1.0. General.

Personnel involved in the shipment, storage, and transportation of munitions that have a potential for producing radiation hazards such as 105 and 230 MM APFSDS-T munitions should have received training to make them aware of the hazards and symptoms related with exposure to radioactive materials. If the proper precautions are taken, the possibility of injury due to radiation exposure is greatly reduced.

2.0. History of Radiation.

Radiation was discovered in the late 19th century but was considered a scientific curiosity with little practical value. This attitude persisted well into the 20th century. During this time, researchers discussed findings in terms of the effects of radiation or the type of equipment used in a particular experiment. For example, an experimenter might describe the effects on the skin of a person exposed to radiation. As experiments became more precise and the experimenters became aware of the effects of radiation on living tissue, the need arose for an accurate unit to enable comparison among the various types of X-ray machines that had proliferated during World War I. For these reasons, the International Commission for Radiological Protection (ICRP) was formed and met in Geneva, Switzerland, in 1925 and again in 1928. Search for a suitable unit culminated in 1928 in the adoption of the ROENTGEN unit, a measure of ionization in air, named after the discoverer of X-rays. In 1929, the National Council for Radiation (NCRP) was formed in the United States. The NCRP was instrumental in getting Congress to pass laws relating to radiation protection.

2.1. Radioactivity Defined.

Radioactivity is defined as a spontaneous, energy-releasing atomic transition that involves a change to the nucleus of the atom. This change in the nucleus is from one nuclear energy level to a lower energy level. Since radioactive decay is a continuing process, the radiation emitted from Depleted Uranium (DU) consists of alpha, beta, and gamma radiation.

- **Alpha Particles.** The alpha particle is a stable combination of two protons and two neutrons. When an element emits an alpha particle during radioactive decay (nuclear disintegration), the particle is traveling at speeds of 9,000 to 20,000 miles per second, but it is rapidly slowed in its passage through matter.

- **Beta Particles.** A beta particle is a charged particle emitted from a radioactive atomic nucleus, either natural or man made. Beta particles result when either a proton is converted to a neutron or a neutron is converted to a proton. In relation to an alpha particle, a beta particle has smaller mass and travels at much higher speeds, almost the speed of light. Beta particle emitters are generally considered a less serious internal hazard than alpha emitters. However, beta emitters can create an external hazard.

- **Gamma Rays.** When radioactive decay results in the emission of a particle from the nucleus, the nucleus is often left in a highly excited state. The excited nucleus gives off its

excess energy in the form of gamma rays. Gamma radiation is the most highly penetrating radiation.

3.0. Matter and Energy.

- **Matter.** Matter is defined as any substance that has weight and occupies space. There are three forms of matter: solid, liquid, and gas. Depending upon the temperature, all substances occur in one of these forms, provided no chemical change takes place. All forms of matter are characterized by certain chemical and physical properties. Physical properties are characteristics such as color, density, solubility, and conductivity. Chemical properties are characteristics that are shown during chemical interactions of one substance with another. When a substance undergoes a physical change, its composition is not altered. For example, the freezing of water is a physical change. However, when a substance undergoes a chemical change, its composition is changed. For example, burning wood is a chemical change.

- **Elements.** An element is a simple substance that cannot be decomposed by chemical means. The smallest unit of an element that still retains the characteristic properties of the element is the atom. In order to simplify discussions concerning elements, a standard notation form is used to talk about atoms. It is based upon the primary characteristics of the atom. The atomic mass of an atom is determined by the number of protons and neutrons found in the nucleus. The sum of the protons and neutrons gives an element its atomic number. In addition each element is commonly designated by a symbol made up of one or two letters of its English or Latin name. For example, uranium is designated by U, hydrogen by H, thorium by TH, and americium by AM.

4.0. Uranium.

This section of the lesson will focus on the element uranium and its use in various munitions. In the chemically pure state, uranium appears as a shiny silvery metal. When exposed to the atmosphere for a short period, it will oxidize to a golden-yellow color and from that, to black. Good quality ore contains about 1 percent uranium, which is composed of three components known as isotopes. These isotopes are:

- **U238.** Approximately 99.284 percent is isotope U238.
- **U235.** Approximately 0.710 percent is isotope U235.
- **U234.** Approximately 0.006 percent is isotope U234.

When a chain reaction is desired, such as the reaction in a nuclear power plant or nuclear weapon, U235 is used. Uranium in which the U235 isotope concentration has been artificially increased above the natural 0.7 percent level is called “enriched uranium.” The process of enrichment follows a complex separation and conversion process. Once the uranium is in a gaseous form, it is ready for the infusion or filtering process. Basically, U235 and U234 pass through a membrane-like filter. U238 does not because it is too thick. This filtering process continues until approximately 70 percent of the U235 is separated. Nearly depleted of U235, the remaining U238 is known as “depleted uranium” or “DU.” All of the radioactive materials have

a unique half-life, the time that it takes for half of the mass of the material to disintegrate through radioactive decay. In the case of U238, the half-life is 4.5 billion years, comparable to the age of the universe as we know it.

4.1. Depleted Uranium (DU).

DU metal and alloys (mixtures) of DU have found application in various areas of service, such as aircraft and missile counterweights, radiation shielding, and weapons/munitions. In these applications, the high density is the important property. For ordnance applications, the pyrophicity (the ability to ignite spontaneously with air and/or produce sparks by friction) of some of the alloys adds to their potential effectiveness. The munitions currently using DU include:

Cartridge	25mm	APFSDS-T	XM919	Weight of DU is Classified
Cartridge	105mm	APFSDS-T	M774	Weight of DU is 7.41 pounds
Cartridge	105mm	APFSDS-T	M833	Weight of DU is 8.08 pounds
Cartridge	120mm	APFSDS-T	XM900E1	Weight of DU is Classified
Cartridge	120mm	APFSDS-T	M827	Weight of DU is 6.90 pounds
Cartridge	120mm	APFSDS-T	M829	Weight of DU is 8.69 pounds
Cartridge	120mm	APFSDS-T	M829A1	Weight of DU is Classified

4.2. Kinetic Energy Projectiles.

The second generation Kinetic Energy (KE) projectile is capable of penetrating the frontal slope of all fielded armor systems. A high technology penetrator and sabot design provides munitions that are accurate in all combat ranges. Its primary function is the destruction of tanks and armored fighting vehicles.

4.2.1. APFSDS-T (Armor Piercing Fin Stabilized Discarding Sabot - Tracer) Munitions Items.

These rounds use a kinetic energy penetrator made from depleted uranium (staballoy). Because of the toxic nature of U238 when ingested into the body, more stringent inspection criteria must be used to ensure that no hazard exists to personnel handling the items. Because of the nature of staballoy, SOPs will be locally developed to ensure that personnel involved in operations with staballoy rounds are protected from possible ingestion. SOPs should include procedures covering accidents, storage incidents, and reporting requirements involving rounds containing DU materials. Procedures for commercial transportation of DU materials must fully reflect the applicable requirements of 49 CFR, part 173. Although chances of any DU particles migrating to the surface of a projectile are considered remote, a swipe (smear) test will be performed to ensure the cartridge exterior is free of contamination. This test is mandatory. The instructions on performing the test are contained in Appendix L, SB 742-1 paragraph L-7 (Supplemental Reading page SR-9). If a cartridge is damaged to the point where the internal projectile components are visible, the item will be treated as CONFIDENTIAL. The damaged cartridge will be placed in a container or otherwise covered to prevent exposure. The cartridge will be

returned in a sealed container as a classified item to the appropriate ASP for disposition. If it is determined that the classified components were observed by anyone without a clearance, the individual must be debriefed as soon as possible.

4.3. Cartridge, 120mm, APFSDS-T, M829.

The M829 is the United States-designed 120mm APFSDS-T cartridge. The complete round contains a propulsion system consisting of a metal cartridge case base with a combustible sidewall, granular propellant within a containment device to prevent spillage, and an M125 electric primer. The projectile consists of a sub-projectile (penetrator) made of DU and an aluminum sabot. The DU penetrator is a one-piece design which is assembled into the sabot by means of grooves. There is a six-blade aluminum fin with an M13 tracer assembly fitted to the rear. The aluminum sabot is composed of four 90-degree, non-interchangeable segments with internal grooves matching those on the outer diameter of the sub-projectile. The sabot has a silicone rubber seal at the rear to prevent gas leakage.

- **Limitations.** All limitations applicable to the M829 cartridge apply to the M829A1. If the cartridge is damaged to the point where the internal projectile components are visible, the item will be treated as CONFIDENTIAL. The damaged cartridge will be placed in a container or otherwise covered to prevent exposure. The cartridge will be returned in a sealed container as a classified item to the appropriate ASP for disposition. The M829 is not to be disposed of by burning or detonation. M829 munitions will be stored with any munitions except storage compatibility group pyrotechnics and incendiaries.

- **Personnel Protection.** Since DU is an alpha particle emitter, it is primarily an internal hazard. This means that, to be of any harm to you, the particle must get inside your body. Alpha particles do not penetrate skin like beta particles or gamma rays. After any operation involving DU, such as inspection of projectiles or empty containers that contained DU, you must wash thoroughly to remove any alpha particle contamination. Also, if it is possible to breath in any DU, you must wear breathing protection. Activities at sites where DU is stored should be limited to doing what must be done and getting away from the DU. The idea is to limit your exposure to the possibility of becoming contaminated. While you are involved in operations with DU, do not take unnecessary time or breaks, or eat or drink in that area.

4.3.1. Surveillance of the 120mm APFSDS M829/M829A1 Cartridge.

- **SOPs.** In accordance with SB 742-1, SOPs should be locally developed to ensure personnel involved in operations with DU rounds are protected. As previously covered, SOPs should include accident and incident procedures and storage and reporting requirements.

- **Testing and Equipment Requirements.** Appendix L of SB 742-1 lists the requirements for testing, air leak testing, swipe/smear testing, and use of chamber gages. Refer to the Supplemental Reading for detailed information.

- **Inspection Category and Sampling Plan.** The M829/M829A1 has no inspection category assigned at this time. An initial upload inspection will be conducted as the rounds are uploaded by the using unit. Annual basic load inspections will be performed in accordance with SB 742-1. Swipe/smear testing procedures are contained in Annex L, SB 742-1 paragraph L-7 (Supplemental Reading page SR-9). Specific inspection points are also contained in Annex L.

5.0. Nuclear Regulatory Commission (NRC) License.

- The NRC is the governing authority for radioactive materials. Any installation possessing, storing, or conducting operations involving DU must be licensed by the NRC. The license is generally very restrictive. It specifically states all the requirements and indicates which operations may be conducted for that specific type of material.

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SUPPLEMENTAL READING 55B40C19

APPENDIX L
CARTRIDGES, 120MM,
M829, M829A1, M829A2, M830, M830A1, M865, AND M831A1

L-1. Item Description:

a. DODACs AND AMMUNITION TYPE:

(1) 1315-C786: Cartridge, 120MM, APFSDS-T, M829.
(2) 1315-C380: Cartridge, 120MM, APFSDS-T, M829A1.
(3) 1315-C792: Cartridge, 120MM, APFSDS-T, M829A2.
(4) 1315-C787: Cartridge, 120MM, HEAT-MP-T, M830.
(5) 1315-C791: Cartridge, 120MM, HEAT-MP-T, M830A1.
(6) 1315-C784: Cartridge, 120MM, TP-T, M831A1.
(7) 1315-C785: Cartridge, 120MM, TPCSDS-T, M865.
(8) 1315-CA05: Cartridge, 120MM, HE-OR-T, XM908.

b. SASIP: 742-1315-94-154

c. M829 Series Cartridges: The M829 series cartridges contain several main components which are of particular concern during surveillance inspections. These components and their basic composition are as follows:

(1) Subprojectile: DU penetrator with aluminum fin, aluminum windshield, and steel windshield tip. The M829A1 has a blunt windshield tip which is not removable.

(2) Sabot:

(a) M829- Four segment aluminum & anodized.
(b) M829A1- Three segment aluminum & anodized.
(c) M829A2- Three segment composite.

(3) Centering Band: Nylon (M829 only).

(4) Obturator: Nylon.

(5) Combustible Cartridge Case: Painted and sealed nitrocellulose.

(6) Combustible Forward Adapter: Inert

(7) Case Base and Seal Assembly (AFT CAP): Steel with rubber.

d. M865 Cartridge, TPCSDS-T:

(1) Subprojectile: Steel Core (tactical rounds have penetrators, training sabot cartridges have cores) with an aluminum conical fin.

(2) Sabot: Aluminum (anodized).

(3) Rear Band: Nylon.

(4) Obturator: Rubber seal.

(5) Combustible Cartridge Case: Painted and sealed nitrocellulose.

(6) Case Base and Seal Assembly: Steel with a rubber seal.

e. M830 and M830A1, HEAT-MP-T; XM908, HE-OR-T and M831A1, TP-T

(1) Projectile:

(a) M830: Steel Body and spike with an aluminum boom and fin.

(b) M830A1: Three aluminum sabot segments and a steel warhead assembly with a stainless steel proximity switch, ogive, and aluminum fin and boom.

(c) XM908: Same as the M830A1 except that the proximity switch has been replaced with a solid steel nose cone.

(d) M831A1: Aluminum body and steel spike assembly with an aluminum stabilizer.

(2) Centering Band:

(a) M830: Copper.
(b) M830A1 & XM908: (Has Sabot)
(c) M831A1:Nylon

(3) Combustible Cartridge Case: Painted and sealed nitrocellulose. The M830 has a live forward adapter (nitrocellulose) .

(4) Case Base & Seal Assembly: Steel with a rubber seal.

L-2. Unique Safety Precautions:

a. M829 Series:

(1) Because of the toxic nature of depleted uranium (DU), SOPs should be developed locally to assure personnel involved in operations with DU rounds are protected from possible ingestion. The SOPs should include procedures covering accidents, incidents, storage and reporting requirements involving round containing radioactive (DU) materials (reference TB 9-1300-278, "Guidelines for Safe Response to Handling, Storage, and Transportation Accidents Involving Army Tank Munitions Which Contain DU").

(2) Procedures for the commercial transportation of DU materials must fully reflect the applicable requirements of 49 CFR 173 and AR 385-11, in addition to the necessary actions required prior to a commercial shipment of explosives.

(3) Cartridges are exempted by NRC license from labeling requirements for radiological material. All shipments must comply with DOT exemption DOT-E-9649.

(4) Projectiles with evidence of damage and/or yellow corrosion will be inspected and swipe (smear) tested for evidence of DU contamination. The swipe test will be conducted as specified in paragraph L-7.

(5) Personnel handling DU cartridges should wear gloves and should not eat, drink, or smoke until they have thoroughly washed their hands with soap and water.

(6) Accidents and incidents involving DU munitions will be reported through the local Radiation Protection Officer (RPO), to HQ, IOC, ATTN: AMSIO-DM, Rock Island, IL 61299-6000. These include: theft or loss of control, functioning, fires, explosions or accidents where the DU munitions are or could be damaged, or damage that exposes or releases DU to the environment.

b. All 120MM Ammunition:

Care must be taken when handling ammunition assembled with combustible cartridge cases. The combustible cartridge case must not be damaged or scratched during handling. Handle the cartridge by the metal case base and projectile sabot.

L-3. Gaging and Test Requirements:

a. Gaging will be performed IAW SB 742-1, para 2-8:

(1) Every lot must be gaged at least once during its storage life cycle and results must be documented on Depot Surveillance Record card.

(2) Gaging will be accomplished whenever possible during initial receipt inspection or at the next scheduled periodic inspection, and/or whenever conditions such as exposure to adverse conditions, deterioration, damage, etc indicate a need to verify serviceability.

b. Swipe Test:

Swipe test will be performed only on damaged or corroded projectiles IAW paragraph L-7.

TABLE L-1 EQUIPMENT IDENTIFICATION LIST

DESCRIPTION	PART NUMBER	APPLICATION
Chamber Gage (Man-portable)	12524967	All 120MM Ctgs
Proportional Counter	Commercial Equip	Swipe (Smear) Test
Ring Gage Set	PN: 12900358 NSN: 5220-01-359-3001	ALL

NOTE: The ring gage set may be used in lieu of the man-portable chamber gage, if unavailable.

L-4. Inspection Category and Sampling Plan:

a. All 120MM cartridge inspection category: Y (3 years, 20 round sample size).

b. Stockpile reliability testing is conducted periodically on selected samples from specific lots in the unit basic loads. This test program is designed to determine the effect uploading, handling, and downloading by tank crews and prolonged exposure to adverse storage conditions may have on performance. Ballistic testing and physical teardown inspection will be performed by the designated licensed facilities. Test intervals will be as prescribed by HQ, IOC, ATTN: AMSIO-QAS, Rock Island, IL 61299-6000. DU ammunition samples will not be individually swiped. Only exterior PA-116 Shipping & Storage Container will be swiped in accordance with paragraph L-7n. (Samples will be swiped as part of the ASRP test).

c. An initial upload inspection will be conducted as cartridges are uploaded by a using unit during peace time loading.

d. The annual or semi-annual basic load inspections will be performed on cartridges by QASAS according to SB 742-1, Chapter 9 and this SASIP. Ammunition contained in basic load stocks will not be rejected for minor correctable defects.

e. Storage of empty PA-116 containers should be examined to verify that lids are in place and containers protected from the elements.

f. QASAS should report any observed stowage area that could affect serviceability of the ammunition. Examples of such areas are: tank stowage compartments including the hull racks which may have standing water, rust condensation, burred racks, or swing tubes, etc. Report findings to: HQ, IOC, ATTN: AMSIO-QAS, Rock Island, IL 61299-6000.

g. QASAS supporting upload operations in conjunction with armored unit deployments should assure that tank stowage compartments are thoroughly dry prior to ammunition upload. QASAS at the receiving end of deployment should assure uploaded ammunition serviceability at earliest opportunity to preclude potential moisture damage to the combustible cartridge case and forward adapter. HQ, IOC, AMSIO-QAS and AMSIO-SMA-T, must be advised of any damage or deterioration of ammunition or stowage compartments attributable to moisture damage in transit. Damage reports shall provide the bumper number and unit ID for the affected tank.

L-5. Specific Inspection Points:

Items will be inspected and classified according to Tables L-2 through L-6.

TABLE L-2 PA-116 SHIPPING & STORAGE CONTAINER:

CLASSIFICATION	INSPECTION METHOD	INSPECTION REFERENCE
1. CRITICAL - none defined		
2. MAJOR. a. Cover Assembly nonfunctional..... b. Gasket missing or defective..... c. Internal components/packaging missing or defective..... d. External components missing or defective..... e. Dents greater than ¼ inch deep that prevent..... cartridge extraction f. Perforations/holes..... g. Internal components/packaging moisture soaked..... h. Markings illegible, precluding proper identification..... of nomenclature and lot number.	VISUAL..... VISUAL..... VISUAL..... VISUAL..... VISUAL..... VISUAL..... VISUAL..... VISUAL..... VISUAL.....	 Para. L-6e Para. L-6l
3. MINOR - Protective finish on container body (not rims and..... rings) with pitted corrosion over 10 percent of surface.	Visual.....	

TABLE L-3: CARTRIDGES, 120MM, APFSDS-T, M829 (C786), M829A1 (C380), AND M829A2 (C792)

CLASSIFICATION	INSPECTION METHOD	INSPECTION REFERENCE
1. CRITICAL: None Defined.		
2. MAJOR: a. Failure to chamber/gage..... b. Sabot segments misaligned..... c. Rear Obturator cracked/damaged..... d. Sabot cracked..... e. Missing components..... f. Cracked cartridge case forward adapter..... g. Yellow corrosion in sabot gaps and/or windshield.. interfaces. h. Corrosion on projectile body causing pitting..... i. Projectile partially or completely separated from. the combustible cartridge case.	 Gage..... Visual..... Visual..... Visual..... Visual..... Visual..... Visual..... Visual..... Visual..... Visual.....	 Para. L-6f Para. L-6c Para. L-6d Para. L-6c Para. L-7 Para. L-6g
3. MINOR: None defined.		

NOTE: See Table L-6 for all cartridge case and case base defect criteria.

TABLE L-4: CARTRIDGE, 120MM TPCSDS-5, M865 (C785)

CLASSIFICATION	INSPECTION METHOD	INSPECTION REFERENCE
1. CRITICAL: None Defined.		
2. MAJOR: a. Rear nylon band defective..... b. Sabot cracked..... c. Missing parts..... d. Failure to chamber/gage..... e. Pitting corrosion on projectile assembly..... f. Obturators - loose, cracked or other damage..... which would preclude gas seal. g. Rubber seal on Sabot torn or split.	 Visual..... Visual..... Visual..... Gage..... Visual..... Visual..... Visual.....	 Para. L-6d Para. L-6f
3. MINOR: None defined.		

NOTE: See Table L-6 for all combustible cartridge case and case base and seal assembly defect

TABLE L-5: CARTRIDGES, 120MM, HEAT-MP-T, M830 (C787) AND M830A1 (C791, TP-T M831A1 (C784) AND XM908 (CA05)

CLASSIFICATION	INSPECTION METHOD	INSPECTION REFERENCE
1. CRITICAL: None defined.		
2. MAJOR: a. Missing parts..... b. Copper/nylon band damaged to the point of.... precluding chambering. c. Failure to chamber/gage..... d. Spike tip damaged (M830 & 831A1)..... e. Proximity sensor damaged M830A1)..... f. Sabot cracked or pitted (M830A1 & M908)..... g. Shoulder switch bent or cocked M830)..... h. Spike shoulder damaged M830)..... i. Projectile rubber seal damaged..... j. Spike Tip loose (M830)..... k. Pitting corrosion on projectile..... l. Projectile partially or completely separated. from cartridge case. m. Projectile rotates relative to forward adapter (M830 only).*	 Visual..... Visual/gage.... Gage..... Visual..... Visual..... Visual..... Visual..... Visual..... Visual..... Visual/Manual.. Visual..... Visual/Manual.. Visual/Manual..	 Para. L-6f Para. L-6h Para. L-6j
3. MINOR: None defined.		

NOTES:
a. See Table L-6 for applicable combustible cartridge case and case base and seal assembly criteria.
b. * Potential exists for M830 projectile fins to break DIGL-RP stick propellant.

TABLE L-6 COMBUSTIBLE CARTRIDGE CASES AND CASE BASE & SEAL ASSEMBLY, 120MM TANK AMMO

CLASSIFICATION	INSPECTION METHOD	INSPECTION REFERENCE
1. CRITICAL: None defined.		
2. MAJOR: a. Abrasion damage or peeling causing coating to be..... absent in one continuous area. Yellow-white nitrocellulose case material exposed in this area totaling 10% or more of the total cartridge case surface (30 sq. in. or 192 sq. cm). b. Case broken exposing internal propellant containment..... bag. c. Skive joint (glue joint at case shoulder)separation..... d. Case base and seal assembly (CBSA) separated from..... cartridge case body. e. CBSA rubber seal torn or separated..... f. Primer above flush..... g. Corrosion of CBSA with visible pitting..... h. Non-removable corrosion on primer..... i. Evidence of moisture damage resulting in a softening..... or penetration of the combustible ctg. case (CCC) or forward adapter.	Visual..... Visual..... Visual..... Visual..... Visual..... Visual/Manual Visual..... Visual/Manual Visual/Manual	Para L-6n
3. MINOR: None defined.		

NOTE: The M830 (C787) has a live forward adapter.

L-6. Inspection Description and Notes:

a. Movement between sub-projectile and sabot is permissible and shall not be considered a defect. M829, M829A1, and M829A2 projectile rotation at the case adapter/obturator joint is permissible.

b. Sabot segment gaps are permissible provided that the cartridge can be chambered.

c. The M829 projectile contains a forward nylon centering band composed of four individual segments attached to sabot petal. The gaps between centering band segments are aligned with sabot segment gaps. The M829A1 projectile does not contain a forward centering band.

d. The M829, M829A1, and M829A2 projectile assemblies contain a Depleted Uranium (DU) fin stabilized penetrator. The M829 series sub-projectiles consist of a penetrator, windshield, and fin. The number of sabot petals and their composition material vary. The M865 TPCSDS-T projectile assembly consists of a steel core encased in three aluminum sabot segments attached to rubber obturator and steel stabilizer.

e. Container dents that are less than 1/4 inch do not require repair. Dents greater than 1/4 inch that are impairing the structural integrity of the PA-116 container or prevent the removal of the cartridge are major defects. A cartridge that cannot be removed from the PA-116 shipping and storage container shall be placed in CC-F and reported to HQ, IOC, ATTN: AMSIO-SMA-T, Rock Island, IL 61299-6000, or emailed to amsio-qas@ria-emh2.army.mil.

f. Perform chamber gaging according to paragraph L-3. Standard ring gage set may be used in absence of man portable chamber gage. NOTE: Ring gages will detect oversized conditions for their specific profile dimension. However, gaging with projectile and case ring gages will not detect an out-of-alignment condition at the mating point of the projectile assembly and cartridge case forward adapter. Therefore, where available, the MPCG is the preferred gaging method to properly verify the entire profile and alignment of a 120MM cartridge.

g. Any deformity (such as tip bluntness or off-center displacement) of the windshield tip may affect the aero-ballistic performance of the sub-projectile.

h. Samples with projectiles exhibiting movement in relation to the cartridge case are not considered defects unless one or more of the following conditions are also noted:

(1) Cartridge deformation (profile misalignment) preventing gaging or chambering.

(2) Evidence of propellant dusting on outside of cartridge case or projectile.

(3) The affected cartridge is either an M829A2 (C792) or M830 (C787) with stick propellant that could become damaged by the movement of penetrator fins or projectile boom/fins.

i. Testing has demonstrated that the electric primer assembled to the round is insensitive to initiation by mechanical impact. Therefore, primers and igniters above flush are considered major defects, rather than critical. Any straight edge rule is suitable for checking primers for an above flush condition.

j. Any cut, nick, or gouge in the projectile rubber seal (M830 or M831A1) more than one half the width or more than 2 inches in circumference shall be cause for rejection.

k. Moisture noted within PA-116 containers indicates ammunition was either wet when containerized or the interior components of the PA-116 were wet when the ammunition was packed out. Containers with wet interior projectile supports and spacers are considered to be unserviceable until the moisture intrusion condition is corrected. Cartridges found in such containers must be closely examined for moisture damage according to the applicable tables.

l. Cartridge cases will be inspected for evidence of moisture, dents, or penetration. Defects can result from packaging or the cartridge not being dry at time of packaging, upload, and download operations during inclement weather, or exposure to standing water or heavy condensation in the bustle and hull ammunition storage racks. Inspect for water damage, soft cartridge cases, and forward adapters which easily deform under hand pressure, water marks indicating case exposure to standing water and metal parts rust or corrosion.

m. A windshield with a single longitudinal crack less than two inches in length is considered an incidental defect.

n. Cartridge cases with less than 10 percent abrasion damage or peeling, or white-yellowish combustible material showing in less than 10 percent of the total surface area of the cartridge case are serviceable. Cases should be touched up IAW procedures contained in TB 9-2350-320-14 and TM 9-1300-251-34&P.

L-7. Swipe (Smear) Test (M829, M829A1, and M829A2, Cartridges Only):

a. A swipe test is performed on a DU cartridge exhibiting external evidence of any DU corrosion or particles migrating to the surface of the sabot. Due to the extremely tight fit of the sabot segments, the potential for DU migration is considered to be very remote. Therefore, a swipe test shall only be performed under either of the following circumstances:

(1) Damaged M829 series cartridge resulting in an exposed penetrator.

(2) Cartridge with visible yellow corrosion (powdery substance) on sabot, between sabot gaps or windshield interfaces.

b. The following safety precautions should be observed when performing a swipe test:

(1) Do not eat or drink while performing swipe testing. Radioactive ALPHA materials pose the greatest harm if taken internally, such as by ingestion. Inspectors should keep their hands away from their face.

(2) Do not perform swipe test with any exposed open cuts or sores. Cover any open cuts or sores with bandages and wear protective rubber gloves. Alpha radiation material can also be taken internally through open cuts.

(3) Do not clean suspect DU projectiles prior to a swipe testing.

(4) Wash hands thoroughly with soap and water when testing is completed.

c. Fill in information required on front of swipe folder to include date, time, swipe number, location, and technician.

d. Swipe does not have to be removed from the paper strip during test.

e. Using moderate pressure, wipe surface of the projectile along
the seams between sabot segments and seam of junction between windshield and sabot with swipe. Swipe should also include any area of the projectile with visible powder/corrosion. Use one swipe per cartridge.

f. Once swipe has been taken, care must be taken to prevent cross contamination. Do not touch side of swipe paper that was used for taking swipe.

g. Fold paper strip over once so that swipe is covered. Place swipe in resealable plastic pouch.

h. Swipes taken on individual cartridges will be tested for radioactivity with a proportional counter. The proportional counter may be located at a central location and swipes forwarded for reading. Field locations may be used and AN/PDR 60 for identification of gross radiation hazards only, but these are not substitutes for the proportional counter required to measure limits specified in paragraph j below.

i. The exact procedure for measuring activity will depend upon the equipment and facilities available. Each swipe must be marked so that a specific cartridge can be located again. Measurement of activity shall be performed by, or under the

guidance of, a Health Physicist or Radiation Protection Officer.

j. Activity levels exceeding background by 500 disintegrations per minute (DPM) alpha or 100 DPM beta-gamma, may indicate a potential corrosion problem. Although activity levels at these DPM values are not considered to present a health hazard, the initiation of a corrosion problem needs to be identified long before actual contamination results.

k. Any cartridge with a reading which exceeds the established background level by above amounts will be sealed in plastic, and the cartridge will be returned for examination to a facility licensed to disassemble DU cartridges as directed by HQ, IOC, ATTN: AMSIO-SMA-T, Rock Island, IL 61299-6000.

l. Whenever activity levels exceed 500 DPM, the following will be immediately notified: (E-MAIL reporting is acceptable)

(1) Commander
HQ, IOC
ATTN: AMSIO-QAS/DMW
Rock Island, IL 61299-6000
Email: AMSIO-QAS@RIA-EMH2. ARMY.MIL/
AMSIO-DMW@RIA-EMH2.ARMY.MIL
DSN: 793-7552. COM: (309) 782-7552

(2) Commander
TACOM-ARDEC
ATTN: AMSTA-AR-QAT-A
Picatinny Arsenal, NJ 07806-5000

m. A report will also be submitted to the above addresses in paragraph l when any activity levels are measured which exceed background levels of the counter being used by a factor of two. This report will include the background and swipe readings; type, serial number, and calibration date of test instrument, and any other information deemed relevant.

n. Following procedure can be used to monitor pallet/outer pack prior to shipment. This procedure is not authorized for individual cartridges:

(1) Swipe at least a 300 square centimeter area of pallet/outer pack using the procedures outlined at subparagraphs c through k above.

(2) Check the swipe with an AN/PDR 27, 56, or 60 radiac meter, or equivalent. Readings of twice background is indicative of contamination.

(3) If readings indicate contamination, suspend shipment of the contaminated item(s) and notify offices in subparagraph l above.

(4) The analysis using a proportional counter is required regardless of the results of the field instrument check.

L-8. References:

a. TB 9-2350-320-14

b. TB 9-1300-278

c. TM 9-2350-264-10-1/2

d. TM 9-1300-251-20

e. TM 9-1300-251-34

f. TM 43-0001-28

g. AR 385-11

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