

Depleted Uranium – Detection and Protection

I. Methodology

1. Material Properties of Depleted Uranium (DU):

- non-magnetic;
- extremely heavy. In relation to size DU is 60% more dense than lead;
- retains heat. DU fragments will retain heat to the point where they will cause serious burns for three to four hours after firing. A red hot core may be coated with black dust and therefore appear cool;
- sparking. When cold, if struck with a metallic object such as a pick or shovel, they will spark in a similar fashion to a cigarette lighter. Do not use this method on purpose to detect DU.

2. Visual Detection of DU:

- jet-black lumps;
- Black dust on or near the penetration point;
- the surface of a fragment which has been in the field for any length of time will not appear metallic. Corrosion will begin in cracks caused by the round impacting a hard surface and will spread from there. Corrosion is light yellow in color;
- honeycombed. The fragment will have an aerated texture;
- Typical holes from the ammunition of the relevant caliber, burned-down tanks or vehicles.

3. Radiological Detection

After the probable location of contamination was determined using visual clues or other information or contamination area was found using random measurements with Portable Contamination Meter (PCM), the site must be further inspected.

a. Line-up survey

- This method can be used for systematic search for contamination in a small area.
- Personnel should systematically walk in a line across the site with 1-2 metres between them, sweeping the ground in front of them with their instruments to make sure that no surface contamination is missed.

b. Entry holes on armored vehicles

- At survey sites look for entry holes on armored vehicles. Look for projectiles and metal pieces at survey sites.
- Calibrate the handheld detector and establish background radiation.
- Put the probe (pancake) 2 to 3 inches from the entry hole and the same with the metal pieces and projectiles.

- List locations and Counts Per Minute (CPM) for each reading that exceeds background radiation.

c.. Measuring soil contamination

- After finding a specific site (where radiation exceeds background radiation), the soil must be examined.
- Put the probe (pancake) of the detector directly facing the soil surface. Gather the top 2 inches of contaminated soil.
- Deposit contaminated soil into lead containers.
- List location and (CPM) for each reading that exceeds background radiation. If the meter reads more than twice background, contamination is likely. Destroy protective clothing at the end of the day's survey.

II. Risk reduction

1. General precautions:

- Bare DU material has to be handled for in excess of **200 hours**;
- Thermoluminescent Dosimeter (TLD), should be worn and exchanged every month for control;
- External radiation hazard can be significantly reduced by the wearing of **gloves** (two layers);
- Keep 50 meters **distance when unprotected** (if target was hit recently);
- Wearing **face masks** would prevent inhalation and ingestion of dust – avoid dust whirlwinds;
- **Covering all exposed skin** would prevent contamination through cuts and grazes;
- Do not eat, drink or smoke **when nearby DU** ammunition or dust.

2. During the mission:

- Keep in mind the **mine risk** at sites;
- Be extremely cautious around **explosive reactive armor (ERA)** on the tanks;
- Take care to **avoid sharp objects** that may rip the gloves and expose the skin;
- Allow a minimum of **four hours** to elapse after firing. Fragments of DU penetrators are red-hot internally for up to four hours after firing;
- **Do not use** your boot to turn over or move fragments. Always use a stick, scoop or similar item as a remote tool;
- Wear **coveralls and overboots** in order to prevent contamination of personal clothing and footwear;
- **Excess material** should be shaken (or even better washed) from boots, clothing and equipment when leaving the site.

Do not forget to:

- **Mark and block off** contaminated areas and **tag** contaminated items appropriately;
- **Inform the authorities** and the **population** about the presence risks of DU.

3. After the mission:

- Urine samples can be checked on a monthly basis for the presence of DU and the medical records of the personnel should be annotated to record that they have worked in a potential DU environment to allow monitoring;
- Any item suspected of being contaminated may be checked using a PCM and all clothing and equipment should be regularly cleaned;
- Regular checking of facemasks using a PCM may also be helpful as a reassurance measure;
- Normal hygiene (especially hands washing and regular showers) after handling DU will overcome any further possibility of cross contamination;
- Care should be taken not to touch the mouth and face after removal or handling of the outer layer of clothing until hands and other exposed skin have been washed;
- 'Dirty' areas, where equipment and outer layers of clothes are left should be kept separate from 'clean' areas, where staff can wash. Staff should keep face masks on while in the dirty area and remove them immediately before leaving.

III. Equipment

Following equipment can be used for the missions:

- disposable plastic gloves, heavy PVC for the outer layer, cotton gloves for the inner layer;
- high quality FFP3 masks or comparable;
- outer layer of clothing and footwear such as full body cotton overall and sturdy boots;
- scoop/gripper
- Thermoluminescent dosimeter (TLD), e.g. from Landauer, Proxtronics or Mirion. Low radiation count from DU munitions is, unlikely to register on a personal dosimeter.
- highly sensitive PCMs - Saphymo-SRAT S.P.P.2 NF scintillometer for gamma radiation (most effective); S.E.International Inspector for beta radiation; Exploranium GR-130G/BGO gamma spectrometer. Highly sensitive instruments are required and readings must be taken very close to the ground. For more information on portable hand-held instruments see here:
<https://www.osti.gov/servlets/purl/14613>

IV. Transportation

The container used must be a **robust metal box** of suitable size and **without holes**. The box must be strong enough to carry the heavy weight produced by even a small quantity of DU, and it must be capable of being secured so as to prevent any leakage of the contents. Wooden or cardboard boxes are **not to be used** as they will absorb contamination. A 20 mm lining of a **suitable material such as sand or earth** is to be inserted into the box. This lining is used as a packing medium to hold the DU fragments, absorb any DU oxides and prevent fire. The 20 mm lining should be built up around the sides and on top of each layer of fragments as the box is filled. A final layer of sand or earth is to be added to the top before the box is closed.

Once filled with fragments and topped with sand or earth, the box is to be closed and sealed to prevent leakage. The box is to then be marked CAUTION RADIOACTIVE MATERIAL - DU FRAGMENTS and the appropriate Trefoil (radiation) sign applied.

Although DU fragments are not highly radioactive, filled boxes should **not be carried close to the body**. They should be held away from the body, as far as is reasonably possible. Two or three boxes may be carried between **two persons** using a robust 6 ft pole through the handles. Maintain **chain of custody** of samples until they are turned over to laboratories.

V. Sources

For more information especially for demining and decontamination of the polluted areas see following documents:

- UNEP Methodology can be found here:
<https://www.unep.org/resources/report/depleted-uranium-bosnia-and-herzegovina-post-conflict-environmental-assessment>
- Technical Note – Clearance of DU Hazards:
https://www.mineactionstandards.org/fileadmin/MAS/documents/standards/NEW_TN_09.30.02_2015_Clearance_of_DU_Hazards_V.3.0_.pdf
- Hand-Held Instruments: <https://www.osti.gov/servlets/purl/14613>
- US Army – Handling Procedures for Equipment Contaminated with Depleted Uranium <https://irp.fas.org/doddir/milmed/duequip.pdf>

ANNEX – DU Ammunition Overview

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| Overview of DU ammunition by military vehicle |
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| Military Equipment | Ammunition | Commentary |
|---|--|--|
| <p>T-90 (Russia) T-72BZ (Russia) T-80BVM (Russia)</p> | <ul style="list-style-type: none"> • 3BM-32 “Vant” • 3BM-60 „Svinets 2“ • 3BM-59 „Svinets“ | <p>The use of depleted uranium ammunition by the Russian armed forces was <u>confirmed</u> by GICHD (Geneva International Center for Humanitarian Demining). 3BM-32 “Vant” ammunition was found on the ground in Ukraine.</p> <p>As Russian Tanks in question use the same ammunition, it is not possible to identify which ones are using DU ammunition. All three types of tanks mentioned here were seen in use in Ukraine.</p> |
| <p>Challenger 2 (UK)</p> | <ul style="list-style-type: none"> • CHARM 1 • CHARM 3 | <p>Only potential DU ammunition is listed here.</p> |
| <p>Bradley Fighting Vehicle (US)</p> | <ul style="list-style-type: none"> • M919 sub-caliber 25mm rounds | <p>Only potential DU ammunition is listed here.</p> |
| <p>M1 Abrams (US)</p> | <ul style="list-style-type: none"> • DU is used as one layer in the armor for the tanks manufactured after 1988. • M829 APFSDS-T | <p>Only potential DU ammunition is listed here.</p> |
| <p>Leopard 2 (Germany)</p> | <ul style="list-style-type: none"> • M829A1 | <p>Only potential DU ammunition is listed here. Ammunition listed is not standard, but compatible.</p> |
| <p>Leopard 1 (Germany)</p> | <ul style="list-style-type: none"> • M774 105mm | <p>Only potential DU ammunition is listed here. Ammunition listed is not standard, but compatible.</p> |