Depleted uranium and collateral contamination in an area of armed conflict

1. <u>What is Depleted Uranium</u>?

The main difference between depleted uranium and natural uranium is the U235 isotope content, to which nuclear fission is attributed. Depleted uranium contains less U235 than natural uranium.
Uranium is a dense, silvery-white mineral of natural origin. It contains two main isotopes, which are:

- **U238 (99.27% of total mass)**
- **U235 (0.72% of total mass)**

Only U235 is fissile, i.e. when subjected to a flux of neutrons, it can cause a chain reaction on contact with other U235 atoms and thus release a huge amount of energy.

By extracting the isotope U235 from natural uranium, uranium enrichment facilities produce enriched uranium, which is mainly used as fuel in nuclear reactors.
Natural uranium is therefore enriched in order to increase its U235 isotope content from 0.72% to **2% or even 5%** for low-enriched uranium used for power reactors (nuclear power plants)

Depleted uranium is a by-product of uranium enrichment. Materials that remain after the production of enriched uranium are considered depleted uranium. It is low in radiation and about 60 to 40% less radioactive than natural uranium.

This isotopic concentration generally fluctuates between **0.2 and 0.4%** of U235 and is a definite indication of an anthropogenic and not natural origin.

2. Why is Depleted Uranium (DU) used on some battlefields ?

The development of the civil nuclear industry generated huge quantities of DU, which was then considered an unusable by-product. It is therefore understandable why, as early as the 1960s, the nuclear industry was concerned with finding outlets to exploit this DU.

DU is a very heavy metal. Its density is **19,050 kg m−3** while the density of lead is "only" **11,340 kg m−3** (i.e. almost double!). What's more, it has a decent melting point of 1135°C.

The kinetic energy is calculated by the following formula: E(c) = 1/2 x m x V2
"m" is the mass expressed in kg and "V" is the velocity expressed in m/s. It therefore becomes obvious that a projectile composed of DU will have a much higher kinetic energy than other metals such as Lead or steel with a much greater impact on a target. In addition, when subjected to a violent impact, DU is **pyrophoric**. That is to say, it ignites spontaneously in the air at very high temperatures, and in this case during impact, which accentuates its destructive effect.

Also, the use of DU to manufacture armor-piercing ordnance, pyrophoric on impact or very resistant armor has become almost a "standard" for some armies, including the US, which was the forerunner in this field.

Concerning the US army, a non-exhaustive inventory* can be provided:

- Small-caliber ammunition:

  - 7.62mm ammunition (50 caliber). These small balls are also called "darts". They were adopted for the American M14 rifle with 7.62 mm caliber and for the M16 with 5.56 mm caliber25
  - MK 149 20mm ammunition
  - PGU-20 25mm ammunition: formerly used by the U.S. Navy
  - PGU-20/U ammunition: in service with the Army and manufactured by Primex Technologies 26 (St. Petersburg, Florida)
  - 25mm M 919 ammunition manufactured by Olin Ordnance (Marion, Ill.) and previously by Aerojet Manufacturing (Chino, California), and now by Primex Technologies (St. Petersburg, Florida)
  - PGU-14 30mm ammunition (for A-10 tank-killing aircraft)

- Penetrators for anti-tank shells:

  - For 105mm shells: M735A1, M774, M833, M900. All of these models were manufactured in the USA by Primex Technologies (new name for Nuclear Metals Inc.)
  - The M829: was manufactured by Chamberlain Manufacturing Corporation (Waterloo, Iowa), Alliant Techsystems Inc., and Primex Technologies for the gun of the M1A1 Abrams tank.
  - The M829A1 was manufactured by Alliant Techsystems Inc. for the guns of the M1A1 and M2A2 Abrams tanks. It was this version of the penetrator (on the M1A1 tanks) that was used during Operation Desert Storm
  - The M829A2 is manufactured by Primex Technologies. In 1995, the Department of Defense ordered 23,278 units of this penetrator.
  - The M829E3 is a development model. Alliant Techsystems Inc. has been awarded the contracts to develop and produce this new penetrator.

Source

This list, which is a few years old, is, of course, not exhaustive and new DU munitions have emerged since then.
In addition, there is no mention of some armour or anti-personnel mines that also contain DU.

3. Radiological collateral consequences

All uranium isotopes are radioactive. DU is considerably less radioactive than natural uranium. The difference is usually in the range of 60 to 40%. Radioactivity comes mainly from Alpha particles, which do not penetrate the skin. A simple sheet of cigarette paper, just like the epidermis of the skin, can stop this Alpha radiation. At this stage, therefore, the DU is completely harmless.

However, this safety is no longer guaranteed in the event of small-calibre bullets or shrapnel entering the body. At this point, we are no longer dealing with external contamination where a simple shower would be enough to decontaminate oneself, but with internal contamination that will affect many internal organs and of course all fluids such as blood.

However, there are much more insidious and worse!

Let's take the example of an armor-piercing shell in DU.
When the latter reaches its target (for example, a tank), the kinetic energy will cause the shell to partially or totally melt (from 1135°C) and an amalgam of metals (Target + shell) will diffuse in the form of aerosols in the atmosphere.
Among these aerosols, we will, of course, find DU nanoparticles in the atmosphere that can spread with the winds for several kilometres around.

Without suitable PPE such as an activated carbon filter cartridge mask, the two opposing sides will inhale these Alpha particles with the consequence of internal contamination that can eventually cause disease and cancer.
It should be noted that this radioactive dust can also enter through the eyes and that wearing specific glasses will also be essential.

Finally, there were reports of a "Gulf War Syndrome" and then a "Balkan Syndrome" which were blamed on the possible effects of the use of DU weapons. The syndromes invoked vary depending on whether they concern civilians (leukemia, congenital malformations in children, breast cancer, etc.) through the inhalation of DU and the ingestion of contaminated water and food or in combatants (chronic fatigue, memory loss, reduced respiratory capacity, etc.).

To conclude, there is just one ethical question:
Should we ban these weapons, which are anything but conventional and can kill indiscriminately?...

L’article est unique et a été rédigé par un bénévole expert de chez ADESS, ayant une grande expertise dans sa thématique de prédilection. Il a accumulé une expérience professionnelle significative et des diplômes qui lui sont associés.

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