

## **SAFETY INSTRUCTIONS - HAZARD MANAGEMENT OF DEPLETED URANIUM ON OPERATIONS – version for open publication**

*This document contains the public version of the safety instructions issued to troops. It differs from the original only in that contact details and references to internal MOD documents have been removed.*

### **INTRODUCTION**

1. These instructions have been prepared by Chief Environment and Safety Officer (Army) (CESO(A)) and approved by Dstl Radiological Protection Services (DRPS). They are intended as an unclassified guide to all personnel who may come into contact with Depleted Uranium (DU) in operational situations.
2. PJHQ is responsible for ensuring that these Instructions are passed down through their operational chain of command to all units and personnel.

### **RADIATION ADVICE**

3. In Theatre Health and Safety is the responsibility of Commander Joint Operations (CJO). CJO and his chain of command will be assisted by a Theatre Radiation Protection Adviser (who may not be in Theatre), and by individual unit Radiation Protection Supervisors (RPS) (who must be deployed in Theatre).
4. HQ Land has appointed Dstl Radiological Protection Services (DRPS) as Theatre Radiation Protection Adviser (RPA) on behalf of CJO.

### **HAZARDS FROM DU MUNITIONS**

5. DU is a heavy metal used in some anti-armour munitions. It is in service with US MBT and ground attack aircraft, UK RAC MBT and RN shipboard weapon systems. DU is a low specific activity radioactive material and presents two hazards, radiological and toxic. Radiation dose rates are detectable when measured very close to DU munitions, but the dose rate reduces very quickly with increasing distance. Trials under worst case conditions indicate that there is no appreciable radiation health risk from the DU.

6. The toxic hazard is presented by inhalation or ingestion of DU dust, or by contamination of open wounds by DU dust. DU dust is formed as a result of a DU round striking or entering an AFV or during a fire or explosion involving DU munitions. The UK MBT shot sub-projectile has aluminium coating over the DU. Trials have shown there is no risk of inhaling or ingesting DU when handling intact rounds or when rounds are dropped onto steel plate from a height of 2 metres. While no contamination has been found inside

MBTs during or after test firing of in service DU munitions, small traces of DU have been found in the gun barrels and fume extractor after firing and these represent a small risk that needs to be taken account when handling and cleaning these items after firing DU.

7. It is important that all those likely to come into contact with DU on the battlefield or on areas used for live fire training are aware of these hazards and instructions. However, they should also remember that DU does not present a significant health risk in most circumstances and is not comparable with NBC risks. Commanders should not impose measures that will restrict operational efficiency on account of potential or actual DU use and neither combat nor life-saving actions should be delayed because of possible contamination.

### **ACTION ON ENTERING CONTAMINATED AREA OR CLOSE TO DU-STRUCK AFV**

8. **Monitoring.** Dose rates near DU munitions are low and most personnel do not need monitoring. Those who handle DU munitions on a regular basis (e.g. tank crews and EOD personnel) or are likely to find themselves in close proximity to 'unboxed' DU munitions (e.g. REME turret crews) are to be issued with Thermoluminescent Dosimeters (TLDs), as supplied by DRPS complete with instructions for use. Sensitive low level monitoring (rather than NBC) equipment is required to check whether a strike is caused by DU. Some UK units (and possibly US Forces) have this equipment and may be deployed to monitor suspected DU strikes as necessary. It is recommended that databases be created at unit level where appropriate to monitor and record TLD readings. Individual readings should be recorded as per paragraph 16 below. This information should be preserved for future use after operations and their medical and personal records annotated as appropriate.

9. **Recognition.** If a DU projectile misses the target it may eventually come to rest on the surface and be recognised thus:

a. **MBT Projectiles.** These will take the form of a long thin rod, pointed at one end, with short stubby fins on the other (although the latter may become detached by passing through a soft target). They will look like brass (US) or be black (UK). The projectile may also be broken up into segments. If the projectile passes through a soft target (e.g. canvas) it may leave a circular or star-shaped hole. The exit hole will be slightly larger than the entry. A hard target struck by DU will emit a much brighter flash than normal, usually with a greenish tinge. Impact will result in DU dust settling on the target exterior and in the immediate area, and, if penetrated, inside the target. DU dust looks like soot or lumps of charcoal. It may, over time, develop a green and/or yellow tinge.

b. **Ground Attack Aircraft Projectiles.** These are about 4 inches long and half an inch in diameter, pointed at one end. They may still be in their windshield (similar to a MBT round sabot) when their diameter will be about one inch.

10. Nevertheless, it will often be difficult to know when an AFV has been struck by DU shot. It should therefore be assumed on encountering struck AFVs that the shot was DU and suitable precautions taken against DU dust as detailed below, until the vehicle can be surveyed for DU contamination.

11. **Avoidance of Contact.** Personnel should not touch, pick up or retain souvenirs from struck AFVs or DU fragments, unless ordered to do so as part of an authorised clean-up operation. When doing so, they must use a shovel or similar implement as fragments can also be very sharp. Note that the discarded sabots from DU rounds may occasionally be very slightly contaminated. There is no significant health risk, but hands should be washed after handling sabot fragments.
12. Personnel should not climb onto or into vehicles or structures possibly hit by DU rounds unless required to do so. Personnel should avoid the surrounding area by at least 50m and attempt to stay upwind of fires involving DU, such as AFV casualties. Above all, smoking, eating or drinking should not be conducted near a target struck by DU.
13. **Entry into DU Contaminated Areas.** When it is necessary to enter DU contaminated areas, exposed skin is to be covered and especially any exposed wounds. If practicable, NBC rubber gloves or leather gloves and a dust mask, such as Mask, Air Filtering Disposable (NSN 4240-99-156-3608) should be worn. If no mask is readily available, a handkerchief, shemagh or sweat rag (wet better than dry) should be used to cover nose and mouth. Full NBC IPE is not necessary unless prolonged dust-raising activities are to be carried out, such as extensive repair or vehicle recovery activities. As little time as practicable should be spent on the task, attempting to keep general dust disturbance to a minimum. As soon as possible after task completion, dust should be brushed off clothing in a controlled and marked site, any nose/mouth and glove protection being maintained until contaminated clothing has been removed. Outer clothing should be changed at the first convenient opportunity and laundered in the normal way before being worn again. Hands should then be washed before eating, drinking or smoking.
14. When operational conditions dictate that DU contaminated areas must be entered immediately, or when the wearing of IPE is not possible, dust-raising activities should be kept to a minimum as far as possible. Damp cloths or similar should be used to wipe down and decontaminate surfaces. Whenever practicable, precautions should be taken to limit the spread of DU dust when moving items that may be contaminated. Decontamination, covering the equipment with a tarpaulin or sealing the contamination in place with paint can be considered.
15. **Medical.** Wounds that may contain DU must be cleaned at the earliest opportunity under running water and covered with a dry dressing. **The Surgeon General's Department has disseminated separate medical instructions to medical staff.** Medical staff should, if practicable, wear filter masks, plastic aprons and double-layered surgical gloves. Apron and gloves should be changed between patients. Patients should be wrapped in a blanket for transport. Contaminated clothing should be cut off and bagged.
16. **Recording.** Personnel that may have been contaminated with DU are to have that fact annotated in their medical and personal records. After the operation, they are to be advised by DRPS of their access to biological monitoring.

## **INSTRUCTIONS TO CREWS IN AFVs LOADED WITH DU AMMUNITION**

17. **Specific instructions to RAC Regiments are available.** Although the DU risk has been assessed as low, the interior of AFV containing DU is designated a "Controlled Radiation Area" to ensure that radiation doses are monitored and kept as low as reasonably possible.

Tank crewmen and turret repair craftsmen are to be issued with TLD and sufficient additional TLDs held to allow replacement on a one for one basis.

## **TRANSPORT, STORAGE AND DISPOSAL OF DU AMMUNITION**

18. **Transport into Theatre**. This is the responsibility of DLO. Until it reaches the MBT, the ammunition is contained in an Ammunition Container Assembly (ACA), and no significant radiation is emitted from it.

19. **In Theatre Storage**. The ammunition is to remain in the correct packaging until it is loaded onto the MBT. Wherever practicable, ACA should be retained for re-packaging rounds not used during work-up training/operations. After completion of training/operations, remaining DU rounds **must** be inspected and replaced in ACA prior to redeployment or back-loading. Should the shot be damaged during storage, technical ammunition staff are to be informed. Once deployed forward, ACA could be struck by direct/indirect fire causing the propellant charges to deflagrate, thereby spreading the DU shot as dust and fragments. The dust is heavy and will not be carried far from the ACA. Once casualty evacuation has occurred, the area within a 50m radius should be cordoned off and Theatre HQ informed.

20. **Recovery of DU Rounds/Fragments**. The subsequent formal recovery of any intact DU cores or fragments is a matter for the civil authorities, but UK troops may wish to assist with such activities e.g. following work-up training or in providing advice. In this instance, any intact DU cores or fragments discovered are to be packed into a sand-filled metal box free of any holes. A minimum 20mm lining of sand is to surround the DU fragments. The box is to be closed and sealed to prevent leakage and marked "CAUTION RADIOACTIVE MATERIAL – DU FRAGMENTS" and a Trefoil sign applied. Although DU fragments only represent a low toxicity Alpha source, hazard boxes should not be carried close to the body. The box should be placed within a suitably marked area and disposed of under local arrangements.

## **AFV RECOVERY**

21. **Vehicle Recovery**. The first action for recovery crews is to determine whether DU contamination might exist. This may be indicated by DU monitors or suspected as the result of known KE projectile strikes from MBT or aircraft. If DU is thought to be present the vehicle is to be marked immediately as contaminated, initially by paint that is easily noticeable at close range but consistent with vehicle camouflage at a distance. If the vehicle is repairable, a decision must be made at the highest practicable level as to whether the need for its return to battle outweighs the medical risk. Damage will range from total destruction (K-Kill), through track damage (M-Kill) to simple ricochet (fight on, but don't touch the scar).

a. If the AFV is to be returned to battle, the contaminated areas/components (including ancillaries such as mine ploughs) must be identified and marked. Crews must be warned.

b. If not, the vehicle is to be recovered to a marked, controlled area. The vehicle itself is to be conspicuously marked.

c. Before backloading further, the vehicle is to be washed down externally and, if practicable, radioactive scars masked with bitumen, then the whole vehicle covered with tarpaulin. It will still represent a radioactive hazard, and should be clearly identified as such. The washdown area will itself be contaminated, and must become a controlled area.

22. **Contaminated Components.** Undamaged components from contaminated vehicles should only be used if a decision is made, again at the highest practicable level, that the operational benefits outweigh the risks. Components should be removed and monitored. If contaminated, they must be decontaminated as far as practicable and conspicuously marked. Repair and operator crews must be warned. Vehicles containing these components must themselves be identified and also marked as contaminated.

23. **Area Clearance.** The area around an AFV DU casualty may be contaminated. Decontamination while operations are in progress is not feasible. Potentially contaminated areas should be checked and, if contamination is found, clearly marked with a 50m cordon, and left. Personnel are to be warned of the hazard. The RPA should be consulted if contamination is found within the boundary of a base that UK troops may need to occupy during periods of settled operations. Formal DU clearance outside any UK bases is a matter for the civil authorities.

24. **Post Conflict.** 'A' or 'B' vehicles affected or suspected of being affected in any way by DU contamination will require decontamination. Affected vehicles should be preferably decontaminated in Theatre, with civil authority agreement:

a. If in Theatre, a decontamination facility will be required, with arrangements in place for collecting and disposing of contaminated water and DU debris, as advised by in Theatre RPA.

b. If recovery to UK is necessary, external decontamination of the vehicle and sealing of hot-spots as far as practicable must be carried out. Controlled areas must be established on the Recovery ship, marked and signed, and crews warned.

c. Crews/maintainers of UK MBTs that have fired DU must comply with extant instructions and advice on barrel cleaning, transport regulations and gun document amendments. There is a slight risk that low levels of DU contamination may be present in gun barrels and fume extractors after DU munitions have been fired. This does not represent a health risk. However, when practicable, only non-abrasive techniques should be used for cleaning barrels until they have been monitored. Monitoring equipment shall be used to determine and record the levels of contamination present. Gloves should be worn and barrels and fume extractors wiped with a damp or oily cloth before maintenance. Similarly, barrel brushes and bore staves should be wiped after use and related waste cleaning materials disposed of in accordance with local instructions.

d. After initial monitoring in Theatre, any AFVs that may have been struck by DU must be clearly marked as such and the vehicle or components re-tested on return to Home Base. These markings must be clearly indicated to any workshop or repair facility where they are delivered.

- e. Arrangements should be considered in Theatre for the collection, temporary storage and disposal of any UK equipment written off as the result of DU contamination.