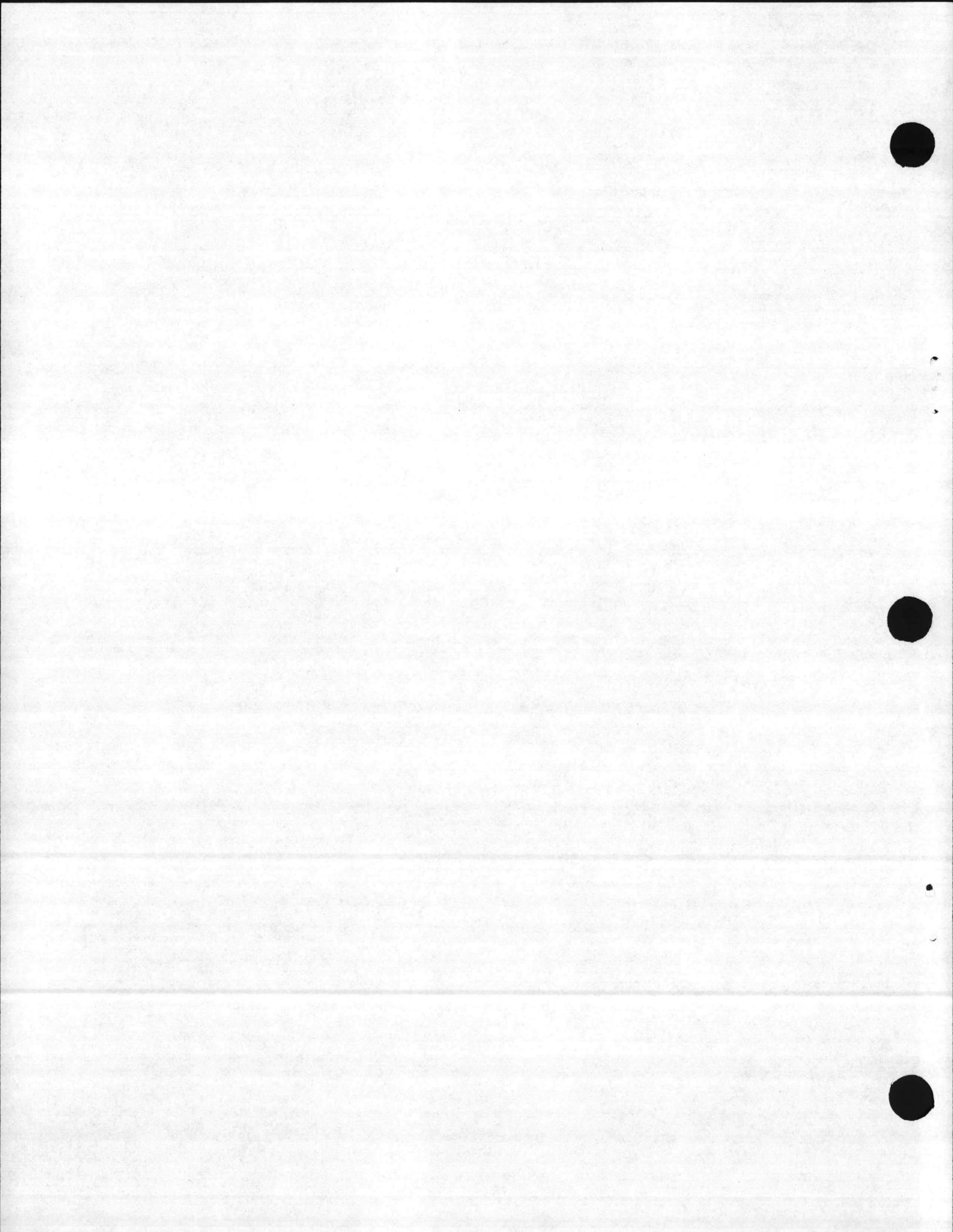
TI-5104-15/2A

4. Fiberboard container with, cushioned interior.
5. H-3.
6. Gas sealed in pyrex glass containers.
7. 1.875 curies total (five sources): 4-0.45 curie, 1-0.075 curie each.
8. Shipment of individual item requires no label per 49 CFR 173.391(b). More than 106 items shipped as one package will require a radioactive white I label.
9. through 13. N/A.
14. VII.
15. BML 12-00722-06.
16. N/A.
17. O.
18. O.
19. M198 Howitzer.

Item Name: Quadrant. Fire Control, M1B (NSN 1290-01-037-7289)

1. Radioactive device, n.o.s.
2. Radioactive material.
3. Dimensions approximately 8-1/4 inches by 4 inches by 6-5/8 inches: weight is 7.5 pounds. Radioactive material composed of six sources with a total activity of 1.95 curies.
4. Fiberboard container with cushioned interior.
5. H-3.
6. Gas sealed in pyrex glass containers.
7. 1.95 curies total (six sources): 4-0.45 curie, 2-0.075 curie each.
8. Shipment of individual item requires no label per 49 CFR 173.391(b). More than 102 items shipped as one package will require a radioactive white I label.
9. through 13. N/A.
14. VII.
15. BML 12-00722-06.
16. N/A.
17. O.
18. O.
19. M198 Howitzer.

ENCLOSURE (7)

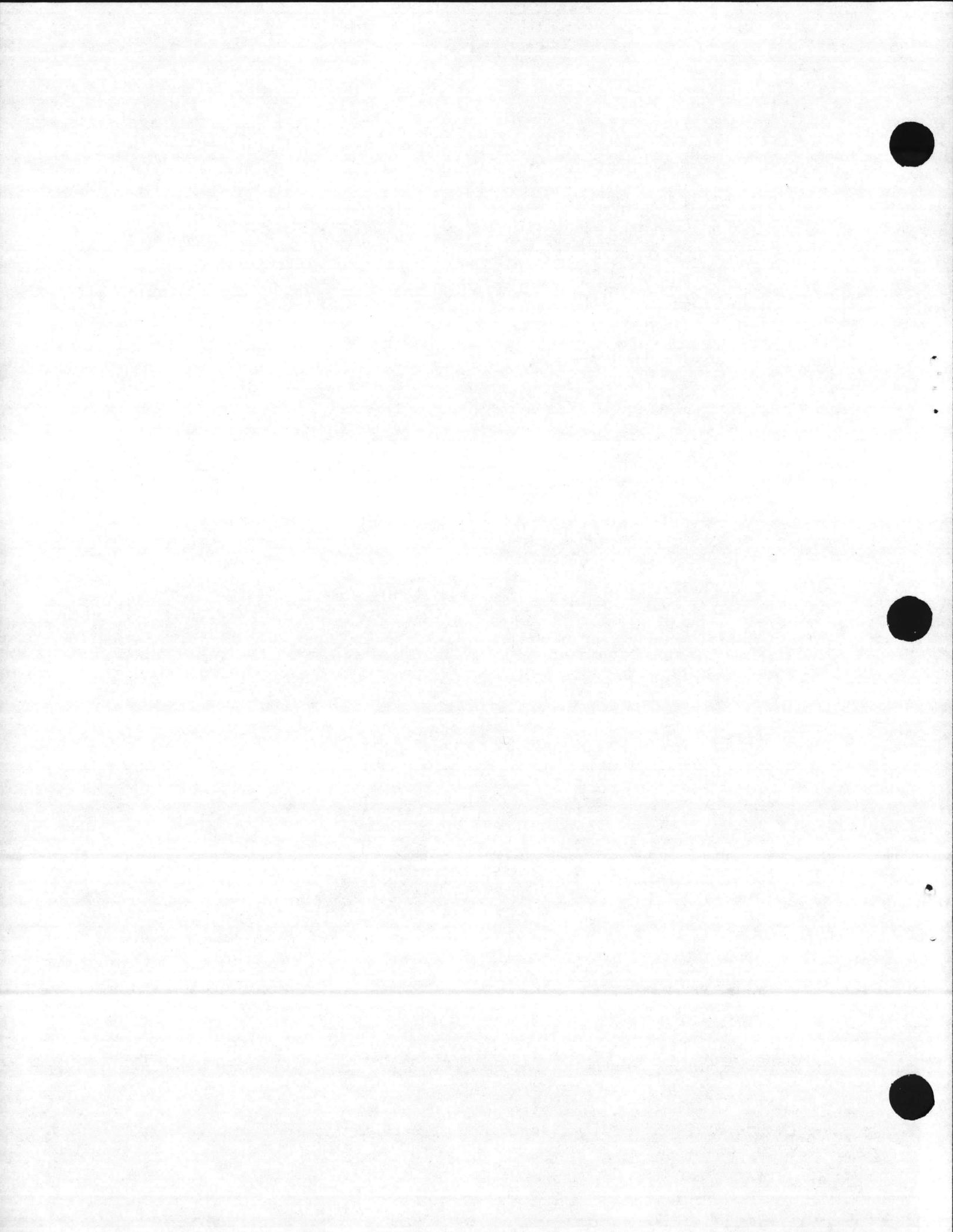


Item Name: Alignment Device, M140 (NSN 4931-00-341-5119)
Alignment Device, M139 (NSN 4931-00-046-5834)

1. Radioactive device, n.o.s.
2. Radioactive material.
3. Dimensions approximately 24 inches by 5 inches by 2 inches. (M140),
16 inches by 5 inches by 2 inches (M139). Radioactive material composed of
one source of 3 curie activity.
4. Fiberboard container with cushioned interior wrapping.
5. H-3.
6. Gas sealed in pyrex ampoules.
7. 3 curies (one source).
8. Shipment of individual item requires no label per 49 CFR 173.391(b).
More than 66 items shipped as one package will require a radioactive
white I label.
9. through 13. N/A.
14. VII.
15. BML 12-00722-06.
16. N/A.
17. 0.
18. 0.
19. Component item for M109A3 Howitzer (M140), and M19S Howitzer (M139).

ENCLOSURE (7)

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GUIDANCE FOR PREPARING SHIPPING DOCUMENTS TO COMPLY WITH 49 CFR

1. Shipping documents for commercial shipments of radioactive materials, made in accordance with 49 CFR, will require the following information: 1

a. The statement "No Label Required" of less than 200 curies; more than 200 curies requires the radioactive white I label.

b. Use one of the following applicable statements of certification:

(1) For all commercial shipments except AIR, use the statement: "This is to certify that the above-named materials are properly classified, described, packaged, marked, and labeled and are in proper condition for transportation according to the applicable regulations of the Department of Transportation."

(2) For air shipments, use the statement: "I certify that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in proper condition for carriage by air according to the applicable national Government regulations. This shipment is within the limitations prescribed for passenger aircraft."

2. Name of radioisotope: "Tritium (H-3) As A Gas Sealed in Pyrex Glass Containers ."

3. Activity of the radioisotope in curies. (See enclosure (1) for the activity for each NSN.)

4. Proper name of the radioactive material: "Radioactive Device, N.O.S."

5. Transport Group: "VII."

1/ Refer to Military Handbook 600.

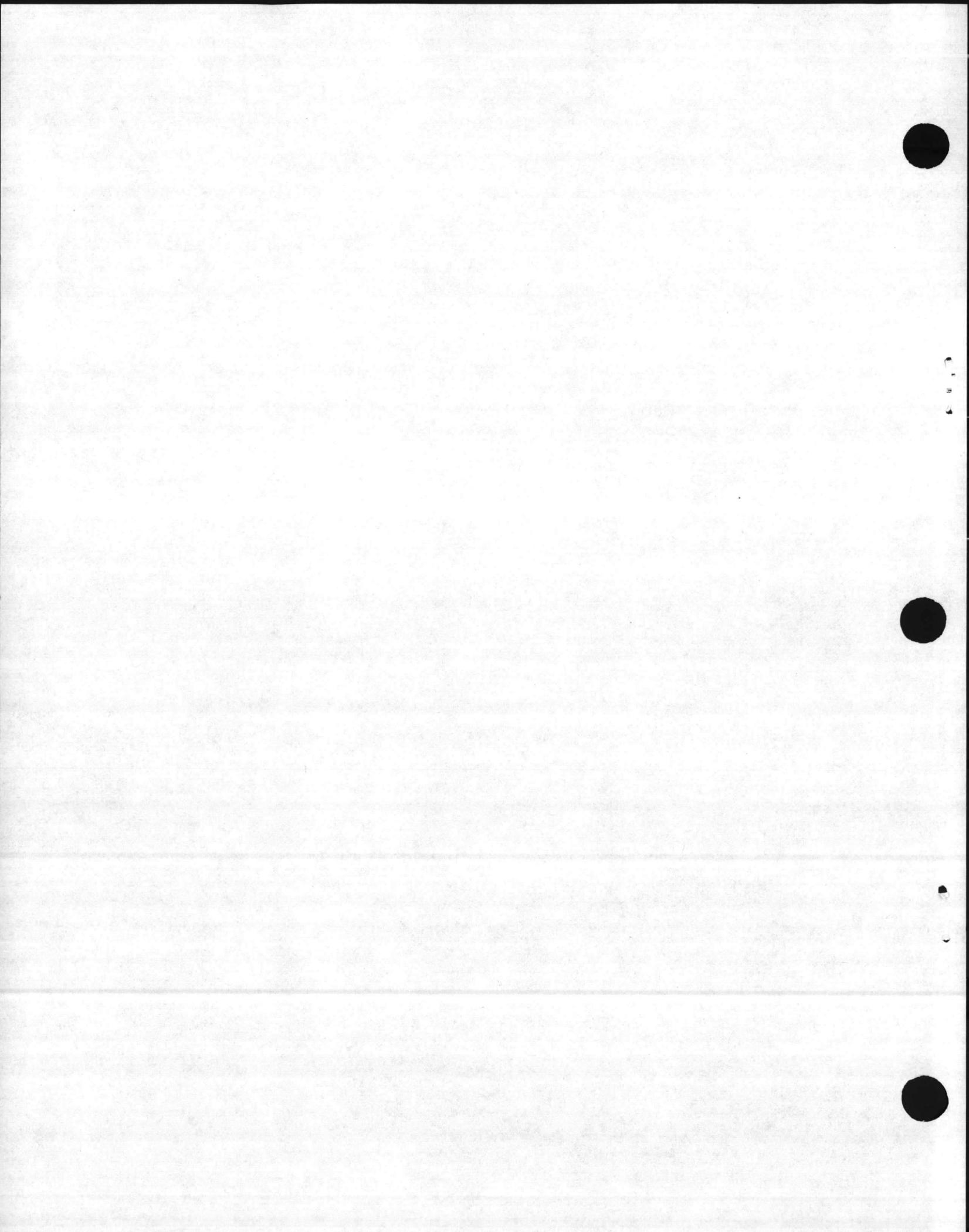
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GUIDANCE FOR PREPARING FORM DD1387-2 (SPECIAL HANDLING DATA/CERTIFICATES FOR MILITARY AIR SHIPMENTS)

1. Shipments made via military air must comply with the current edition of MCO P4030.19. For packages not exceeding 200 curies, the form DD-1387-2 will require the following information. Sample statements are provided.

a. Item Nomenclature Block:

(1) Proper Shipping Name. "Radioactive Material Limited
Quantity N.O.S."

(2) Classification. "Radioactive Material."

(3) Labels Required. "Label-None."

b. Net Quantity Per Package Block. Ensert "N/A."

c. Supplemental Information Block:

(1) Transport Group. "Transport Group VII."

(2) Name of Radionuclide. Enter "H-3."

(3) Physical or Chemical Form of the Material. "Gas sealed in pyrex glass containers."

(4) Activity of the Radioactive Material in Curies. See enclosure (1) or (7), if data sheet is available.

(5) Transport Index. Enter "0 MR/HR."

(6) For exempt radioactive materials, 1/ the following words shall appear: "Nonhazardous Quantity."

1/ "Exempt radioactive materials" include shipments of radioactive devices in transport group VII not exceeding 25 curies per device and 200 curies per package.

(7) The following statement, as indicated in paragraph if, following. "This shipment is within the limitations prescribed for passenger aircraft."

d. Loading and Storage Chart Block. Enter "26", "" (Note 'd' is N/A.)

e. Flash Point Block. Enter "N/A."

f. Shipment Within Passenger Aircraft/Cargo Aircraft Limitations Block. "X" and insert in the supplemental information block the statement "This shipment is within the limitations prescribed for passenger aircraft." See paragraph 1c(7), precedin9.

g. Subparagraph Certification Block. Enter "X" and insert the following subparagraph number af shipment doee not exceed 200 curies "12-6d."

ENCLOSURE (9)

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GUIDANCE FOR SHIPMENT BY MAIL

1. The guidance in this enclosure is an extract of Postal Publication 6, dates December 1975.

2. Nonmailable Matter. Any package of radioactive material bearing any of the Department of Transportation's "Radioactive White I," "Radioactive Yellow II," or Radioactive Yellow III" label or which contains quantities of radioactive material in excess of those authorized in paragraph 3a, following.

3. Mailable Matter. Authorized mailable radioactive material includes those classified as radioactive devices" as prescribed in 49 CFR 173.391. The maximum quantities and tune conditions under which they will be mailed are as follows:

a. For radioactive devices in transport group VII, the total radioactivity content of a single package containing radioactive devices must not exceed: 25 curies per device, 200 curies per package.

b. The radioactive material must be securely contained within the device, or securely packaged in strong tight packages, so that there will be no leakage of radioactive materials under conditions normally encountered in postal handling. 1/

c. The radiation dose rate at 4 inches from any unpackaged device must not exceed 10 millirem per hour. 1/

d. The radiation dose rate at any point on the external surface of the outside container (package ready for mailing) does not exceed 0.5 millirem per hour. 1/

e. There must be no significant radioactive material on the exterior of the package. (Refer to 49 CFR 173.397,) 1/

f. Additional NRC License Requirement. All pail shipments of these devices shall be via "Registered" mail.

1/ Serviceable devices and double-wrapped unserviceable devices will not exceed these requirements.

ENCLOSURE (10)

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