This copy is a reprint which includes current pages from changes 1 and 2.

Supersedes copy dated 20 March 1981 and all changes

DEPARTMENT OF THE ARMY TECHNICAL MANUAL

HANDLING AND DISPOSAL OF UNWANTED RADIOACTIVE MATERIAL

12 MAY 1988

HEADQUARTERS, DEPARTMENT OF THE ARMY

CHANGE
NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington , DC 31 October 1990

HANDLING AND DISPOSAL OF UNWANTED RADIOCATIVE MATERIAL

TM 3-261, 12 May 1988, is changed as follows:

1. Remove old pages and insert new pages as indicated below.

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By Order of the Secretary of the Army:

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CHANGE

NO. 1

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HANDLING AND DISPOSAL OF UNWANTED RADIOACTIVE MATERIAL

TM 3-261, 12 May 1988, is changed as follows:

1. Remove old pages and insert new pages as indicated below.

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A-1 and A-2	A-i and A-2

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Chief of Staff

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The Adjutant General

DISTRIBUTION: To be distributed in accordance with DA Form 12-34B, Maintenance requirements for Handling and Disposal of Unwanted Radioactive Material.

TECHNICAL

MANUALHEADQUARTERS
DEPARTMENT OF THE ARMY

No. 3-261

WASHINGTON D.C., 12 May 1988

HANDLING AND DISPOSAL OF UNWANTED RADIOACTIVE MATERIAL

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in back of this manual direct to: Commander, U.S. Army Armament, Munitions and Chemical Command, ATTN: AMSMC-MAS, Rock Island, IL, 61299-6000.A reply will be furnished directly to you.

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*This manual supersedes TM 3-261, dated 20 March 1981, including all changes.

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CHAPTER 1

INTRODUCTION

1-1. PURPOSE. This manual provides commanders of installations and activities guidance on the handling, storage, and disposal of radioactive waste and other unwanted radioactive material.

1-2. GENERAL.

a. Radiological operations should be carefully planned to minimize the risk to personnel and to property. Use of radioactive materials should be planned in order to generate a minimum amount of radioactive waste. For example, in the case of research-oriented units, dry-running the operation using nonradioactive materials can eliminate errors which would otherwise create considerable waste as a result of contamination. Also, the indiscriminate use of radioactive material in items supplied in large quantities should be avoided.

b. Central storage and collection services should be provided for unwanted radioactive material. Each radioactive material user should coordinate his proposed use and disposal of the material with the installation or activity commander's staff to assure that:

(1) The total quantity of radioactive material to be disposed into sanitary sewage systems, into air, or into nearby streams by all users and activities located on the installation will not exceed the quantities established for a single licensee in Title 10 (Code of Federal Regulations) CFR Part 20, or the quantity limitations established by applicable regulatory agencies.

(2) Coordination is effected with local civil authorities when required by 10 CFR, AR 385-11, or by Status of Forces Agreements (SOFA). Coordination overseas, except Hawaii and Alaska, will be effected through Command and State Department channels.

(3) Safe logistical support, medical, fire, security, public relations, and transportation services are available.

c. The terms "shall, " ':must, " and "will" are used for requirements which are applicable for any amount of unwanted radioactive material. The terms "may, " "can, " "could, " or "should" are advisory requirements.

d. Special problems concerning radiation safety and disposal of radioactive waste should be forwarded to HQ, U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL, 61299-6000, ATTN: AMSMC-SFS (RPO), or directed to the AMCCOM Radiological Protection Officer, AV 793-2964; Commercial (309) 782-2964.

e. The word "he" when used in this publication represents both the masculine and feminine genders, unless otherwise specifically stated.

CHAPTER 2

AUTHORIZED METHODS FOR DISPOSAL OF UNWANTED RADIOACTIVE MATERIALS

2-1. DECONTAMINATION PRIOR TO DISPOSAL ACTION.

a. In the case of property which is contaminated with radioactive material, all possible effort should be made to decontaminate the items before requesting disposal action. In the event it is economically unsound to decontaminate the property, or if the contamination cannot be reduced to a safe level, the contaminated property should be treated as radioactive waste. Decontamination procedures and techniques are contained in DARCOM P 385-1.

b. Prior to ultimate disposal, the volume of radioactive waste can be reduced by removing the radioactive components from the non-radioactive components whenever the item can be disassembled safely and the disassembly is authorized under the associated Nuclear Regulatory Commission (NRC) license or DA permit/authorization.

2-2. PROPERTY (NO REPAIRS NEEDED OR ECONOMICALLY REPAIRABLE) CONTAMINATED WITH OR CONTAINING RADIOACTIVE MATERIAL. Accountable radioactive property which is economically repairable, or which does not require repairs, will be reported for disposition to the National Inventory Control Point having logistic responsibility for screening against known requirements within the Army, unless otherwise directed in the technical literature pertaining to the item. Upon receipt of request for disposition of such property, the National Inventory Control Point having logistic responsibility for the property should take the following actions, as appropriate:

a. Direct that the property be transferred for further utilization to another Army installation or agency which is authorized to receive such material.

b. Request authority through command channels to HQ, Army Materiel Command, ATTN: AMCSF-P, 5001 Eisenhower Avenue, Alexandria, VA, 22333-0001, for transfer of property to authorized agency outside the control of the Army. (After a policy has been established for a particular type of equipment, further coordination is unnecessary for transfers of items covered by such policy.) Upon receipt of approval, the transfer of the material can be effected.

c. Direct the possessor of the property to decontaminate it or to process it for ultimate disposal as radioactive waste in accordance with AR 385-11 and implementing directives (see chapter 6).

2-3. ULTIMATE DISPOSAL AUTHORIZED LOCALLY.

a. Unless banned by local policy, regulation, or Status of Forces of Agreement (SOFA), defective electron tubes (small quantities) will be disposed of as normal waste if---

(1) The radiation level at 1 centimeter from the tubes' surface is less than 1 millirad per hour, as measured with an AN/PDR-27 ( )radiacmeter or equivalent.

(2) Each tube is exempt from licensing or contains less than 0.01 microcurie of radium (RA-226). Defective tubes exceeding the above amounts per tube will be disposed of as radioactive waste (para 5-1). Electron tubes handled as normal waste should not be segregated and piled up before disposal, but should be disposed of as they become defective to avoid a possible radiation hazard.

b. Unless prohibited by SOFA, Federal, or local regulation, installations and activities may make local disposal as follows:

(1) Dispose of specific types and quantities of radioactive commodities according to disposal instructions in applicable technical publications.

(2) Dispose of effluents (liquids and gases) in unrestricted areas under 10 CFR 20.106, if not prohibited by local government.

(3) Dispose of liquids in accordance with 10-CFR 20.303 or 20.306, unless prohibited by local government.

c. Burning NRC-licensed radioactive material is not authorized, except by units having a valid NRC license or authorization to do so. Request for such a license or authorization will be prepared according to chapter 2, AR 385-11.

d. Conventional disposal of radioactive waste is authorized if radioactive decay is controlled to less than the amounts listed in Schedule A, 10 CFR 30.70. This procedure is recommended for facilities with adequate local storage and for materials containing radio isotopes with half-lives of less than 30 days. It may also be used by some hospitals and laboratories where short half-live radioisotopes are used in tracer techniques and the resulting waste contains low level activity in items such as excreta, laboratory animals, infectious waste, absorbent tissue, and sputum. The amount of radioactivity released locally should be kept to the lowest level practicable.

e. Waivers to the requirements in a through d above will be granted only under unusual circumstances. Requests for waivers will be addressed to Commander, AMC, ATTN: AMCSF-P, 5001 Eisenhower Avenue, Alexandria, VA, 22333-0001, with a copy furnished to Commander, AMCCOM, ATTN: AMSMC-SFS (RPO), Rock Island, IL, 61299-6000.

CHAPTER 3

SELECTION OF RADIOACTIVE MATERIAL TEMPORARY STORAGE AREA

3-1. AREA FOR TEMPORARY STORAGE. It is more economical for the U.S. Army to process a single large quantity of radioactive waste for ultimate disposal than to process small quantities. Therefore, installations which are able to store and to safely consolidate unwanted radioactive material are encouraged to establish a special area for temporary storage and consolidation of radioactive material until such time that the installation can dispose of the material in accordance with AR 385-11 and implementing directives.

3-2. SITE SELECTION. Criteria for selecting a temporary storage site are listed below.

a. Risk of fire, explosion, or flood should be strongly considered.

b. Area should be relatively free of animals such as rodents which might gnaw their way into storage containers or otherwise track radioactive contamination out of the storage area.

c. Site should be sufficiently secure to prevent unauthorized removal of the radioactive material.

d. Area should be used to store radioactive materials only.

e. Area should be isolated from other activities of the installation to keep personnel exposure at a minimum.

f. Water from any decontamination process should not be permitted to run into sanitary sewers, lakes, or streams, except as authorized in Title 10, CFR, Section 20.303, and local government rules. Decontamination water will, under no circumstances, be drained onto ground within 500 feet of a drinking water source.

g. Personnel decontamination facilities should be available.

h. If possible, site should be chosen so that, in event of unplanned contamination, decontamination may be effected rapidly, economically, and safely.

i. Drainage from the storage area should be such that domestic water supplies (surface and subsurface sources) will not become contaminated.

j. Site should not be in an area subject to inclement weather.

CHAPTER 4

COLLECTION OF RADIOACTIVE MATERIAL

4-1. GENERAL.

a. The installation should furnish radioactive material collection containers to each of its units and/or activities which generate radioactive material. Containers should be painted yellow (AR 385-30) and marked "Caution: Radioactive Materials." Lids of the collection containers should be easy to open so that the container is not tipped over in the process of removing the lid.

b. The method of handling and storing the material should be such as to prevent the accidental release of radioactive material from its container.

c. Waste collection containers should be checked periodically to assure that:

(1) Radiation levels are not excessive.

(2) Outside surfaces of container are free of contamination.

(3) Corrosion is not weakening the container.

d. All radioactive material collection containers should be emptied periodically. Frequency of collection will be dependent upon the quantities of radioactive waste generated and upon the levels of radiation emitted. The collected material should be taken to the installation’s radioactive waste storage site.

e. Personnel handling the radioactive material or the collection containers should wear film badges and dosimeters as required by AR 40-14. Protective clothing and devices should be used to prevent internal and external contamination of personnel.

f. Waste which will create a "high radiation area" should not be stored in temporary containers but should be taken immediately to the radioactive waste storage site.

4-2. LIQUID RADIOACTIVE WASTE.

a. Liquids must be segregated from solids to process the waste through the Army system.

b. Within the waste-generating site, the radioactive liquids should be collected in plastic, earthenware, or thick-walled glass bottle inner containers. Leak proof metal cans may also be used

providing the container is chemically inert to the liquid. These inner containers should be placed within secondary containers to hold the liquid if the inner container leaks.

c. Liquids should be stored in containers that will not break if their contents should freeze.

d. Excess volumes of volatile liquids containing nonvolatile radioactive materials can be avoided by means of evaporation or distillation.

e. If liquids are exposed to freezing temperatures, a compatible antifreeze should be used to prevent freezing.

f. Animal carcasses must not be treated as liquid waste because of difficulty in predicting behaviour of the carcass with respect to swelling and degassing (para 4c).

g. Liquid waste must be solidified in accordance with existing low level radioactive waste burial site criteria.

4-3. LOW LEVEL SOLID WASTE.

a. Low level solid waste (which does not present an external radiation hazard) may be collected in metal containers equipped with self-closing lids. Lids of the collection containers should be easy to open so that the container will not tip over. In order that these containers can be reused, the inner and outer surfaces should be painted. The painted surfaces will resist contamination. Use of strippable paint will facilitate decontamination. Contamination of these collection containers can be prevented to a large extent by using disposable plastic or other waterproof inner linings.

b. Combustible waste should be separated from noncombustible waste. Combustibles (such as paper towels, filter papers, etc.) which have been exposed to strong oxidizing agents such as nitric acid should be collected and handled separately.

c. Animal carcasses containing radioactive material should be considered solid waste. Small animals should be placed in plastic, earthenware, or thick-walled glass bottles. At least one-third of the volume of the container should be left above the level of the waste material to allow for swelling of the carcass. No liquid wastes will be put in the containers used for animal disposal. Storage and transit of animal carcasses should be in accordance with instructions provided by appendix C.

d. Care must be exercised to avoid adverse chemical reaction resulting from uncontrolled addition of wastes.

4-4. HIGH LEVEL SOLID WASTE. High level solid waste (which can over-expose personnel) should be stored in shielded containers. Normally, high level radioactive material is transported and received in lead shipping containers. When economically feasible these shipping containers should be used as storage containers when the radioactive material becomes waste or unwanted.

4-5. MARKING OF COLLECTION CONTAINERS. Each radioactive waste container must be labelled. Contents must be identified as to radioisotopes, level(s) or radioactivity, and date(s) measured. Information required by chapter 6 should be compiled for each container if it is to be disposed of through the Army disposal system.

4-6. MONITORING OF CONTAINERS. Units generating waste will check waste collection containers to assure that:

a. Containers are in good condition and meet requirements for waste disposal (appendix C).

b. Containers are properly labelled.

c. Radiation levels do not become excessive.

d. Although individual radioactive items might not present a hazard, the filled container might emit excessive radiation.

e. Outside container surfaces are free of removable contamination.

f. Contamination is not being tracked away from collection container.

CHAPTER 5

PROCESSING AND STORAGE OF UNWANTED RADIOACTIVE MATERIAL PENDING SHIPMENT

5-1. SOLID RADIOACTIVE MATERIAL.

a. Use of the same container for both storage and transportation will avoid unnecessary duplication in handling the waste. In those cases wherein the transportation regulations exempt radioactive waste from specification packaging and labeling, the container should be of leakproof construction and sturdy enough to withstand the rigors and shock normally incident to the type of transportation to be used. As a minimum, containers must comply with the requirements set forth in appendix C.

b. The design and construction of containers used in the storage area should be the same as that required for transportation of the material. Specifications for such containers are found in the various parts of the Code of Federal Regulations listed in appendix A. Copies of the Code of Federal Regulations are normally available from the Post Judge Advocate. Tariff No. BOE-6000 listed in appendix A, summarizes the major Federal transportation regulations. Radioactive waste to be disposed of through the Army system must be packaged in accordance with the specifications outlined in appendix C.

c. The dose rate at the outside surface of the storage container should not exceed 200 millirads per hour nor should the dose rate at one meter from any outer surface of the storage container exceed 10 millirads per hour. In order to assure that these radiation levels are not exceeded, the dose rate at the surface and at one meter from the container will be monitored while the container is being filled. Limit the amount of radioactive material in a container so these dose rates are not exceeded. Fill any voids with nonradioactive packing material.

d. While the radiation emitted by individual containers might be small, care must be exercised where a number of such containers are stacked together to assure their cumulative dose rate will not over-expose personnel or exceed 2 millirads in uncontrolled radiological areas.

5-2. LIQUID RADIOACTIVE MATERIAL.

a. Because of the extensive contamination which can result if radioactive liquids leak, the transportation regulations require that radioactive liquid be placed in a tight glass, earthenware, or other suitable inner container. The inner container must be surrounded on all sides and within the outer shipping container with a suitable material capable of absorbing twice the entire liquid content. The

type of material used should be such that its absorbent ability will not be diminished as a result of chemical interaction between the absorbent and the liquid. Storing liquids in the manner prescribed by the transportation requirements will prevent extensive contamination of the storage area should a leak occur. The addition of a suitable dye to the liquid will facilitate the detection of a leak should one occur.

b. Care should be exercised to avoid combining two or more radioactive substances which might chemically interact to cause frothing, fire, or explosion.

c. Each container or radioactive materials will be labeled as required by transportation regulations.

d. Sometimes the half life of the radioactive material is short enough that the material can be stored until local disposal is feasible.

e. Liquid waste to be disposed of through the Army system must follow the guidelines and specifications set forth in appendix C. Liquid waste, unless solidified or absorbed, is not permitted at any disposal site.

5-3. RADIOACTIVE GASES. A few gases are radioactive. Containers must be capable of withstanding the pressures generated by the gases contained therein. Further, during their decay, certain radioactive materials evolve gases which are radioactive. Among these are radium and thorium which evolve radon gas. Radon is difficult to contain. In order to avoid contamination, radioactive gases and waste containing thorium and/or radium should be contained in airtight moisture-proof containers. The filled containers should be stored in the open or in well-ventilated areas.

CHAPTER 6

RADIOACTIVE WASTE'DISPOSAL REQUESTS AND SHIPPING INSTRUCTIONS

6-1. REQUESTS FOR DISPOSAL

a. Requests for disposal instructions should be submitted in accordance with AR 385-11 as follows:

(1) Installations and activities located in the United States and Greenland and overseas radioactive waste processing facilities will send disposal requests to Commander, AMCCOM, ATTN: AMSMC-PCW-HA, Rock Island, IL, 61299-6000.

(2) Army installations and activities (except those cited in (1) above) will send disposal request per instructions of theater commander.

b. Requests for disposal instructions must contain the following information for each shipment:

(1) Nomenclature, NSN, and serial numbers.

(2) Physical descriptions of items, to include---

(a) Solid, liquid, or gas.

(b) Quantity per stock number and, if gas, the volume under standard pressure and temperature.

(c) Shipping weight (pounds) and volume (cubic feet). (Volume needs to be accurately reported to nearest cubic foot.)

(d) Number of shipping containers.

(e) AMCCOM control number.

(f) Deleted.

(g) Package specification.

(h)Labels used (if required).

(3) Chemical and radioisotope description, to include---

(a) Hazardous chemicals present.

(b) For liquids, the solvent present.

(c) Radioisotopes present.

(4) Radioactivity and radiation measurement, to include---

(a) Millicuries of activity of each radioisotope; for special nuclear material, give number of grams; for source material, list the quantity in pounds.

(b) Maximum radiation dose rates (mrem/hr) at the surface and (mrem/hr) at 1 meter from the surface of the package.

(c) Classification and basis for classification and procedures for declassification.

(d) Special instructions or requests for unique service, such as return of the containers.

(e) Name and telephone number of responsible person to contact for additional information.

(f) Remarks, if required.

(g) Requests for technical information or assistance should be submitted to Commander, AMCCOM, ATTN: AMSMC-SFS, Rock Island, IL, 61299-6000, or AV 793-2964/2969, Commercial (309) 782-2964/2969.

6-2. SHIPPING INSTRUCTIONS.

a. Shipping Instructions, in the form of replies to disposal requests, will be forwarded by HQ, AMCCOM, and will designate the authorized land burial site, provide certification forms, radioactive waste shipping forms, special instructions, and a checklist (appendix C).

b. Checklist (appendix C) will be used as guidance while processing radioactive waste material for shipment and will be returned to HQ, AMCCOM, prior to shipment.

c. Since burial criteria periodically changes, specific instructions will be furnished by HQ, AMCCOM, as such occur.

d. Random audits of radioactive waste shipments will be made by HQ, AMCCOM, at the shippers installation prior to approval to ship. Some of the audits will consist of the AMCCOM Health Physicist being on-site during packaging and loading of the waste material.

CHAPTER 7

TRANSPORTATION

7-1. ON-POST TRANSPORTATION OF UNWANTED RADIOACTIVE MATERIAL. Within an installation, it usually is not convenient to package and to transport radioactive waste in the manner required for off-post shipments. However, the following precautions should be observed:

a. In loading the vehicles:

(1) Keep within the weight limitations.

(2) Limit or arrange cargo to keep radiation levels to which personnel (including the driver) will be exposed during transportation as low as possible. (Maximum permissible dose rate in occupied areas of the vehicle will depend upon the time required to transport the radioactive material.)

(3) Keep the containers as far away from the cab of the vehicle as possible.

b. Do not haul loose radioactive materials. Tail gates should be closed to minimize chance of cargo loss.

c. Containers should be sturdily constructed, sealed airtight, and be free of removable contamination.

d. A suitable vehicle should be used. Vehicles which are difficult to decontaminate and privately-owned automobiles should not be used.

e. Route used should be planned to avoid areas in which explosives are stored or handled and in which there is heavy traffic or personnel activity. The fire department and military police should be informed of the exact route and time of movement in time to allow implementation of any special protective measure required.

f. Unless emergency personnel, e.g., military police, security guards, and fire department, have demonstrated a capability to cope with a radiological emergency, a technically trained person should accompany the movement to be able to advise in the event of an emergency. Local emergency response personnel should maintain suitable radiation survey instruments in accordance with AR 385-11.

g. Vehicles should be surveyed for contamination prior to, and following, transportation of radioactive material. Vehicles used to transport radioactive material shall be appropriately marked.

7-2. OFF-POST TRANSPORTATION OF UNWANTED RADIOACTIVE MATERIAL.

a. Requests for disposal of unwanted radioactive material will be forwarded in accordance with AR 385-11.

b. Radioactive shipments will be transported in accordance with DOT regulations, AR 55-355, and specific HQ, AMCCOM, instructions.

c. Radioactive material will normally not be forwarded through the U.S. mail. Should transmission by mail be necessary, shipment will comply with Title 39, Code of Federal Regulations, Postal Service and will be registered.

d. Containers should be secured by blocking and/or tie-down, when appropriate.

e. Personnel who will transport and/or escort radioactive shipments will be briefed as to potential hazards, methods to minimize the hazards, and emergency procedures. Written information will be provided as to the means for obtaining the assistance of radiological emergency teams. Appendix B is a sample of supplemental emergency instructions which can be adapted for the type of radioactive shipment involved. In accordance with CONUS Army procedures, the consignor will provide the escort commander or custodian of the shipment with telephone numbers to be contacted along the route in an emergency.

7-3. ON-SITE COMMAND OF EMERGENCY DURING TRANSPORTATION. The ranking person accompanying the shipment will take immediate steps to clear the area and request assistance. He retains command at the accident site pending arrival of the commander of the nearest military installation or his representative. The designated Army area representative assumes responsibility upon his arrival.

CHAPTER 8

RADIATION PROTECTION

8-1. RADIOLOGICAL PROTECTION OFFICER.

a. The commander of the installation or activity where radioactive material is used or stored will appoint a radiological protection officer to provide consultation on radiation hazards control procedures. The individual must be technically qualified by virtue of education, training, and/or experience to assure a capability commensurate with the assignment. The term "radiological protection officer" is a functional title and is not intended as, and does not denote, a commissioned status or job classification with the Armed Forces (AR 40-14).

b. Duties of the local radiological protection officer include:

(1) All aspects of radiation protection in the storing, handling, reporting, disposing, and shipping of radioactive material.

(2) Inspecting and monitoring as necessary to ensure that persons working with radioactive materials are complying with the designated safety measures and are not working under unsafe conditions.

(3) Investigating radiation incidents.

(4) Providing guidance as to the types of protective clothing and equipment needed and when they are to be used.

(5) Instructing personnel working in the storage area and/or handling the unwanted radioactive material.

(6) Familiarity with applicable regulations.

(7) Preparing reports of overexposure and radiological incidents.

8-2. INSTRUCTION OF PERSONNEL. Personnel working in the storage area and/or handling the radioactive waste will be informed of the following:

a. The presence of radioactive materials and the radiation emitted therefrom.

b. Safety problems associated with exposure to such radiation and radioactive materials.

c. Precautions and procedures to minimize exposure.

d. In the case of U.S. Nuclear Regulatory Commission (NRC) controlled or licensed materials, personnel shall also be informed of the provisions of applicable NRC regulations and licenses for the protection of personnel and shall be advised of reports of radiation exposure which may be requested pursuant to Title 10, Code of Federal Regulations, Section 20.206.

e. Applicable regulations (appendix A).

8-3. EXPOSURE OF PERSONNEL.

a. Radiation exposures are regulated by Title 10, Code of Federal Regulations and AR 40-5. Unnecessary exposure must be avoided.

b.Exposures in excess of those listed in above regulations should be investigated and corrective measures taken to preclude further incidents. All exposure to radiation must be kept as low as reasonably achieveable.

8-4. SAFETY RULES. The following rules are listed for personnel who are exposed to radiation or to unwanted radioactive material:

a. Individuals shall wear a film badge while in the storage area or while handling radioactive material. In addition to the film badge, two pocket dosimeters or pocket chambers should be worn by each individual while in an area in which there exists radiation at a level of 5 millirads per hour or higher.

b. No individual should work alone in a radioactive material storage area in levels exceeding 20 millirads per hour.

c. Smoking, eating, drinking, or chewing tobacco or gum within the area is prohibited.

d. Visitors will be escorted by qualified individuals assigned to the area.

e. Personnel working in the area will be responsible for monitoring themselves and any visitors. Contaminated individuals will be required to decontaminate themselves, using soap and warm water. Except in an emergency, no person will leave the area after being in an area where he may have been contaminated until he has been monitored and determined to be free of contamination. In the event of an accident, injured personnel will be removed under the supervision of medical personnel.

f. The references in appendix A are furnished for guidance in radiological protection.

g. Personnel will wear and use prescribed protective clothing and equipment to prevent both external or internal exposure re to radiation.

h. Film badge service will be obtained where required. Spare film badges should be obtained for use by visitors and emergency personnel.

i. Calibration of radiac meters and dosimeters will be in accordance with TB 43-180.

j. Local medical facilities will be informed of radiological handling operations and will be alerted to the possibility of receiving contaminated persons. Medical facilities should have radiac instruments (AN/PDR-27 and AN/PDR-54 or -60) or equivalent on hand.

8-5. PROTECTIVE CLOTHING AND EQUIPMENT.

a. Protective clothing and equipment do not protect the wearer from penetrating radiation but are intended to prevent particles of radioactive materials from contacting the body. Protective clothing and equipment include items such as coveralls, safety shoes, shoecovers, caps, gloves, and respirators. The radiation protection officer will recommend the type and the extent that protective clothing and equipment will be used.

b. Protective clothing and equipment used in disposal operation will be marked to limit their use to radioactive material disposal operations. A complete set of clothing should be provided personnel to preclude the possible contamination of personal clothing. Clothing which must be maintained by personal funds will not be used.

c. Protective clothing will be monitored at the end of each workday and accumulated for laundering, if necessary. If decontamination of the clothing to a safe level is impracticable, the item will be considered as waste.

8-6. USE OF PROTECTIVE CLOTHING. Personnel will wear prescribed protective clothing when handling radioactive materials or entering a potentially contaminated area. The protective clothing consists of marked seasonal undergarments and the following where appropriate:

a. Marked Seasonal Outergarments. Openings such as unsewed seams, pockets, trouser, and sleeve cuffs will be taped shut with marking tape. The trouser cuffs should be taped onto footwear or protective shoe covers; sleeve cuffs should be taped over protective gloves.

b. Shoe Covers. Rubber boots, overshoes, or similar protective shoe covers will be worn while walking on surfaces which may be contaminated. The protective shoe covers will be removed prior to walking over "clean areas" to avoid tracking the radioactive material.

c. Protective Gloves. Protective gloves and/or remote handling tools will be used when handling radioactive material. Telephones, notebooks, and reports should not be handled with contaminated gloves.

d. Aprons. Rubber or plastic aprons should be worn while handling radioactive liquids.

8-7. DOSIMETERS.

a. In addition to the use of film badges, pocket chambers, or self-indicating pocket dosimeters, will be carried if the dose rate exceeds 5 millirads per hour. Preferably, two dosimeters should be worn per individual. The dosimeters can be used to obtain daily personnel dose information. In the event the doses recorded on two dosimeters differ, and if these dosimeters have been worn in close proximity to one another by the same individual, the higher reading will be good for planning purposes.

b. Dosimeters which leak 2 percent of full scale after 24 hours in a radiation free area will be returned for repair. Each dosimeter should bear a label showing the correction factor which, when multiplied by the indicated reading, corrects for the chamber's response to cobalt 60 or radium gamma rays under average temperature and pressure. When the dosimeter is subsequently exposed to a standard radium or cobalt 60 source, the corrected reading should be within 5 percent of the actual exposure. Dosimeters are used to give the wearer an estimate of his exposure while receiving the dose, in order that he may limit himself to permissible levels. Disagreement between dosimeter and film badge measurements is to be expected. The film badge reading will be used as the official dose for record purposes unless the badge is shown to have recorded an incorrect exposure.

8-8.PROTECTIVE RESPIRATORY EQUIPMENT.

a. It is recommended that whenever an atmosphere is contaminated with radioactive particulates in excess of the maximum permissible concentration, respiratory protection be afforded by the use of the U.S. Army protective mask M9 with the M14 canister; M17 protective mask; Bureau of Mines approved self-contained breathing apparatus; or Bureau of Mines approved airline respirator (TB MED 223). When the contamination involves the presence of radioactive gases (i.e., radon), only the latter two devices should be used.

b. In conjunction with the use of these devices in atmospheres contaminated with radioactive particulates, appropriate protective clothing, as prescribed by the radiation protection officer, should be worn.

8-9. MARKING OF CLOTHING. All clothes which are likely to be exposed to radioactive contamination should be marked with the standard radiation symbol. A magenta or purple trefoil with sides at least 1 inch long should be used. Similar colors may be substituted if exact

colors are not available. No lettering is necessary. All markings should be made with paint or ink that will withstand laundering.

8-10. PERSONNEL MONITORING. Personnel monitoring includes the use of swipes and/or portable radiac meters. To be free of the influence of radiation from the stored radioactive material, personnel should be monitored away from the stored radioactive material or be monitored with a shielded probe. This is necessary to prevent low levels of contamination from being masked by higher levels of radiation emitted by radioactive material in the radioactive material storage area.

8-11. SWIPES.

a. A "swipe" is used to determine the presence of removable contamination. A swipe is made by rubbing a piece of absorbent tissue, filter paper, or cheesecloth over the area in question and counting it with laboratory scaler counting equipment. Before being used, the swipe may be moistened with water or an alcohol-water solution. If the swipe has been moistened, it must be dried prior to being counted since the moisture will prevent the alpha particles from being counted. Booties, shoe covers, and other footwear, appropriately checked after being worn through a contaminated area, can be a good indication of the likelihood of spreading contamination.

b. Nose swipes, a method of determining the effectiveness of respiratory protection, are made with a 3-inch X 1/2-inch strip of paper wrapped tightly around the end of a swab stick. Applicators are dipped in distilled water and used to swab each nostril. The swab is placed in an envelope on which is written the date and the individual's name. After drying, the outer 1 inch of paper is counted in an appropriate counter. If the respiratory protection being used is adequate, the activity on swipes taken for the radiation workers should be comparable to those taken as controls using individuals not working near radioactive material.

8-12. PERSONNEL SCANNING. Personnel monitoring should be done with the AN/PDR-27 and AN/PDR-54 or -60 or equivalent. These meters when used for personnel monitoring will be equipped with earphones to permit aural indication to supplement the slower needle response. Ludlum MOD 3 and other radial meters with built in aural indicators are exempt from earphone requirements. While monitoring, the meters will be turned on their lowest range to achieve the highest electronic sensitivity of the meter. The sensory portion of the meter probe will be placed as close to the portion of the body being checked as possible without bringing the probe into physical contact. The probe should be moved slowly. An individual will be considered to be contaminated with alpha emitters if there is an auditory response or any observable needle response above the background level on the AN, /PDR-54 or AN, /PDR-60 while checking him with the sensory portion of the probe within 1/4-inch of his body. An individual is contaminated with beta-gamma if there is an auditory response or if there is a reading above background on the AN/PDR-27 when the sensory portion of the probe-, with the shield removed, is placed as close to the skin as possible without touching the skin.

CHAPTER 9

DECONTAMINATION

9-1. PERSONNEL DECONTAMINATION.

a. Thorough washing with nonabrasive soap and lukewarm water is the best general method of decontamination of the hands and other parts of the body. If the contaminant is localized, it is often more practical to mask off the affected area and cleanse with swabs rather than risk the danger of spreading the contaminant by general washing. Organic solvents must be avoided as decontaminating agents because they may increase the probability of the radioactive materials penetrating through the pores of the skin. Special attention must be given to the areas between the fingers and around the nails. The outer edges of the hands are readily contaminated and must not be neglected in the washing.

b. After repeated washings the skin may tend to chap. To avoid this, apply lanolin or hand cream and then continue to wash. If repeated washing with soap and water is unsuccessful in the personnel decontamination, the individual should be referred to the local medical officer for application of the more drastic chemical decontamination listed in National Bureau of Standards Handbook No. 48.

c. In the event several individuals have become contaminated or the contamination on an individual is not localized to a small portion of the body, the following decontamination procedure is recommended:

(1) Place individual in a lukewarm shower.

(2) Using a mild soap, individual should cover entire body with lather.

(3) While still covered with lather, individual should step out of shower.

(4) Sprinkle a heavy coat of mild soap flakes all over lathered individual. (Purpose of lather is to cause soap flakes to adhere to person.)

(5) Using his hands, the contaminated individual should rub the soap flakes on his body into a paste.

(6) Individual should then return to shower and rinse soap off his person by starting at the top and working his way down.

NOTE: It will be necessary for individual to rub body surfaces with his hands while rinsing in order to remove soap paste. Soap paste will

remain on those areas which have not been thoroughly washed. Although a soft cloth may be used, a brush may not. Particular attention should be given hairy portions of the body.

(7) When the individual has rinsed himself to the point that he no longer feels slimy, and while still under shower, he should be examined by an assistant for traces of soap. The presence of soap will indicate which areas of the body have not been decontaminated.

(8) After removing all traces of soap, individual should leave the shower and dry himself.

(9) After drying off, individual must be monitored. If still contaminated, above procedures should be repeated. In the event residual contamination is localized, repeat procedures should be limited to those areas still showing contamination.

d. In all cases of personnel contamination, the radiological protection officer must be consulted.

9-2. EQUIPMENT AND AREA DECONTAMINATION.

a. General.

(1) Care must be taken during the decontamination process to avoid further spread of the contaminant. This can be accomplished by:

(a) Always working from the area of least contamination towards the area of the heaviest contamination.

(b) Taking precautions not to track the contamination. Use protective clothing and shoe covers. Periodically remonitor the area.

(c) Using a minimum amount of decontamination liquids and being aware that the runoff solutions and mops, rags, and brushes may be contaminated.

(2) The following decontamination methods should be tried in the sequence in which they are listed:

(a) Damp mopping. The area is wiped with a damp rag. The wiping surface of the rag is changed repeatedly to minimize spreading of contaminant.

(b) Water and detergent. The area is wetted with a minimum amount of detergent solution. The area is then wiped dry with absorbent gauze or cloth.

(c) Steam cleaning.

(d) Cleaning with solvents other than water.

(e) Surface removal by controlled use of chemicals, abrasives, sand blasting, and grinding.

NOTE: Use of vacuum cleaners is not recommended. If used, vacuum system must be dedicated to radiation contamination.

b. Specific Methods. If the above decontamination methods do not work, the following specific methods may be tried:

(1) Metals.

(a) Remove any oily surfaces with organic solvents.

(b) Soak in a solution of citric acid prepared by adding 1pint citric acid to 1 gallon of water.

(c) Soak in a solution of diluted hydrochloric acid prepared by carefully adding one part of commercial grade concentrated hydrochloric acid to four parts of water. Hydrochloric acid should not be used on stainless steel because of the etching which will destroy the smooth surface.

(d) Use metal polish.

(2) Plastics. Clean with ammonium citrate, dilute acids, or organic solvents.

(3) Glass and porcelain. Clean with detergent solution. If this does not work, soak in concentrated nitric acid or chromic acid cleaning solution.

(4) Painted surfaces. Use liquid scrape-off paint remover, brush, and scraper or putty knife. Discard the brush with the paint scrapings, decontaminate the scraper with rags. In cases where surfaces were covered with strippable paint, peel the paint from the surface.

(5) Rubber, including respirators and gas masks. Wash with detergent water or with a hot 20 percent (by weight) water solution of sodium citrate.

c. Decontamination of Clothing.

(1) Determine extent of contamination using an AN/PDR-27 with the beta shield removed and with the AN/PDR-54, AN/PDR-60, or AN/PDR-56F.

(2) Segregate the clothing into two classes with Class 1 used for low activity, i.e., less than 0.1 millirad per hour above background on AN/PDR-27 and 50 counts per minute on APN/PDR-54, AN/PDR-60, or AN/PDR-56F. Release for ordinary laundering. Class 2 is for activity higher than 0.1 to 10 millirads per hour on AN/PDR-27 and 50 cpm on AN/PDR-54, AN/PDR-60, or AN/PDR-56F. Wash Class 2 in special

laundry facility washer or washer-dryer kept in the facility for washing "hot" clothing only. Use the following steps:

(a) Soak overnight in water solution of laundry detergent.

(b) Drain.

(c) Wash for 15 minutes with hot water and powdered soap or laundry detergent.

(d) Rinse.

(e) Dry and remonitor.

CHAPTER 10

PROCEDURE IN CASE OF EMERGENCY

10-1. GENERAL.

a. In view of the complicating factors that may arise in an emergency, it is impossible to establish simple rules of procedure to cover all situations. However, in any emergency the primary concern must always be the protection of personnel from radiation hazards Second should be the confinement of the contamination to the local area of the accident, if this is possible.

b. Emergency procedures should be preplanned and rehearsed.

c. Examples of emergencies which may arise include:

(1) Spill of radioactive material.

(2) Explosion.

(3) Fire.

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(4) Overexposure.

(5) Injury to personnel.

10-2. EMERGENCY PROCEDURES. In the event of an emergency, the following action should be taken:

a. Spills.

(1) Notify all persons not involved with spill to vacate to a known area of safety. Personnel believed to be contaminated should be instructed where to go so as not to intermingle with "clean" persons.

(2) If the spill is liquid and the hands are protected, right the container and take steps to contain the spillage.

(3) If the spill is on the skin, flush thoroughly.

(4) If the spill is on the clothing, discard outer or protective clothing at once.

(5) Notify the radiological protection officer.

(6) Decontaminate personnel.

(7) Decontaminate the area.

(8) Monitor all persons involved in the spill and cleaning operation to determine adequacy of decontamination.

(9) Permit no person to resume work in the area until an area .survey is made and the area is cleared by the radiation protection officer.

(10) Prepare a complete history of the accident and decontamination operation related thereto. Forward an information copy to Commander, USA AMCCOM, ATTN: AMSMC-SFS, Rock Island, IL, 61299-6000, within 10 working days of occurrence of the incident.

b. Accidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors, and Gases.

(1) Notify all other persons to vacate the area immediately.

(2) Hold breath and switch off any air circulating devices; e.g., fans, air conditioners, and blowers.

(3) Vacate the area.

(4) Close all entrances into the area and post conspicuous warning signs or guards to prevent unauthorized entry.

(5) Notify the radiological protection officer. He will direct all activities pertaining to segregation of personnel, decontamination, monitoring, and coordination with other emergency personnel such as fire, security, and medical. Medical personnel will supervise removal of injured personnel.

(6) Immediately report all known or suspected inhalations of radioactive materials to the local radiological protection officer and local medical officer so that they can take necessary action.

(7) Evaluate the hazards and the safety devices required for safe re-entry.

(8) Determine cause of contamination and rectify the condition.

(9) Decontaminate area.

(10) Perform area survey (including air samples) of the area before resuming normal operations.

(11) Monitor all persons suspected of contamination. Decontaminate when necessary.

(12) Prepare a complete history of the accident and subsequent activity related thereto. If disposal of radioactive material is involved, forward an information copy to Commander, USA AMCCOM, ATTN: AMSMC-SFS, Rock Island, IL, 61299-6000, within 10 working days of occurrence of the incident.

c. Injuries to Personnel Involving Radiation Hazards.

(1) Immediately -flush minor wounds thoroughly with running water.

(2) Regardless of how minor the wound, the patient will be examined by medical personnel.

(3) Personnel with minor wounds should be monitored, and decontaminated if necessary, before leaving the radioactive material disposal facility. If the wounds are of a serious nature, the injured individual will be immediately removed to the local medical facility as quickly as possible. Those persons accompanying him will warn the medical personnel that there is a possibility that the injured individual is contaminated.

(4) Report all radiation accidents to personnel (overexposure, wounds, ingestion, and inhalation) to the local radiation protection officer.

(5) Permit no person involved in a radiation injury to return to work without the approval of the attending physician and the local radiation protection officer.

(6) Prepare a complete history of the accident and the subsequent activity related thereto for the laboratory records. Forward an information copy to Commander, USA AMCCOM, ATTN: AMSMC-SFS, Rock Island, IL, 61299-6000, within 10 days of occurrence of the incident.

d. Fires and Other Major Emergencies.

(1) Notify all other persons in the area at once.

(2) Attempt to put out fires if it can be accomplished safely.

(3) Notify the fire department and other emergency personnel.

(4) Notify the local radiation protection officer. The local radiation protection officer will advise and assist the emergency personnel.

(5) Monitor the area and determine the protective devices necessary for safe decontamination.

(6) Decontaminate when necessary.

(7) Monitor all persons who were in the emergency area and those who were involved in combating the emergency.

(8) Permit no one to resume work without approval of the local radiation protection officer.

(9) Prepare a complete history of the emergency and subsequent activity related thereto for the facility records. Forward an information copy to Commander, USA AMCCOM, ATTN: AMSMC-SFS, Rock Island, IL, 61299-6000, within 10 working days of occurrence of the incident.

10-3. EMERGENCY REPORTS. Reports covering the emergency situations listed in 10 CFR 20.403 will be prepared as established earlier in this manual. These special reports do not waive the reporting requirements of AR 385-40.

CHAPTER 11

RECORDS

11-1. TYPES OF RECORDS. The following records should be maintained:

a. Inventory of radioactive materials.

b. Personnel exposure.

c. Reports of investigation of emergencies.

d. Area surveys.

e. Monitoring and decontamination.

f. Personnel instruction.

g. Instrument calibration.

h. Checklist and disposal forms.

11-2. INVENTORY. All receipts, transfers, and disposals of radioactive materials will be recorded. Balance on hand should be verified periodically (AR 385-11).

11-3. PERSONNEL EXPOSURE. DD Form 1141 (Record of Exposure of Ionizing Radiation) is a permanent component of the individual's medical record and will not be removed except as authorized by AR 40-14, paragraph 11. The custodian of medical records will prepare and maintain DD Form 1141 (AR 40-14). The radiological protection officer will maintain a local form for recording personnel exposure data for control planning purposes. Commanders, radiological protection officers, authorized inspecting officials, or supervisors of persons occupationally exposed to ionizing radiation, and the individual concerned, may review his DD Form 1141 with the custodian of the medical records at any time.

11-4. AREA SURVEYS. At least once a month any storage area used for radioactive waste should be monitored. Location of monitoring points should be marked on a scale drawing of the area. Levels of radiation and/or contamination, and any other significant observations and actions, should be recorded.

11-5. CALIBRATION.

a. Instruments used for radiation protection must be calibrated at least every 3 months.

b. Survey instruments should be calibrated at two points on each instrument scale when possible. Use of check sources included with the instrument does not constitute a calibration.

c. Records will be maintained showing date of calibration, manufacturer, and model number of instrument, type of calibration source, name of person performing calibration, and results of calibration.

11-6. MONITORING AND DECONTAMINATION RECORDS. If property or personnel contamination is discovered, the extent of contamination and circumstances involved, decontamination performed, and preventive action taken will be recorded.

11-7. INSTRUCTION. A record will be maintained showing the name of each person instructed.

CHAPTER 12

SECURITY

SECURITY. a. Radioactive materials will be secured against unauthorized removal in accordance with AR 385-11 and AR 380-20.

b. In those cases where national security is involved, local plans and procedures for handling, storage, and movement of the unwanted radioactive material will be coordinated with the appropriate intelligence officer, as required.

CHAPTER 13

QUALITY AUDIT

13-1. An audit program initiated by HQ, AMCCON will establish uniform guidance and training for personnel packaging and transporting radioactive waste. This program will:

a. Assure compliance with all federal, state, and Army regulations.

b. Assure the adequacy of instructions to the shipper and the shipper's documentation for the radio-active waste packages.

c. Provide on-site training by experienced Health Physicists to infrequent shippers as required.

d. Establish a better line of communications between the U.S. Army, the site contractors, and the state authorities.

13-2. On-site Audit.

On-site audits will be conducted by the HQ, AMCCOM, assigned Health Physicist on a randomly selected basis. Appendix D provides an outline/checklist that will be followed by the auditor. Some of the audits will consist of the AMCCOM Health Physicist being on-site during packaging and loading of the waste material.

APPENDIX A

REFERENCES

Specific Subjects

AR 40-4	Army Medical Department Facilities/Activities
AR 40-5	Health and Environment
AR 40-14	Control and Recording Procedures Occupational Exposure to Ionizing Radiation (DSAR 4145.24)
AR 40-37	Licensing and Control of Radioactive Materials for Medical Purposes
AR 55-16	Movement of Cargo by Air and Surface, Including Less Than Release Unit and Parcel Post Shipments
AR 55-38	Reporting of Transportation Discrepancies in Shipment
AR 55-355	Military Traffic Management Regulation
AR 380-20	Restricted Areas
AR 385-10	Army Safety Program
AR 385-11	Safety: Ionizing Radiation Protection
AR 385-30	Safety Color Code Markings and Signs
AR 385-32	Protective Clothing and Equipment
AR 385-40	Accident Reporting and Records
AR 700-58	Reporting of Packaging and Handling Deficiencies
AR 700-64	Radioactive Commodities in the DOD Supply System
DARCOM P 385-1	Fundamentals of Health Physics for the Radiation Protection Officer
FM 3-5	NBC Decontamination
FM 3-15	Nuclear Accident and Contamination Control
TB 43-180	Calibration and Repair Requirements for the Maintenance of Army Materiel
TM 38-250	Packaging and Materials Handling: Preparation of Hazardous Materials for Military Air Shipment
TM 55-315	Transportability Guidance for the Safe Transport of Radioactive Materials

Title 10[1]	Energy, Chapter I, Nuclear Regulatory Commission (Parts 0-199)
Title 14[1]	Aeronautics and Space, Chapter I, Federal Aviation Administration, Department of Transportation (Parts 0-199)
Title 39[1]	Postal Service, Chapter I, United States Postal Service (Parts 0-199)
Title 46[1]	Shipping, Chapter I, Coast Guard, Department of Transportation (Parts 0-199).
Title 49[1]	Transportation, Chapter I, Materials Transportation Bureau, Department of Transportation (Parts 100-199)
Tariff No. BOE-6000[2]	Hazardous Materials Regulations of the Department of Transportation by Air, Rail, Highway, Water, and Military Explosives by Water including Specifications for Shipping Containers

General Information on Radiation Protection and Radioactive Material

TB MED 223	Respiratory Protection Program (AFOSH STD 161-1)

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[1]Copies of the Code of Federal Regulations are normally available from the Post Judge Advocate. Copies can be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20036.

[2]The Tariff No. BOE-6000 is available from the Association of American Railroads, Bureau of Explosives, 1920 "L" St. N.W., Washington, DC,20036.

[3]Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC, 20402.

APPENDIX B

INSTRUCTIONS TO PERSONNEL TRANSPORTING RADIOACTIVE MATERIAL

B-1. PART A. GENERAL. Excessive exposure to radiation may be harmful to health. Should personnel be exposed to large amounts of radiation or radioactive material get onto the skin or enter the body, serious injury can result. Proper radioactive material shipping containers are designed to prevent this danger as long as the containers are undamaged. However, the shipping containers might be damaged in such a manner that overexposure or contamination can occur. This can happen as a result of collision, fire, explosion, theft, spillage, leakage, or misplacement of the cargo. Should any of these happen, an emergency exists. Your first aim should be to protect yourself and others from overexposure and contamination. Second, efforts should be made to confine the contamination to the local area of the accident.

B-2. PART B. EMERGENCY ACTION IN THE EVENT OF FIRE, EXPLOSION, LEAKAGE, OR SPILL.

a. Minimize the hazard if possible. Examples:

(1) Pull out of the line of traffic.

(2) In case of fire, attempt to put the fire out with fire extinguishers.

(3) In case of leakage, try to control the spread of liquid by earth dams or, if this is not practical, use other available material to direct the spillage off the highway.

(4) By means of the sweeping action of a high pressure hose jet, the fire department might flush leakage or spillage off the highway

b. Use on-site people.

(1) To isolate the area. If necessary, increase the distances to keep people out of smoke, leakage, spillage, and mists.

(2) To give first aid.

(3) To call for medical, fire, police, or civil defense assistance.

(4) To get names and addresses of personnel who were involved with the incident or who may have handled and damaged containers or who may have contacted the fumes, spillage, smoke, or dust. These people should be checked by radiological experts before leaving the

scene of the accident. If these people need medical attention, do not delay getting them medical help; however, warn the medical personnel that these people may be contaminated.

c. During normal work hours, call the shipper (area code, telephone number, extension). After normal work hours, call the duty officer (area code, telephone number, extension). Describe the incident, give your location and telephone number where you can be reached. Request emergency assistance and any special instructions.

d. Show the instructions contained in paragraphs 4 through 6 of this appendix to the emergency personnel. Paragraphs 4, 5, and 6 below are intended to assist the emergency personnel.

B-3. PART C. PROCEDURES IN CASE OF THEFT OR LOSS.

a. Notify Army area headquarters.

b. Notify consignor.

c. Notify local police officials and FBI if theft is suspected.

d. Attempt to recover in case of loss.

B-4. PART D. DESCRIPTION OF THE RADIOACTIVE MATERIAL.

Radiosotope _____.
Activity _____.
Radiation emitted _____.
Chemical/physical form _____.

B-5. PART E. MEDICAL ASSISTANCE.

a. Immediate medical treatment is required for:

(1) Persons who may have eaten or inhaled radioactive contamination.

(2) Persons with wounds which may have been contaminated.

(3) Persons whose faces or extensive areas of their bodies were contaminated.

b. Effectiveness of eliminating radioactive material in the body depends upon promptness of medical treatment.

B-6. PART F. PERSONNEL DECONTAMINATION.

a. If packages were undamaged, contamination is unlikely. However, radiac instruments are necessary to verify the presence or absence of contamination. For beta-gamma materials, this requires an instrument capable of reading 0-5 millirads per hour. For alpha

emitting materials an instrument capable of detecting 30 alpha particles per square inch, or 5 alpha particles per square centimeter (by probe or swipe), is required. Uniform distribution of the material is assumed, at least for the area under the probe. Further, it should be noted that alpha radiation cannot be detected from moist or wet surfaces.

b. Thorough washing with nonabrasive soap and lukewarm water is the best general method of decontamination of the hands and other parts of the body.

CAUTION: Organic solvents must be avoided as decontaminating agents because they may increase the probability of the radioactive materials penetrating the pores of the skin. Special attention must be given to the areas between the fingers and around the nails; also, the outer edges of the hands are readily contaminated and must not be neglected in the washing.

c. In the event several individuals have become contaminated or the contamination on an individual is not localized to a small portion of the body, the following decontamination procedure will be used:

(1) Place individual in a lukewarm shower.

(2) Using a mild soap, individual should cover entire body with lather.

(3) While still covered with lather, individual should step out of shower.

(4) Sprinkle a heavy coat of mild soap flakes all over lathered-individual. (Purpose of lather is to cause soap flakes to adhere to person.)

(5) Using his hands, the contaminated individual should rub the soap flakes on his body into a paste.

(6) Individual should then return to shower and rinse soap off of his person by starting at the top and working his way down.

NOTE: It will be necessary for individual to rub body surfaces with his hands while rinsing in order to remove soap paste. Soap paste will remain on those areas which have not been thoroughly washed. Although a soft cloth may be used, a brush may not. Particular attention should be given hairy portions of the body.

(7) When the individual has rinsed himself to the point that he no longer feels slimy, and, while still under shower, he should be examined by an assistant for traces of soap. The presence of soap will indicate which areas of the body have not been decontaminated.

(8) After removing all traces of soap, individual should leave the shower and dry himself.

(9) After drying off, individual must be monitored. If still contaminated, above procedures should be repeated. In the event residual contamination is localized, repeat procedures should be limited to those areas still showing contamination.

APPENDIX C

RADIOACTIVE WASTE DISPOSAL CHECKLIST

C-1. This checklist will serve as a guide to avoid frequently found errors associated with the packaging, marking, labeling, and shipping of radioactive waste material. A check mark in the appropriate block and signature at the end of this checklist will signify compliance and/or understanding of the provisions of this checklist.

C-2. General Packaging Requirements.

a.___The following list of absorbents is approved for packaging scintillation vials and animal carcasses only. No other absorbents are authorized:

(1) Zonalite (Grade 2, 3, or 4)

(2) Speedi Dry

(3) Celatom (M-P 78)

(4) Floor Dry - Super Find (Diatomite)

(5) Hi Dri

(6) Florco and Florcox

(7) Instant-Dri

(8) Safe-T-Sorb

(9) Oil-Dry (Safe N Dri)

(10) Krolite

b.___Metal containers, i.e., 5-gal., 30-gal., or 55-gal. Must meet DOT Specification 17H, Title 49 CFR (178.118 and 178.350). Metal containers must be used unless otherwise directed by HQ, AMCCOM.

c.___Wooden box, when authorized by AMCCOM, must meet DOT Specification 19A Title 49 CFR (178.190). Boxes must be banded.

d.___No package shall have any surface contamination (49CFR173.443).

e.___Each package of radioactive material in excess of 110 pounds (50 kilograms) must have its gross weight plainly and durably marked on the outside of the package (172.310 Radioactive material).

f.___Each package which conforms to the requirements for TYPE A or TYPE B will be marked on the outside as "TYPE A" or "TYPE B" as appropriate (172.310 Radioactive material).

g. All manual markings will be at least 1/2 inch (13mm) high and in a durable, contrasting color (172.304(a) Marking requirements).

h. Labels or markings must be displayed on at least two sides or two ends (excluding bottom of package) (172.406(e) Placement of labels) i.e., RADIOACTIVE WHITE I, RADIOACTIVE YELLOW II, RADIOACTIVE YELLOW III.

i. An inspection shall be conducted to determine if the package is sealed and tight and to determine the worthiness of the package to undergo transport without incident 49CFR173.411, 173.412, 173.413.

j. Radioactive labels require specific information to be displayed on them:

(1) WHITE I: radionuclide contents and number of curies.

(2) YELLOW II and III: radionuclide contents, number of curies, and transport index (172.403(g)).

k. Radioactive packages must be properly loaded onto the transport vehicle; heaviest packages on the bottom, boxes on top of barrels. Loaded packages must be shored to prevent movement during transit which may cause damage to the package.

l. Shipment by parcel post not authorized.

m. Shipment by rail not authorized.

C-3. Special Packaging Requirements.

a. Scintillation Vials

(1) Container must meet Department of Transportation (DOT) Specification 7A requirements as listed in CFR 49, 173.415 and could be 30-gal. or 55-gal. size.

(2) Container must be lined with a 4 mil plastic liner and sealed at the top when container is packed. It is recommended that a layer of absorbent be placed in the bottom of the drum prior to the installation of the plastic liner.

(3) Place approximately 3 inches of absorbent at the bottom of the container, inside the plastic liner. Vials and absorbent must be placed in the container in alternate layers not exceeding 6 inches in depth. The top layer of absorbent must be at least 3 inches in depth.

(4) The vials are NOT to be opened.

(5) Container must be filled with enough absorbent material to absorb at least twice the volume of radioactive liquid contents (absorbency not based on volume or weight).

(6) Seal the drum.

b. Procedure for Animal Carcasses.

(1) All containers must meet DOT performance specification 7A. The final package will be a double-walled metal container with the outer container having a capacity at least 40 percent greater than the inner container (i.e., a 30-gal drum in a 55-gal. or a 55-gal. drum in an 85-gal. drum).

(2) Line the inner metal drum with 4 mil plastic liner.

(3) Place animal carcasses into the inner metal drum with absorbent and lime. Ratio: One part lime to ten parts absorbent.

(4) Seal plastic liner and inner metal drum.

(5) Place approximately 3 inches of absorbent in bottom of outer drum.

(6) Place the inner metal drum inside the outer metal drum.

(7) Place absorbent between the inner and outer drum.

(8) Seal the outer drum.

c. Procedure for Dry Solid Waste.

(1) Container must meet DOT Specification 7A requirements as listed in Title 49 CFR 173.415 and can be 5, 30, or 55-gal. size.

(2) Container must be lined with a 4 mil plastic liner and sealed at the top when container is filled.

(3) Sharp objects should be packed or consolidated into smaller packages so as not to puncture the 4 mil liner.

(4) No liquids or absorbed waste is permitted.

(5) Seal the drum.

d. Procedure for Packaging Absorbed Liquids, Including Oils.

(1) Container must meet DOT Specification 7A requirements as listed in CFR 49, 173.415 and could be 30 gallon or 55 gallon size.

(2) Container must be lined with a 4 mil plastic liner and sealed at the top when container is packed.

(3) Container must be filled with enough absorbent material to absorb at least twice the volume of radioactive liquid contents (absorbency not based on volume or weight). Waste containing liquid should be added at approximately every foot of absorbent to ensure even dispersion.

NOTE: Applies only to Richland, Washington,disposal site.

C-4.___Marking and Labeling. Each outer container must be marked and labeled as directed by HQ, AMCCOM specific instructions.

C-5.___Distribution of Documents. A Radioactive Waste Shipment and Disposal Record Form (RSR) and appropriate compliance certifications will be forwarded to the requester by HQ, AMCCOM, when disposition instructions are furnished.

C-6.___Distribution of Documents and Advance Notice. Follow specific guidance contained in disposition instructions provided by HQ, AMCCOM

C-7.___Final Inspection. A final inspection by a Quality Assurance Specialist, accompanied by a Radiation Safety Officer and Transportation Specialist, will be made to assure that all provisions are met

a.__Each package to be used for shipment of radioactive waste is in compliance with DOT and U.S. Nuclear Regulatory Commission (NRC rules and regulations and that the container is authorized for shipment of that type and quantity of waste.

b.__Radiation levels are in compliance with DOT and NRC regulations.

c.__Each container is properly marked and labeled in accordance with DOT regulations.

d.__The GBL and RSR have been completed in detail, signed, dated, and accompany the shipment.

e.__The transport vehicle is placarded (if required) in accordance with DOT regulations.

f.___The transport vehicle is roadworthy and can pass a DOT safety inspection.

APPENDIX D

GENERAL HEALTH PHYSICIST CHECKLIST FOR AJUDIT OF ARMY SHIPMENTS

CRITERIA	YES	NO	NA	COMMENTS

1.0 ADMINISTRATION

1.1 Are written guidelines available for use by shipper?
- a. Title 10 CFR.
- b. Title 49 CFR.
- c. Review of DOT regulations.
- d. AR 385-11.
- e. NRC license (if required).
- f. AMCCOM Pamphlet 385-1.

1.2 Previous audits: Have deficiencies been corrected?

1.3 Personnel qualifications of shipper:
- a. Experience adequate?
- b. Training adequate?

1.4 Shipping forms:
- a. Complete?
- b. Accurate?

2.0 PACKAGING

2.1 Is container type:
- a. 17H or 17C metal drum?
- b. Strong, tight, sealed package?
- c. Clearly marked "17H" or "17C"?
- d. Have a security seal?
- e. Been inspected prior to use?
- f. Meet AMCCOM specifications?
- g. Others Specify.

2.2 Has an inventory been made of contents?

2.3 Is type of material to be shipped:
- a. LSA?
- b. Large quantity?
- c. Limited quantity?
- d. Suitable for burial at specified site?

2.4 Is a transport index entered properly?

CRITERIA	YES	NO	NA	COMMENTS

2.5 Is rad waste material checked for:
- a. Percent of liquid?
- b. Percent of oil?
- c. Complete solidification?
- d. Transuranic content?
- e. Approved absorbent?
- f. Authorized for burial at the selected site?

2.6 Does biological/organic rad waste have:
- a. Inner container?
- b. Outer container?
- c. Approved absorbent?

2.7 Does packaged waste have a survey of all containers for rad dose rate and contamination?

2.8 Are the records of the surveys adequate and complete?

2.9 Does any measurement exceed the authorized limit?

2.10 Are containers/liners compatible with material shipped?

2.11 Is volume and weight of material stated?

2.12 Is checklist complete and adequate?

3.0 SHIPPING

3.1 Are all containers marked and labeled IAW DOT regulations?

3.2 Is there an isotopic analysis of waste material?

3.3 Is the transport index properly specified?

3.4 Is the type of material to be shipped properly specified?

3.5 Are all shipping documents complete and accurate?

CRITERIA	YES	NO	NA	COMMENTS

3.6 Do reports of radioactive surveys agree with actual readings?

3.7 Drum conditions:

a. Are seams and seating surfaces clean and free of rust?
b. Is there a 5/8-inch bolt on the retainer ring?
c. Are lids free from physical deformation?
d. Does ring fit snugly?
e. Is drum marked and sealed with security seal?

3.8 Other container conditions:

a. If wood, is the container made of 100 percent Grade 1 plywood?
b. Is the container free from cracks, knots, and other perforations?
c. Is the seal on the container strong and secure?
d. Does the container meet specifications of DOT and the burial site?
e. Has the container been approved in writing by AMCCOM if other than metal drum?

APPENDIX E

GLOSSARY

ALPHA PARTICLE -	A positively charged particle of matter emitted by the nucleus of a radioactive atom. Radioactive atoms with large atomic weights tend to emit alpha particles; radioactive atoms with lower atomic weights tend to emit beta particles.
BETA PARTICLE -	A negatively charged particle of matter emitted from the nucleus of a radioactive atom.
CONTAMINATION (RADIO-ACTIVE) -	The undesired presence of radioactive material on persons, objects, or areas.
CUMULATIVE DOSE -	Total dose resulting from repeated exposures to radiation of the same region or of the whole body.
DECONTAMINATION -	The removal of contaminating radioactive material from a structure, area, object, or person. The reduction of contaminating radioactive material to an acceptable level.
DOSE -	Radiation delivered to a specific area or volume or to the whole body.
DOSE RATE -	Amount of radiation delivered per unit time.
DOSIMETER -	An instrument for measuring dose received during a period of time.
FILM BADGE -	An appropriately packaged photographic film for determining dose received by personnel.
GAMMA RAY -	A type of radiant energy, emitted from the nuclei of radioactive atoms, which can cause ionization of matter.
IONIZATION -	Separation of a normally electrically neutral atom or molecule into electrically charged components.
IONIZING RADIATION -	Radiant energy (gamma rays or x-rays) or charged particulate radiation (alpha par- ticles, beta particles, or neutrons) which can cause ionization.

GLOSSARY (Cont'd)

MONITORING - Determination of presence of radioactive contamination and of dose rates.

RAD PER HOUR - Unit used by the Army to measure dose rate.

RADIOACTIVE MATERIAL - Army material or identifiable component of equipment which emits ionizing radiation as a result of nuclear disintegration. To be considered radioactive, the radioactivity (rate of nuclear disintegration) must exceed 0.002 microcuries per gram.

By Order of the Secretary of the Army:

CARL E. VUONO
General. United States Army
Chief of Staff

Official:

R. L DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-34B, requirements for Handling disposal of Unwanted Radioactive Materiel.

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THE METRIC SYSTEM AND EQUIVALENTS

'NEAR MEASURE

. Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches
1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches
1 Kilometer = 1000 Meters = 0.621 Miles

'VEIGHTS

Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces
1 Kilogram = 1000 Grams = 2.2 lb.
1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons

LIQUID MEASURE

1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces
1 Liter = 1000 Milliliters = 33.82 Fluid Ounces

SQUARE MEASURE

1 Sq. Centimeter = 100 Sq. Millimeters = 0.155 Sq. Inches
1 Sq. Meter = 10,000 Sq. Centimeters = 10.76 Sq. Feet
1 Sq. Kilometer = 1,000,000 Sq. Meters = 0.386 Sq. Miles

CUBIC MEASURE

1 Cu. Centimeter = 1000 Cu. Millimeters = 0.06 Cu. Inches
1 Cu. Meter = 1,000,000 Cu. Centimeters = 35.31 Cu. Feet

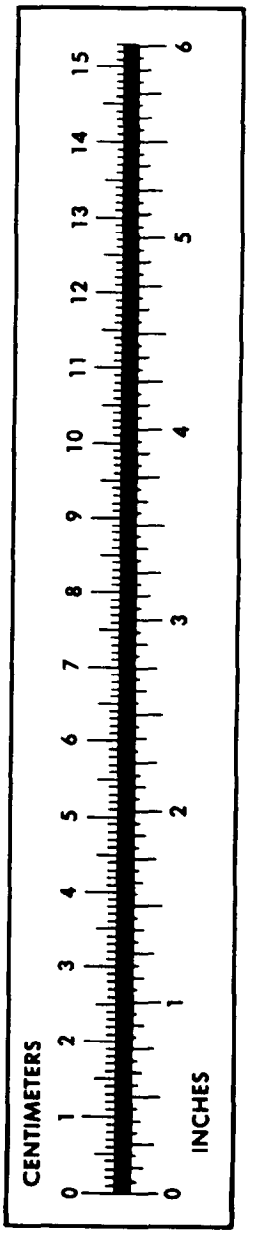
TEMPERATURE

5/9(°F - 32) = °C
212° Fahrenheit is evuivalent to 100° Celsius
90° Fahrenheit is equivalent to 32.2° Celsius
32° Fahrenheit is equivalent to 0° Celsius
9/5C° + 32 =°F

APPROXIMATE CONVERSION FACTORS

TO CHANGE	TO	MULTIPLY BY
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Square Inches	Square Centimeters	6.451
Square Feet	Square Meters	0.093
Square Yards	Square Meters	0.836
Square Miles	Square Kilometers	2.590
Acres	Square Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
ıts	Liters	0.473
arts	Liters	0.946
allons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Square Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

TO CHANGE	TO	MULTIPLY BY
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Square Centimeters	Square Inches	0.155
Square Meters	Square Feet	10.764
Square Meters	Square Yards	1.196
Square Kilometers	Square Miles	0.386
Square Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
ers	Gallons	0.264
ms	Ounces	0.035
ograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pounds-Feet	0.738
Kilopascals	Pounds per Square Inch	0.145
lometers per Liter	Miles per Gallon	2.354
meters per Hour	Miles per Hour	0.621



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