Part 4 January 2002

DU weapons review: Human, environmental and political issues in 2002

Parts 1-3 identified suspected proliferation of DU weapons and their potential use in the Afghan War in 2001. Part 4 reviews the immediate implications of these questions for Afghanistan, the need for radical re-assessment of DU use and hazards, and priorities for international action in 2002.

Independent specialists are already investigating several of these issues. But effective action in 2002 will rely on public awareness, international co-operation and rigorous legal and political accountability for the development and use of DU weapons.

The scenarios and issues in Part 4 will require updating as post conflict assessments and aid programmes get underway in Afghanistan and as more facts emerge.

1. DU scenarios: What if DU is used in hard target weapons?

This report questions the identity of the high density "mystery metal" used in hard target guided weapon systems. What is it? The answer is currently a military secret. But all available evidence indicates that it is either Depleted Uranium alloy or Tungsten.

If the mystery metal is DU this raises fundamental questions about the potential effects of high load (large warhead) DU weapons. These questions have not been publicly debated by any government, or by medical or environmental scientists outside military research establishments until the DU Conference in Prague on 25 November 2001.

The answers could be vital to the health of civilians and troops in Afghanistan now. If they have to wait several months until physical proof of DU becomes available - in health epidemics, birth defects or samples of DU contamination - thousands of preventable fatalities may occur. But this is the likely outcome if these issues are not put on the international agenda now.

Aid organisations and UN agencies cannot wait for proof about DU hazards before committing resources to post-conflict aid. The US and UK governments know the facts about the weapons used and from their initial NBC survey results. They firmly deny that any DU has been used. Unfortunately they may be relying on obsolete assessments of DU health hazards. On the evidence in Part 2, UK Government statements about hard target weapons cannot be trusted. So how can other governments and aid organisations commit human resources to Afghanistan without risking the health or lives of their personnel?

In business and military planning one method for decision making in conditions of uncertainty is called **scenario planning.** This involves asking "what if" questions before disasters occur - not waiting until they become obvious. Experienced aid organisations probably do this too. Any post-combat environment requires careful and comprehensive risk assessments. This was the objective of the UNEP Balkans Task Force.

DU involves political as well as physical hazards. **There are compelling commercial, military, legal and political reasons for the US, UK and other governments to minimise public interest and concern about Depleted Uranium - both in military and civilian use**. This creates the additional risks that the global proliferation of DU weapons may be far wider than realised and that their risks have been trivialised.

The US, UK and possibly other alliance governments appear to believe propaganda from the nuclear and arms industries, and their sponsored scientists that DU involves minimal health hazards. In doing so they may be putting the lives of their own troops and civilians, as well as the Afghan people, at serious risk. This re-assurance was promoted very effectively with post-Balkans DU assessments published in 2001.

The danger is that this new found confidence in DU safety could deter, delay or subvert rigorous medical and environmental DU risk assessments in Afghanistan (page 127).

DU scenario planning is important to counter any complacency about potential DU hazards following the Afghan bombing. This involves considering a range of options - from the most positive hope that DU has not been used to a worst-case scenario. Relevant assessment methods and safety precautions can then be planned for each. The new UNEP PCAU started a desk study of potential environmental hazards in early December prior to field inspections. Should they look for evidence of DU or not?

DU scenarios can be built around the present areas of uncertainty e.g.:

1. Capability:

a) How many **US and alliance weapon systems** use DU components - past, present and under development? Which versions are involved, which warhead technology, and how much by weight in each munition? (This question is not restricted to systems used in Afghanistan.)

b) Do **Al Qaeda or the Taliban** have DU or any other potential weapons of indiscriminate effect i.e. radioactive, toxic, chemical or biological weapon systems or materials? What is known about them - version, technology, location and weight?

2. Use

c) **Have any DU or other uranium based weapons been used** by either side since October 7th 2001?

d) **If DU weapons have been used** then which ones, how many, on what targets and exactly when were they used? (Time correlates with wind/dispersal.)

3. Targets and exposure risks

e) **Population directly exposed** in target area at time of attack: remote location (military personnel only), rural community, or high density urban area.

f) **Population indirectly exposed** after attack - in target area and downwind.

g) **Individual dose levels** - low, medium or high. Temporary or ongoing exposure.

g) **Hazardous target materials** e.g. ammunition stores (with DU?), medical X-ray facilities, other toxic materials (suspected NBC targets).

Seven DU-exposure risk scenarios illustrate some combinations of these variables. Other scenarios can be added. Estimated DU tonnage is for the first 3 months.

Low or minimal risk scenario

1) **No DU** has been used by any party in the conflict and no radioactive targets hit.

Localised risk (less than 1 kilometre)

2) **Small quantities of DU** have been used by allied forces **in known DU weapon** systems i.e. the AC-130 gunship. Estimated quantity **less than 10 tons**.

3) DU has been used **in some new** (or not previously admitted) **allied weapon** systems. Relatively **small mass of DU per weapon**, or in **very few, non-urban locations locations**. Estimated quantity **10-50 tons**.

Serious risk to target zones and significant risk to surrounding areas (5-10 km)

4) DU has been used **by Al Qaeda forces** (suggested in US "**dirty bomb**" report, 5 December). Size of weapons and contamination levels unknown. Tactical reason unknown. OR allied bombs hit weapons store containing DU or other radioactive materials. Estimated quantities **10 - 50 tons, possibly in populated locations**.

5) DU has been used in **larger weapons systems but in remote locations** e.g. the Tora Bora region. Estimated quantities **100-500 tons**.
Contamination likely to spread to other areas over years through wind & water.

Severe exposure risk in target zone and widespread areas (10-20+ km)

6) DU has been used in several of the **larger weapon systems** identified in this report some of which have been used **in urban locations** like Kabul and Kandahar. Estimated quantities **100-500 tons.** Extensive contamination of populated areas. Contamination likely to spread to wider areas over years through wind and water.

Nightmare scenario (20-50+ km)

7) DU has been used in **most of the hard target weapon systems** identified and **in many locations** including **water catchment areas and supply systems**. Estimated quantity **500-1000 tons or more**. Extensive contamination over large areas. Water supplies and irrigated areas permanently contaminated. Exposure spreads to other regions and across borders in dust storms, rain and snow.

Part 3 explained the type of **US / alliance weapons** that may contain the **mystery dense metal** and approximate amounts per warhead. It can only be Tungsten, Depleted Uranium alloy or a combination of both. If **Al Qaeda "dirty bombs"** have been used, or DU stocks hit by US bombing, these are most likely to involve DU, not enriched uranium. High-level radiation hazards would have been obvious to normal military monitoring and should have reported by now. The environmental impacts and health hazards of DU dirty bombs are likely to be similar to those of hard target DU warheads of similar size. However they would require specialised DU detectors.

Scenarios 1-3 are the most optimistic and feasible to contain. 2 and 3 still present significant hazards to that need urgent assessment and precautions.

Scenarios 4-7 involve serious levels of risk. Unfortunately DU dust requires alpha radiation monitoring and laboratory analysis of dust or water samples. Large quantities could have been used without the public being aware of widespread hazards yet.

DU contamination may be localised if hard target weapons explode in **underground targets** without a large surface crater and dust cloud. Some weapons are designed to minimise risks of collateral contamination from chemical or biological weapons targets. However contamination could be very severe within such targets. Full NBC protection would be essential for military or civilian inspection teams including Afghan civilians involved in "clean-up" operations.

Long term ground water contamination could be a serious issue for such targets, especially in natural caves or underground water supply aqueducts (or "**kerez**") - refer Fred Pearce's **New Scientist article** reported on page 43. UNEP inspections need to include these targets. Locations should be chosen independently since US forces will known which weapons have been used on each target. Older versions may not contain DU. Newer versions of guided bombs especially **GBU 24** and the **GBU-28** and **GBU-37** Bunker Busters are highly suspected of being DU-based munitions. The New Scientist article suspected they would be used on Kerez targets which supply local communities and irrigation systems. These weapons have the highest contamination potential if they contain DU alloy ballast or casings - potentially from 700 to 1500 kg per weapon - see **Figure 1** on page 89. Comprehensive target and water testing needed

Immediate DU contamination health effects e.g. those suspected by Taliban doctors in October (see page 35) could go undiagnosed by non-military personnel as part of multiple injuries associated with heavy conventional bombing. This possibility is illustrated in Professor Herold's study. The reports he analysed recognise many casualties but concentrate on fatalities and obvious blast or fragmentation injuries without questioning potential effects of inhaled or ingested DU dust. Low level radiation is an invisible hazard that may not be recognised for many months until birth defects or cancers become apparent. Even then suspected DU causes may be denied by military and political authorities for years as for Gulf veterans and Iraqis.

Several fundamental problems could arise if DU is the mystery metal used in large guided weapons warheads, or in fairly large Al Qaeda devices:

1. **Scale of use per target:** The new hard target warheads - unitary penetrators and multiple warhead systems - could yield up to 100 times more DU oxide contamination per target than an A10 attack with 30mm DU ammunition as monitored by UNEP in Kosovo.

2. **Wider tactical applications than known DU weapons**: Hard target guided weapons are designed for use in a much wider range of combat situations - for any fortified or underground target, not just anti-armour operations.

3. **Higher DU combustion potential in explosive warheads**: The new hard target warheads, penetrators and shaped charges, are all explosive devices. If they contain DU this is likely to yield up to 100% combustion to form DU oxides. Known DU anti-armour ammunition consists of non-explosive penetrators which do not ignite unless they hit a heavily armoured target.

4. **Wider geographic dispersal**: DU oxide contamination from large warheads is likely to be widely dispersed owing to a combination of explosive effects and thermal convection from the intense heat of DU combustion when fragmented or superheated. Larger particles will deposit near and downwind of the target but 60+% of DU oxide converts into fine dust less than 1.5 microns diameter. This may stay suspended in the atmosphere in smog like conditions.

When DU oxide dust settles into sand, soil or water it cannot be economically removed. Estimated cost for decontaminating the DU testing area at the Jefferson Proving Ground is $7.8 billion. Heavily contaminated areas could be perpetually unsafe for human habitation, agriculture or water catchment.

5. **DU contamination with higher isotopes**: UNEP analysis of DU penetrators in Kosovo highlighted the issue of "dirty DU" - contamination with exotic isotopes due to recycling nuclear fuel rods during reprocessing. The isotopic mix declared by Starmet for DU supplied to the UK Government contains lower levels of contamination than other reported DU samples. Refining quality control probably varies widely between differing production facilities and at different times. Small percentages may seem insignificant in a 30 mm penetrator. But even the Starmet figures could represent 4 kg of U235 in a 2 ton GBU-28 Bunker Buster bomb. Isotopic contamination could be even more serious if Al Qaeda had obtained DU from unreliable processing sources e.g. possibly from old nuclear facilities in Russia.

6. **New health problems are to be expected from acute DU contamination**: Previous health studies related to Gulf War syndrome investigations have assumed low level exposure to low level radiation hazards e.g. based on the quantities of DU reported in Kosovo. DU is suspected of contributing to long term health hazards but until now military commanders, analysts and politicians have discounted short-term hazards to troops (and presumably civilians) in DU targets zones as "minimal". They didn't have Doha data.

   " Even for the relatively small quantities of DU oxide contamination per target known in the Gulf war (0.3 to 3.0 kg) US Government sponsored studies gave misleading estimates of exposure to soluble DU. The OSAGWI report (1998) indicates that soldiers in the worst case scenario could have inhaled 9 mg of soluble DU. CHPPM's study shows they could potentially inhale up to 25 mg of soluble DU." (Don't Look, Don't Find, pages 20-21)

   If DU has been used in bomb and missile warheads in both Afghanistan and the Balkans then these previous exposure assumptions become invalid. There are no published studies of DU contamination levels in the vicinity of DU bomb or missile targets. Since such weapons do not officially exist there are no published studies of the health of troops or civilians with acute DU exposure near bomb or missile targets.

   Radiation and toxic exposure levels are likely to be far higher than previously reported except for troops in vehicles hit by large (120 mm) DU penetrators which ignited. Very few of these would have survived the intense heat involved. Serious health effects from acute DU contamination are likely to develop in weeks or months, not years. US and UK forces may already be seeing these effects on special forces troops asked to investigate recently bombed command bunkers etc unless they were wearing full NBC protection.

The DU scenarios suggested for the Afghan bombing, combined with the factors above, raise serious issues for military commanders concerned for the welfare, trust and morale of their troops. The carcinogenic and teratogenic risks to children of troops exposed to moderate or acute DU contamination may have serious implications for future military recruitment.

These scenarios should ring alarm bells for all politicians and heads of state who are currently committing troops and civilian aid workers to post-conflict support, or enabling the return of refugees after the recent US bombing in Afghanistan. If 500 - 1000+ tons of DU has been used in Afghanistan, many areas may be unsafe for human habitation.

Such scenarios also raise severe dilemmas for the international community. Afghanistan needs humanitarian aid and military security immediately. But personnel in the international support programme are at potentially serious risk until DU hazards are fully investigated. The immediate task is to find out whether the mystery metal used in hard target guided weapons is Depleted Uranium, and if so exactly how much has been used and where in Afghanistan since October 7th 2001. This information is unlikely to be volunteered by the US or UK governments. It will require pressure from politicians, the media, the UN and possibly the International Court.

Equally urgent is the need to assess potential DU contamination in Afghan locations targeted for bombing, cruise missile and cluster bomb attacks. It is hoped that this will be an immediate objective of the UNEP PCAU team.

However UNEP's analysis is likely to take several weeks before initial environmental samples can be analysed. Full environmental monitoring of all bombing locations and neighbouring areas will take many months and will need to be repeated in the spring and summer as potential airborne dust and water contamination increases. Several waves of sampling will be needed with initial priority on highest potential risk sources e.g. airborne dust and water supplies.

These delays could increase potential DU exposure risks to thousands of people. How can potential DU exposure risks be minimised until more facts are available? Health and safety risk assessments are needed based on all the scenarios proposed. One hope is the possibility that airborne contamination may be less during the winter. This needs to be checked by environmental scientists. It could give 2-3 months for field investigations to be analysed before decisions have to be made about whether to relocate communities in potentially high contamination risk areas.

An immediate concern is for Afghans and international personnel who have been in Afghanistan during the bombing period. This includes refugees now in neighbouring countries near the heaviest bombing zones e.g. northern Pakistan. They may have already had significant DU exposure. Civilians and refugees may need extra medical support in addition to the problems of famine, drought and winter.

These scenarios raise major health and welfare policy issues for all organisations involved in managing the aftermath of the Afghan war - issues that have not even been debated in public yet. The final sections of this report highlight key implications.

2. Re-thinking DU: effects of high load DU weapons

Politicians and the public in UK, and probably most other countries appear largely unaware or unconcerned about the use of depleted uranium in military or civilian applications. They are more aware of Gulf War syndrome as a mysterious illness that seems to evade diagnosis. The term "depleted" has been very effective for reducing anxiety and legitimate concerns about "Uranium", well known as a radioactive metal.

Those politicians, reporters, researchers, union representatives and campaigners that are more aware of the uses and potential problems of DU have usually had some direct involvement in its potential hazards. Some have raised questions on behalf of people who are suffering serious health problems, either after military service in the Gulf, after working in civilian or military manufacturing processes involving DU or who live near manufacturing or testing facilities. Others have become concerned about the horrendous health problems in parts of Iraq since the 1991 Gulf War.

Most suspected DU health problems have slow and insidious effects e.g. cancers or birth defects. Except in Iraq or near Uranium mining or intensive weapons testing facilities (e.g. in the USA) these health effects appear to be fairly low occurrence e.g. Leukaemia deaths among Nato troops after the Balkans war. These are not easy to distinguish from effects in the general population owing to a wide range of causes e.g. widespread use of chemicals or fallout from the 2000+ nuclear tests conducted mainly by the USA and Russia in the last 50 years.

The main health problems suspected from DU are due to its "low level" radiation hazards. These have been trivialised in periodic health studies e.g. the US RAND report (1999), the UK Royal Society Report (2001), and a number of Nato troop studies following the Balkans War. These studies are listed in the US Department of Defense report "Depleted Uranium Environmental and Medical Surveillance in the Balkans" (25 October 2001) at http://www.deploymentlink.osd.mil/du_balkans/index.html

Most of these studies and their associated publicity have assumed that exposure levels to DU oxide are usually low - based on small quantities of airborne dust following use of anti-tank munitions. e.g. the UK ***Royal Society*** report comment:

> "Except in exceptional circumstances any extra risks of developing fatal cancers as a result of radiation from internal exposure to DU arising from battlefield conditions are likely to be so small that they would not be detectable above the general risk of dying from cancer over a personal lifetime". (The Health Hazards of Depleted Uranium Munitions Part 1, May 2001).

Most studies have been conducted so long after initial exposure (several years or not at all) that individuals suffering more severe effects may have already died and been excluded from sampling. This appears to have happened with US and UK studies of Gulf War veterans. I am not aware of any systematic studies of civilian populations exposed to military use of DU by the US, UK or other governments, or by the WHO.

Studies of Gulf war veterans and casualties have been curiously selective. The highest suspected exposure cases - crews injured by shrapnel in vehicles hit by DU penetrators - who appear to have had relatively few health problems are used to indicate that DU munitions are relatively safe. These studies are riddled with flaws explained in **Don't Look, Don't find**, page 3 onwards. They excluded two thirds of the personnel exposed. DU testing and other health assessments were delayed for years.

The smaller penetrators that cause shrapnel without igniting (depending on hardness of armour and angle of impact) would not present anything like the acute inhalation hazards associated with those which did ignite, and less than the larger 120 mm shells. When these ignite they create dense clouds of black DU oxide dust (see picture below left). In the latter case most casualties would also have suffered severe burns (partly carbonised, see below right) and were likely to die of these or multiple injuries.

It possible that rescue and recovery teams who worked with DU casualties or recovered DU damaged vehicles were at special risk during the Gulf War, and possibly in parts of the Balkans. They may have experienced higher and more prolonged exposure to DU oxide dust from the larger (120 mm) penetrators that ignited, than casualties injured by shrapnel when small penetrators passed through their vehicles, creating some shrapnel but without full ignition. Some of these latter casualties with embedded DU shrapnel have been centre-pieces of the US DoD view that DU is not hazardous even in acute doses. Dan Fahey explains how difficult it was to get accurate exposure statistics for these and thousands of Gulf War veterans.

It now seems possible that other troops and support personnel in the Gulf War may have been exposed to different, and potentially larger, sources of DU contamination from guided weapons not previously suspected e.g. Maverick and TOW missiles.

It follows that the precise circumstances of exposure for these "high risk" DU survivors may need to be questioned more carefully. Were these survivors actually exposed to the same levels of internal DU oxide contamination as others who have since died, or suffered multiple medical problems? How comparable are the biological and radiological hazards of DU as embedded metal shrapnel compared to inhaled and ingested DU oxide dust?

All casualties deserve respect and concern and hope that they have minimum disruption from any kind of contact with DU. But some may have been at higher risk than previously acknowledged by military and medical researchers, depending on exactly the type of exposure they suffered, and how long for.

For example some UK veterans with Gulf War Syndrome symptoms were apparently discounted from DU studies by the UK MoD because they had not been exposed to DU anti-tank penetrators but to other friendly fire weapons i.e. Maverick missiles. The Maverick missile is one of the weapon systems suspected of containing DU listed in Part 3 - either in their shaped charge or penetrator warheads or both. Maverick version G penetrator warheads weigh 135 kg - potentially containing far more DU than the 120 mm anti-tank shells (about 5 kg).

Full evidence in these cases may need a legal enquiry requiring MoD and DoD witnesses to give evidence under oath without the protection of existing secrecy legislation to conceal this information. The design and construction of guided weapon systems are matters of fact and contained in official, though secret, records.

The only obvious reason for concealing the use of DU instead of Tungsten would be to cover up evidence that DU weapons do represent serious health and environmental hazards to troops and civilians. Covering up such hazards if known and proven would constitute deliberate violation of international conventions regarding weapons of indiscriminate effect.

If the UK Government or courts are unwilling to make or permit MoD witnesses to give evidence under oath then these cases should perhaps be referred to the International Court.

The **UNEP Balkans study** had serious limitations. They studied eleven A10 anti-tank target locations in November 2000. According to Nato information these targets had been hit with 8,112 DU rounds. The survey teams found just 7 and a half penetrators.

Penetrators that miss the target may go into the ground or ricochet. They should have found many more than they did. At Gjakove Garrison ***"Only one and a half penetrators were found from 300 reportedly fired. Some penetrators had been found and removed from the site during earlier clean-up work"*** (UNEP report page 47). The DoD report Tab C "Chronology of environmental sampling in the Balkans". http://www.deploymentlink.osd.mil/du_balkans/du_balkans_tabc.htm finally admitted that at least 10 survey teams had visited Balkans sites in the 16 months before UNEP were allowed to do their measurements. Some or all of these sites were sampled before the UNEP visits, and probably cleaned up by the 4 KFOR survey teams plus wind and rain, significantly reducing the validity of UNEP's data and conclusions.

DU metal in weapons offers relatively low level, external radiation hazards before firing. Much higher risks of long lasting internal radiation occurs in target zones if DU oxide dust is inhaled or ingested through air or water contamination. Penetrators that miss their target or do not burn on impact will still oxidise or be slowly dissolved in acidic soil, contaminating soil and water supplies. For A10 shells less than 30% are expected to impact and burn to form breathable dust so UNEP reported minimal contamination scenarios compared to larger penetrators used in Iraq and far less than DU warheads.

These known DU systems have provided the basis for assuming very low (or nil) DU exposure for most Gulf and Balkans war veterans. Reports on DU in the Balkans War published in 2001 by UNEP, WHO, the Royal Society and US DoD focused on exposure to A10 targets. For the 11 sites inspected by UNEP they averaged 202 kg of DU rounds of which 30% might have been aerosolised (burned). In practice most ground contamination appeared to be limited to a few centimetres around unburned penetrators. UNEP did not report testing target vehicles in the Balkans.

The rest may have thinly dispersed in the atmosphere so UNEP concluded there was very low risk to troops though possible long-term risks of soil and water contamination for civilians. Reports of several Leukaemia deaths plus the discovery of **dirty DU** (U236 and Plutonium contamination) in the UNEP samples aroused serious political and media concern from Autumn 2000 to March 2001. But the UNEP, WHO and Royal Society reports in March-May re-assured European media and governments that DU is relatively safe. Their conclusions may need review if DU has been used in other and much larger weapons systems several of which were used in other Balkans locations.

The **most serious oxide dust exposure from known DU munitions** arises when 120 mm tank rounds (c 4-5 kg each) ignite. Up to 70% may burn to create up to 3 kg of DU oxide dust. These are known to contaminate the area 50 metres or more around the target subject to wind direction. These rounds were not used in the Balkans War but left far more oxide contamination in the Gulf War. A10 attacks in the Gulf War may also have been far more intense than in the Balkans, and with higher ignition rates from hitting large armoured vehicles. Several Balkans war targets turned out to be wooden decoy tanks. Penetrators would have passed through them without ignition.

By contrast with known DU weapons the new hard target warheads (advanced penetrators or shaped charges) would create orders of magnitude more contamination if they are DU based. This would create far more acute DU exposure risk for humans in the immediate vicinity and downwind, and affect far larger areas.

The only comparable exposure data for military personnel would have been **the Doha ammunition dump fire in the Gulf in July 1991**. This involved 660 120 mm DU rounds of which 300 were unaccounted for. 111 were in tanks that caught fire. The rest were in storage containers. These "exploded in fires that were of a sustained intensity that steel howitzers and other equipment had melted, making it likely that many DU rounds had been damaged by oxidation." (OSAGWI, 1998 quoted in Don't Look, Don't find, pages 23-24).

Approximately **1450 kg of DU was lost, presumed burned**, in the Doha fire. This is **equivalent to the suspected DU in one GBU-28 Bunker Buster bomb** (assuming its "dense metal ballast" to be 75% of its 2000 kg warhead). Unfortunately the results of the air monitoring team sent to Doha 6 hours later are "missing" from US military records. And no medical assessments were made of the troops exposed to the fire, smoke, or initial clean-up operation (conducted without any NBC protection).

Since the possible use of DU in hard target guided weapons has never been admitted there are no known studies of the environmental contamination to be expected. But if DU warheads have been developed then military research teams should have done contamination studies of their own, including the possibility of very wide dispersal in smoke plumes. **Questions to the US and UK governments should include requests for disclosure of any such studies if they exist**.

The effects of potential DU warheads in guided weapons or cluster bombs used in the Balkans (Bosnia, Serbia and western Kosovo) were not seriously questioned, far less evaluated by mainstream political organisations or media channels in Europe. Targets are obvious from the destruction caused. These should be located and studies made of the immediate sites, and the troops and civilians exposed, under EU not US control. Health studies should be thorough, long term (5 years +) programmes

Unfortunately the Balkans studies published in spring last year led to a serious reduction in public vigilance by mid-2001. This has given the US and alliance forces a free hand to use hard target weapons in Afghanistan with no suspicion that they may have contained DU. Hence there has been no restraint on their use by either the US Congress or UK Parliament. There was at least some public debate about the use of known DU weapons (A10 shells) during the Balkans war and consequently some precautions for troops and civilians later.

In Afghanistan much of the bombing has involved hard target guided weapons. Warheads weigh from 250 - 2000 kilograms in smart bombs, and from 100 to 500+ kilograms in cruise missiles (see Figure 1, page 89). Hundreds if not thousands of tons of these weapons have been used in the Afghan War. **The critical question is whether any of these had DU based warheads? Also how many of each weapon were used and where?** These studies should also include cluster bombs and mines - i.e. any weapon using penetrator or shaped charge technology.

If only 50% of these warheads are DU alloy (99% uranium, 0.75% Titanium, plus 0.25% of U235 and other Uranium and Plutonium isotopes) then **health and environmental analysts must expect a faster and wider range of environmental contamination and adverse health effects**.

The potential use of large quantities of DU based weapons in Afghanistan needs urgent investigation and evaluation of their potential health and environmental effects. Ideally the DoD and MoD should be required to publish all their research and field study data on the use of hi-load (100-1000 kg) DU weapons. This should include full disclosure of environmental monitoring carried out by US and UK NBC teams over the last two months.

Some predictions for modelling the potential contamination effects from large hard target weapons should be available from military sources. Some may be available in civilian universities and research centres that research military weapons and strategy. Some are discussed in the DoD Information Paper **The Use of Modelling and Simulation in the Planning of Attacks on Iraqi Chemical and Biological Warfare Targets** at http://www.gulflink.osd.mil/aircampaign/index.htm **.**

These models were questioned by USA Today in August 1997 to establish whether the DoD had considered the potential effects of bombing chemical or biological targets as they might affect contamination for troops. Some modelling was based on previous work to assess the potential effects of nuclear weapons, and the potential effects of Iraqi weapons on coalition troops.

The possibility of contamination risks from DU contained in large target warheads was not an issue in 1991. It may have become an issue for military simulation before the Desert Fox campaign in Iraq in December 1998 as new hard target guided bombs were coming into service. **Such models, although intended to monitor effects of toxic agents from enemy sources, should be very similar to the dispersion effects of potential DU weapons contamination.**

Other non-military organisations may also have **computer models for environmental contamination from explosive or radioactive sources** e.g. for disaster planning in the event of civilian nuclear or chemical incidents. These would have been useful to evaluate the probable DU contamination in the area of the DU fire at the Royal Ordnance factory near Wolverhampton, UK in February 1999.

DU contamination studies also need to question the assumption in military training that because uranium metal is very heavy uranium oxides will deposit close to the target location. Because of the very high temperature of DU combustion much the oxides produced is in the form of very small particles, 60% of less than 1.5 microns. These can travel long distances, increasing the area of air, soil and water contamination.

Nuclear fallout models may be relevant. Past assumptions about the initial dispersal of DU particles in an explosion plume may need to be modified to include the "fly away" effect of very fine particles that remain suspended in the air for long periods. In this respect Depleted Uranium fallout may have similar behaviour to other nuclear weapons fallout with very wide dispersal, though for DU weapons at much lower altitudes.

These **DU dispersion models** may need to be combined with other atmospheric pollution models for fine particles that become re-suspended owing to heat, wind or electrostatic effects, and precipitation effects of rain or snow falling through haze or smog. (refer latest Balkans studies by Dr Chris Busby at http://www.llrc.org).

US and UK military researchers should have prediction methods that can be adapted to the effects of potential large DU hard target warheads. However their previous analysis has probably been focussed on the dispersal of enemy NBC agents. They may not have considered their own weapons as a potential environmental hazard since the military mindset for the last 10 years has been that "DU is safe". Alternatively they may be fully aware of DU's ability to "disappear" into the atmosphere with very few traces unless **rigorous air monitoring** is conducted including rainwater and snow.

Chris Busby's advice for re-investigating air contamination in the Balkans could be highly relevant to UNEP's forthcoming study in Afghanistan. See his recommendations for air and rainwater monitoring in **Response to UNEP**, section 7 at http://www.llrc.org/du/duframes.htm

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The following Bulgarian News report on 9 January 2002, http://www.news.bg gives further cause for concern:

> **Bulgaria would send 20 servicemen to Afghanistan**
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> "The special envoy of Ministry of Foreign Affairs Angel Orbetsov would leave for Afghanistan by the end of the month. His mission would be to make contacts with the new government in Kabul and to inspect the state of Bulgarian properties there, the Ministry of Foreign Affairs spokeswoman Elena Poptodorova said for News.bg Agency. She added that sending 20 Bulgarian servicemen within the framework of the peacekeeping mission of UN in Afghanistan was in a process of preparation. **The troops would be composed of specialists in maintenance of decontaminating baths for cleaning the organism of radioactive particles**. The servicemen are expected to leave by the middle of February. They would be under the command of the British contingent."
> 01/09/2002 18:30 (This is available in the 9 Jan archive).

Why should the British-led peacekeeping force require a decontamination team if NBC assessments over two months had not detected any radiation hazards? Are they involved because of reports about Al Qaeda dirty bombs? It was only on 16 January that US Defense Secretary Donald Rumsfeld reported the first Taliban target with "elevated radiation readings", see page 119. Whose radiation and how much is involved?

These comparisons between past reports of DU use in small, non-explosive penetrators and the likely effects of much larger, explosive DU warheads highlight the need to consider very different models of DU contamination in Afghanistan. They may also apply to re-analysing potential DU bombing in the Balkans and Iraq.

3. High exposure DU health risks: Identification & re-assessment

A thorough review of health studies into the effects of high dose DU contamination on humans is urgently needed. DU health monitoring has already been delayed too long in Afghanistan for acute exposure victims. The nearest equivalent for predicting the health risks of DU contamination from large warheads (500 - 1500 kg) or multiple hard target attacks may be studies of fatalities and survivors following large DU fires.

Unfortunately there is no health monitoring data for survivors of the Doha ammunition dump fire in the Gulf (see page 102). The US military report about the A10 crash, with DU ammunition, in the German village of Remscheid in 1988 seems to be unavailable. See http://wir-remscheid.de/Stellungsnahmen/Diverses/14022001.htm

In the 1992 El Al Boeing 747 crash in Amsterdam the plane had an estimated 450 kg of DU counterweights. In 1999 the Laka Foundation established that there had been DU contamination (from dust samples where the wreckage was stored) including up to 0.66% U235) despite years of official prevarication. See the Laka report at http://www.antenna.nl/wise/uranium/dhap997.html Various studies were done including "the report 'Health risks during exposure of uranium' made by radiation expert Leonard A. Hennen from the Dutch Ministry of Defense. The findings of Hennen strongly contradict the findings in the final report of Zuidoost. He said that the people at a possible crash site are running risks. In his report Chapter 5, page 9, he proposes the taking of urine samples and in vivo measurements when there is suspicion of internal contamination of the DU" (from 'Health risks of depleted uranium' page 4 at http://www.aeronautics.ru/archive/du-watch/us_gov_about_du.htm).

In each of these large fires a thorough environmental assessment should have been done for DU contamination, and a full medical and epidemiological study should have been done for the troops and civilians involved. These situations had obvious occupational and public health implications when they occurred.

Each of the incidents listed above involved the amount of DU suspected in just **one** of the suspected warheads used in the Afghan bombing (sizes from 250-1500 kg each). These may have involved equally serious local radiation hazards but potentially affecting far larger geographic areas and communities if DU has been used. For humanitarian, legal and professional reasons it is vitally important to start monitoring troops and civilians in Afghanistan for potential acute and long-term health effects of exposure to severe DU contamination as soon as possible.

The track record of the US and UK governments in health monitoring after known DU exposures for troops and civilians is so poor that their denials of DU use in Afghanistan simply cannot be trusted by employers or aid organisations. This has legal and ethical implications for employers and medical professionals.

Medical aid organisations have many pressing priorities in Afghanistan. But this report recommends that they include medical monitoring to detect early signs of acute DU contamination so that this can be included in diagnosis and treatment. Ideally these should be co-ordinated closely with environmental monitoring by the UNEP PCAU.

If it is proved that people have been exposed to significant DU contamination in Afghanistan it may be important that exposed individuals or communities should be removed from risks of further contamination as soon as possible. This is important for planning and co-ordination between refugee and medical aid organisations.

Most existing DU studies assume low dose exposure or low risk from medium doses (e.g. tank crews). But **much higher DU doses** may occur if victims are enveloped in the smoke / explosion cloud of a bomb or missile attack, assuming they survive the immediate blast, shrapnel or burns.

Medium to high doses are likely downwind of large explosion plumes, or by disturbing contamination in the immediate target zone weeks or months later e.g. entering underground bunkers or caves destroyed by DU-based warheads. Did Nato medical investigators check exposure to guided bomb or cruise missile targets for KFOR troops who have died of early onset leukaemia? Those deaths were mostly among troops from Mediterranean countries that were deployed to western Kosovo. This region received more guided bomb and cruise missile attacks than the US and UK sectors. US and UK special forces troops, and Afghan helpers, sent to investigate US bombing targets may have been at similar risk of severe DU contamination.

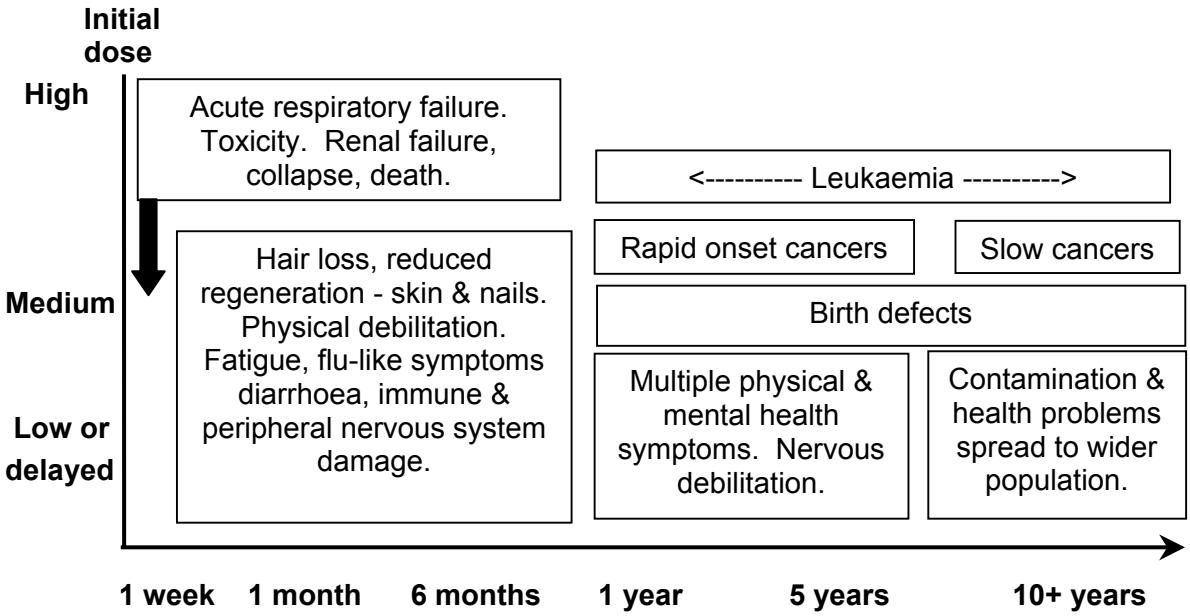
Exposure risks depend on distance from source at the time of the impact, disturbing DU dust in the target areas at any time, or indirect exposure to low dose contamination in air, water or food. This should be a standard epidemiological formula.

What may not be standard in Afghanistan is the size of the potential DU fallout plume downwind of heavy bombing attacks e.g. by 1-2 ton JDAM guided bombs and Bunker Busters (see Part 3). The Tora Bora region received the highest level of hard target bomb and missile attacks. This must be a high priority for environmental assessment and epidemiological monitoring after major urban areas have been checked.

Low but chronic exposure risks may arise from contamination in air, water or food in far larger surrounding areas building up over several years as dust deposited in high ground is washed into water catchment areas.

The **acute symptoms** in **Figure 2** have been reported by Gulf War veterans including medical personnel exposed to DU contaminated targets in Iraq. The slow onset disorders have been reported by Gulf veterans groups and by doctors and health researchers who have worked with civilian populations exposed to DU in Iraq.

Figure 2: Medical conditions associated with DU oxide exposure



Better medical descriptions and more sophisticated epidemiological models are described by medical researchers. In 1995 Professor Siegwart Horst-Gunther reported the following medium-term health disorders for civilians exposed to DU contamination in Iraq four years after the Gulf War:

" The results have produced ample evidence to show that contact with DU ammunition has the following consequences, especially for children:

1) A considerable increase in infectious diseases caused by severe immuno-deficiencies in a great part of the population.
2) Frequent occurrence of massive herpes and zoster afflictions, also in children.
3) AIDS-like syndromes.
4) A hitherto unknown syndrome caused by renal and hepatic dysfunctions, now so-called 'Morbus Gunther.'
5) Leukaemia, aplastic anaemia and malignant neoplasm.
6) Congenital deformities caused by genetic defects; also partly diagnosed in animals.

The results of my studies show similarities to a clinical picture described recently by the term 'Gulf War Syndrome' in allied soldiers and their children. The congenital deformities in American and Iraqi children are identical."
[From his paper "The Gulf War Syndrome - a parallel to Chernobyl" 1995 available at: http://www.wakefieldcam.freeserve.co.uk/gulfwarsyndrome.htm

Professor Gunther's point (1) has grim and immediate implications for the Afghan population facing starvation and cold during the winter. Acute DU exposure casualties are unlikely to survive common diseases with reduced immunity.

Similar serious health effects are described in Dan Fahey's report Don't Look, Don't find, pages 37-45, and the Low Level Radiation Campaign website http://www.llrc.org .

Official DU studies to date indicate very little data for high dose incidents that could be used to predict the potential effects of DU in large warhead guided weapons. Military data has always lacked early medical monitoring for DU casualties. Troops injured in the GBU-31 accident on 5 December may be the first DU contaminated casualties to receive full medical assessment and treatment in the USA. Nothing more has been heard about their condition since they were repatriated, or of the four UK SAS troops who were also evacuated for urgent but unspecified medical injuries.

The lack of published studies leaves description and assessments of the early stages of DU radiation and toxic exposure very poorly defined. Military medical personnel must be aware of many cases, including birth defects for the children of Gulf War veterans, concealed owing to DU secrecy policy. This must present responsible military officers and medical professionals with severe ethical dilemmas when silenced by military, political and commercial agencies with a high investment in DU projects.

Acute DU exposure effects may have some similarities to intermediate radiation exposure from more energetic (Beta and Gamma) radiation sources e.g. nuclear weapons and nuclear accidents (Three Mile Island, Chernobyl etc.). But again official studies of civilians have been severely limited, starting from the 6-year delay in monitoring populations in Hiroshima and Nagasaki reported by Rosalie Bertell (http://www.mothersalert.org/bertell2.html) up to studies of Chernobyl in the 1990's. The nuclear military-industrial establishment does not like bad publicity.

Figure 2 suggests **the likely progression from acute to delayed onset medical problems** arising from exposure to DU contamination from medium and large warheads, or fires involving DU. If DU has been used in large quantities in Afghanistan there may be an increased incidence of early onset disorders during the first year after the bombing compared to the Balkans or Iraq. Over longer periods the range of disorders already associated with Gulf War veterans are likely to develop.

There are significant differences between troops and civilians in the duration of their exposure to DU e.g. between troops visiting DU target zones for a short period and civilians who are permanent residents in contaminated areas.

Civilians may have a range of initial exposures from acute to none at all. But if they live in a highly contaminated and dusty environment e.g. in Iraq and potentially in Afghanistan they may be frequently re-exposed to medium or high doses of DU oxide. They may disturb a high risk DU contaminated target zone, or be exposed to on-going and cumulative DU contamination through water, airborne dust or food.

If DU weapons have been used in Afghanistan there are two ways to reduce exposure risks. Either DU contamination must be removed from the environment (e.g. micro-filtration of drinking water). Or individuals and communities at risk must be removed from the contaminated environment.

Dan Fahey and other independent DU researchers have looked at longer term health hazards associated with DU in other populations with known or suspected DU exposure. These include Uranium mining communities, nuclear industry process workers and communities in the vicinity of DU weapons manufacturing plants. Many of these show significant increases in slow onset cancers, see reports on the Military Toxics Project website at http://www.miltoxproj.org .

Most military studies focus on "healthy soldier" populations. But pregnant women and children in rapid growth phases are likely to be most vulnerable to the mutagenic effects of low level radiation (refer reports by Busby, Fahey and others).

Unfortunately potential DU health hazards in Afghanistan have not been notified to aid organisations, other than my message to the UK Red Cross and Oxfam on 5 November 2001 (see page 37). It is not known whether medical aid organisations like the **International Committee for the Red Cross** http://www.icrc.org have had the time to record symptoms of bombing casualties and other seriously ill civilians e.g. from Tora Bora. Have **Médecins Sans Frontières** http://www.msf.org doctors seen unexpected causes of death like those reported by Taliban doctors in October (Part 1, page 35)? Watch http://www.doctorswithoutborders.org/news/afghanistan.shtml .

It is hoped that this report will alert medical personnel in Afghanistan, and in neighbouring countries working with refugees from the bombing, to be alert for possible medical effects of acute exposure to DU contamination (see Figure 2 page 106).

Occupational health advisers for employers who have sent expatriate personnel to Afghanistan since 7 October are urged to include DU exposure as a potential health hazard. It is also desirable to monitor the health of these personnel for 1-5 years after they return to their home countries. If DU contamination is discovered in Afghanistan this should include uranium testing for expatriates.

Since the first evidence of DU contamination has been reported by the Pentagon the need for these medical precautions and monitoring proposals becomes more obvious.

Occupational health professionals, epidemiologists and other health researchers can do a more rigorous assessment of these potentially new DU health hazards. Ideally these assessments would be co-ordinated by the World Health Organisation - if the UN General Assembly can guarantee their independence.

On March 20, 2000 the Balkans Task Force convened a team of experts in Geneva to discuss post-conflict evaluation in the Balkans. According to Don't Look, Don't Find, page 55, their recommendation number 3 was as follows:

> " 3. A follow up of the BTF Desk Study should be organised with good inter-agency co-operation **and should be conducted in a way as to safeguard independent and reliable results**. Success in the study requires smooth collaboration with military organisations and UN organisations in Kosovo."

This statement of principle is equally relevant to UN post-conflict studies in Afghanistan.

The co-operation and independence needed by UN agencies in the Balkans was plainly undermined by US delays in disclosing DU targets for over a year and deliberate disinformation in providing inaccurate maps. I suspect that far more serious deception occurred in failing to disclose the suspected use of depleted uranium in much larger weapons systems and in entirely different target locations.

This saga brings the reputation of many scientists and some medical professionals into disrepute. It appears that many professionals have been associated with falsification of DU environmental or medical research studies by their methods or omissions. In doing so they may have jeopardised the health, welfare and prompt medical treatment of thousands of loyal troops, civilians and returning refugees over the past 10 years. The Pentagon and other Nato military commanders and spokesmen are plainly involved. Politicians and Governments involved in covering up the hazards and scale of use of DU have either been naïve to the point of incompetence, or complicit in this deception.

These are grave accusations but they are not new. They can be found in most of the references provided in this report. Whether other parliaments, professional organisations or national and international courts will act on them is considered in section 6. But such actions will take years.

The immediate concern for medical professionals, aid organisations and other employers of expatriate personnel remains the threat of extensive DU contamination in Afghanistan. However this time these organisations and the world press should be on their guard for similar interference from the US or other governments, or from arms manufacturers and the nuclear industry.

This time, due to the size of weapons suspected of containing DU, UNEP may not need military maps to plan their investigations. Any large hole in the ground (bomb crater or entry point) in Afghanistan will do as a start point for environmental and community health monitoring. And evidence can come from two independent lines of research: either environmental or health monitoring. Ideally both will be done and carefully co-ordinated. However full disclosure of all DU targets - locations, times, weapons, DU quantities and weather conditions - is needed to do a thorough environmental impact assessment of each target area to optimise monitoring and health precautions. Over 50 locations may be involved plus area assessments.

If widespread DU contamination has occurred in Afghanistan this will become obvious to medical and other aid organisations within 12 months, possibly much sooner. It may already have become obvious to Afghan personnel recruited by the US to inspect bombing targets in the search for evidence of bin Laden and Al Qaeda operations. They are now withdrawing co-operation. They are likely to have suffered acute contamination already if DU has been used in hard target bomb and missile warheads

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4. Environmental impacts of DU: Assessments & radical re-assessment

From the reported health effects summarised above it is important that thorough environmental monitoring should be co-ordinated with biomedical sampling and epidemiological studies.

Previous studies have assumed relatively low dose sources in the immediate vicinity of armoured vehicles hit by DU penetrators. Small, medium and large warheads that may contain DU (ranging from 10 to 1500 kg of DU) imply progressively larger contamination zones. ALL these warheads have explosive ignition sources likely to shatter DU into small fragments capable of rapid ignition and much higher conversion ratios to DU oxide.

Depending on the design and size of the weapon (from cluster bomb to bunker busters) and on the nature of the target (e.g. surface, near surface or deeply buried) the size of contamination zones may vary a lot. Assumptions that most DU dust particles are heavy and deposited in the immediate target area are not consistent with recent analysis of DU oxide and ceramic aerosol particle sizes (e.g. reported by Pier Denesi, a Director of IAEA, at the Prague DU Conference in November 2001) where 60%+ may be less than 1.5 microns.

Completely new models are required for forecasting contamination areas for high-load DU weapons. These need to include long term suspension and re-suspension of very fine DU oxide particles in "battle haze" and smog conditions. Atmospheric dust levels may remain much higher than normal for months in regions that have experienced extensive bombing. Seasonal factors and local meteorological conditions need to be included in suspected DU bombing environments.

This implies much more extensive monitoring procedures than available to UNEP in the Balkans study. However their multi-disciplinary team had an excellent range of skills to cover different environmental implications - given the right target information and unrestricted access to inspect any area of their choice.

Epidemiologists should be able to develop exposure graphs related to distance from target and medical effects tracked over weeks, months and years from high level DU exposures. Studies by Dr Chris Busby of the Low Level Radiation Campaign and Theodore Liolios in Greece may provide starting points for this different scale of analysis. UNEP teams may also have developed desktop models for large scale DU contamination, and how this may be affected by local geography, weather conditions and wind direction at the time of bombing and changing seasonal conditions in Afghanistan.

End of section & Notes

5. Humanitarian aspects of DU risks in Afghanistan

The UN and other aid organisations are well aware of the practical health and survival problems for civilians in Afghanistan - shortage of food, water, shelter and medical supplies. These may be desperate in many areas so potential DU risks may seem a low priority against more obvious hazards.

BUT if there is widespread DU contamination of buildings or water supplies in bombed areas **DU precautions must be given a very high priority - especially for people most vulnerable to low level radiation effects**. These are pregnant women, young children and sick people whose immune systems may already be weakened by acute DU exposure during the bombing. ANY known additional exposure must be avoided.

Many of the Afghan population are already weakened physically and psychologically by the war and pre-existing humanitarian problems. Any significant radiation exposures in addition to these other problems may **further reduce their resistance to health problems, potentially increasing winter fatalities**. Such fatalities may conveniently "cull" many people already suffering significant radiation or toxic exposure from DU contamination, long before any systematic health investigations can be carried out.

Humanitarian problems include **refugees returning** to communities with shattered infrastructure and potentially DU-contaminated water, air and dusty ground. In December they were returning at 3,000 per week. Ideally they should stay away until DU assessments have been done. This has immediate implications for **UN refugee policy** in Afghanistan and neighbouring countries. Medical monitoring for refugees outside Afghanistan may also be important if they were exposed to significant DU contamination during the bombing.

Medical monitoring for Afghans recruited by the US forces to investigate Al Qaeda target locations - especially caves in the Tora Bora region - may be very important. It may also be too late to prevent high levels of DU contamination.

The US Government should be asked to consider its legal liability to Afghans employed in search missions in potentially DU contaminated target zones if they or their families subsequently develop radiation related diseases. Or have they been provided with full protective equipment as supplied to US forces required to do the same task? (Were US, UK or other special forces troops provided with protective equipment when investigating strategic bombing targets?)

The current military and political perception of DU being "a minimal risk" to humans has to be challenged. It has to kept out of political and humanitarian assessments of DU risks and precautionary action. Potential and recurring DU contamination through water supplies and airborne dust must be considered **a vital public health priority**. Hopefully **these potential hazards may be temporarily reduced by winter weather conditions** (snow, ice).

But if significant DU contamination has occurred **these hazards could be greatly increased in spring** as temperatures rise and wind re-suspends fine DU oxide particles (60% less than 1.5 microns particle size) in dry and dusty conditions to create DU toxic haze, smog or dust storms.

How can non-scientists relate to the potential health hazards of large scale DU contamination? For practical purposes **the nearest health risk analogy for DU dust exposure may be blue asbestos dust in similar quantities**. Imagine from half- to 1.5 tons of blue asbestos dust being dropped for each bomb in a village or town in the US, UK or Europe.

- What health precautions would most adults take for their families?
- What precautions would employers be legally liable to take for their staff?
- How much care would be taken in conducting environmental sampling and impact assessments?

If there is ANY evidence of DU contamination in hard target bombing locations then **these precautions should be applied in all Afghan communities that have received guided bomb or cruise missile attacks**. DU monitoring and precautions should also be extended to **cluster bomb target areas** and any vehicle or building hit by aerial strafing from AC-130's or low level fighters with 25mm GAU-12 DU cannon.

These same precautions should be of **immediate concern to international employers** sending civilian staff or troops to Afghanistan in the next 6 months, until rigorous and independent environmental assessments have been completed. After the Balkans War some Swiss agencies exempted pregnant women from serving in the Balkans. Some organisations were also reported to have supplied bottled water to troops and civilian personnel. In view of dust conditions seen in many Afghan news reports breathing masks may be a wise precaution in windy weather or when travelling in vehicles that stir up dust.

If widespread contamination is discovered in some areas the most logical action would be to evacuate the population to avoid further risk.

Environmental monitoring and health precautions may be needed several kilometres from target areas as wind and weather spread suspected DU contamination. One report from the Balkans suggests that rain and snow tend to wash fine suspended DU oxide particles out of the air. While this may improve air quality it is likely to contaminate surface water supplies and soil.

Over longer periods of time airborne DU dust is likely to migrate to wider areas. Local geography and weather conditions may result in new concentrations away from original target locations.

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6. Political context: deception, DU proliferation and control

One problem encountered in these investigations has been mounting evidence of deception or mis-information by commercial, scientific, military and political interests associated with the use of DU in military and civilian applications. This was not always the case. For many years Depleted Uranium was recognised as a hazardous material, subject to handling regulations in the US and UK as a radioactive substance by military, civilian and aviation authorities. Boeing removed DU counterweights from use in new Boeing aircraft in the 1980's.

Although DU regulations still apply in certain situations e.g. military training areas the DU cover-up started during the Gulf War when the value of DU for defeating armoured targets was first tested on a large scale. The US first tested DU tank rounds in combat when they were supplied to Israel for the Yom Kippur war in 1973. Military warnings about potential DU health hazards were circulating within the US military in 1990. For some reason they were not passed on to front-line troops in Operation Desert Storm until after the war had finished. By then over 275,000 US and UK troops had been exposed to DU contaminated environments. This is documented in Dan Fahey's comprehensive DU study **Don't Look, Don't Find** (March 2000) at http://www.miltoxproj.org/DU/IOM-cover.htm

Fahey quotes the following memo from Lt Col Ziehmn on 1 March 1991 from Los Alamos National Laboratory. It has defined US military policy towards DU ever since:

> "It is believed that du penetrators were very effective against Iraqi armor; however, assessments of such will have to be made.
>
> There has been and continues to be a concern regarding the impact of du on the environment. Therefore, if no one makes a case for the effectiveness of du on the battlefield, du rounds may become politically unacceptable and thus, be deleted from the arsenal.
>
> If du penetrators proved their worth during our recent combat activities, then we should assure their future existence (until something better is developed) through Service/DoD proponency. If proponency is not garnered, it is possible that we stand to lose a valuable combat capability.
>
> I believe we should keep this sensitive issue at mind when after action reports are written."

Fahey described 5 successive US government enquiries into the health risks of DU for Gulf War veterans in the 1990's, each deliberately distorting the evidence of severe DU health effects. The title of the study sums up DU medical and scientific research practices. Long delays in starting even very limited studies of troops exposed to DU safely ensured that many with acute exposures died without autopsy.

Autopsies to seek evidence of DU contamination are still rare. The wife of a Canadian veteran who died of severe DU related illnesses had an autopsy conducted that provided proof that he suffered high DU levels. The evidence was stolen soon after.

Critiques of the methodology of more recent DU reports produced by RAND, WHO, UNEP, the Royal Society etc. are available from several independent DU researchers quoted in this study (see page 56 and on the Low Level Radiation Campaign website at http://www.llrc.org/du/duframes.htm).

Official reports illustrating US Government propaganda about DU to re-assure troops and the public about the low risks of DU weapons can be found by searching for Depleted Uranium on the US Department of Defense **DefenseLINK** website at http://www.defenselink.mil .

The US Department of Defence Information Paper "Depleted Uranium Environmental and Medical Surveillance in the Balkans" (25 October 2001) lists recent medical assessments of Nato troops.

> " Spurred by the reports of a higher incidence of leukaemia and various health complaints associated with exposure to DU, the Committee of the Chiefs of Military Medical Services in NATO (COMEDS) called a special plenary meeting on January 15 2001 to discuss issues related to DU. The meeting resulted in a report on the initial impression of the health issues as seen by the Surgeons General of the NATO nations' military medical services. Preliminary data provided by the nations at that meeting indicated no causal link between exposure to DU and the health complaints or pathologies, and no link between DU exposure and leukaemia or other cancers in Balkans veterans." Their reports are summarised in Table 1 at: http://www.deploymentlink.osd.mil/du_balkans_s04.htm

However enquiries into leukaemia deaths of Italian peacekeeping troops from Bosnia and the Balkans War have been re-opened in recent months. So the **US Embassy in Italy** opened a Depleted Uranium page at http://www.usembassy.it/policy/topics/du with links to previous re-assuring DU health studies. The latest analysis of morbidity data for Italian peacekeepers indicates a 12x higher incidence of lymphomas and leukaemia than in the initial medical reports referred to by the DoD Information paper. The original statistics used invalid reference groups (Busby, 2002, http://www.llrc.org).

Overall DU exposure in the Balkans was hopefully much lower than for troops in the Gulf War. But if DU was used in hard target bombs and missiles, especially near the Albanian border, then properly controlled health studies for peacekeepers and civilians in those areas are needed. They may suffer increasing DU-related health problems in the next 5 years. Some of the weapons used were prototypes of guided bombs and cruise missiles used extensively in Afghanistan. It is important that environmental assessments of these potentially heavily contaminated targets should be carried out by independent researchers. At the same time regular medical assessments for troops and civilians deployed in those areas are urgently needed. They may provide important clues to the environmental and health hazards that may exist now in Afghanistan if DU is used in hard target warheads.

The characteristics of DU propaganda are analysed in Piotr Bein and Pedja Zoric's paper **Propaganda for Depleted Uranium - a crime against humankind** presented at the DU conference in Prague on 25 November 2001. In essence they are **delay, deny, deceive**. See http://groups.yahoo.com/group/du-watch/files/DUPraha.doc

The issue of DU deception spreads far wider than the United States. It has required complicity by the UK and other governments in the UN to prevent the World Health Organisation conducting a thorough DU study in Iraq - even 10 years after the Gulf War. When the UN Balkans Task Force sought to include DU in its post conflict assessments of the Balkans War this was clearly subverted by delay and deception before the UNEP study could start (see also page 101).

The US or Nato severely limited UNEP access to the most relevant sites (armoured targets) and somehow managed to influence the final conclusions of the report to exclude the hot spots of contamination they did find. Robert James Parsons challenged this interference in UNEP and WHO investigations in "**DU - the law of silence**" in Le Monde Diplomatique on 1 February 2001, and in his report **"DU Balkans cover-up"** in the Nation on 9 April 2001, see: http://urbana.indymedia.org/front.php3?article_id=3601&group=webcast

The links in this report are offered so that readers can check the history of official DU studies and critiques of them by independent DU researchers from original sources.

One advantage of this trail of official deception is that it has to contain mistakes. Denials or omissions give valuable clues to the type of weapons or health hazards that governments, military and the nuclear industry are trying to conceal.

This study of **suspected DU weapons** has found **frequent anomalies between official reports, press releases and government statements** when trying to identify when weapons become available for combat use. Reports of the timing of upgrades to the **AGM-86D CALCM and BGM-109 Tactical Tomahawk** and the introduction of the UK/French **Storm Shadow** missile illustrate this. The FAS and manufacturers' websites include authorisation and planned delivery dates. But recent reports from the US and UK governments implied that they were not ready for use in Afghanistan.

For example the hard target **AGM-86D** upgrade for the CALCM was authorised in November 1999 for delivery of 50 units by July 2001 (Boeing news release, December 1999 at http://www.boeing.com/defense-space/missiles/calcm/calcmnews.htm). Yet on 29 November 2001 the latest Boeing release reported what appeared to be the first field test of the AGM-86D in New Mexico (same link).

The latest Boeing report conveniently linked with a Pentagon report published on 4 December 2001 in the International Herald Tribune: **US is developing powerful weapons to pierce the deepest sites**. This is available at: http://www.iht.com/cgi-bin/generic.cgi?template=articleprint.tmplh&ArticleId=40871

> "Another combat-ready weapon is the AGM-86D, a refurbished deep-penetrating version of the U.S. Air Force's aircraft-launched cruise missile. Last Thursday, the contractor, Boeing, said a missile launched from a B-52 over the White Sands Missile Range, in New Mexico, had successfully struck "a hardened, buried target complex" and detonated inside.
>
> The U.S. Air Force has already received part of an order of 50 of the missiles, on which nuclear warheads had been replaced with a slender, heavy conventional warhead that can drive deep into the earth. A variant of this earth-piercing warhead was used in a small number of bombs dropped in Kosovo in 1999, defense documents say."

Part of this report creates the impression that the AGM-86D was still being developed but it goes on to say that a part order had been delivered. A few days later the Center for Defense information in Washington reported that AGM-86D missiles had been used in Afghanistan.

On 16 December The Telegraph reported that the Israeli developed AGM-142 Hav Nap hard target missile was being deployed in Afghanistan because US forces were beginning to run short of air launched cruise missiles (i.e. the AGM-86D CALCM).

See article **Intelligent missile used against bin Laden caves** by Sean Rayment at: http://www.portal.telegraph.co.uk/news/main.jhtml?xml=%2Fnews%2F2001%2F12%2F16%2Fwtora216.xml

On 30 December The Telegraph again reported that US forces were running out of "air launched cruise missiles" (CALCM) although the attached photograph was of a Tomahawk missile. Article **US missile shortage delays Iraq strike** by Sean Rayment http://www.portal.telegraph.co.uk/news/main.jhtml?xml=%2Fnews%2F2001%2F12%2F30%2Fwirq30.xml

Analysis of earlier Boeing and FAS reports about the AGM-86D (Part 3, page 85) indicated that the new warheads were first tested in summer 1998. Competitive evaluation of the two new hard target warhead options (Lockheed Martin's AUP-3M and BAE-RO's BROACH/MWS) continued from 1998 until the Lockheed version was chosen in November 1999. Boeing's website reported that the AGM-86 was used in Operation Desert Fox in Dec 1998 and in the Balkans War. It seems logical that both prototype warheads were being tested in combat conditions during this period.

Other Boeing reports (except the latest) indicated that delivery plans were on schedule for July 2001. Taken together it seems likely that most of the 50 AGM-86D's were delivered in summer 2001 and used in the Afghan bombing. So why should the Pentagon try to give the impression that this top-of-the-range hard target missile was not available for use in Afghanistan in early December?

Similar mis-information seems to apply to the **Tactical Tomahawk Advanced Penetrator** upgrade, approved in 1999 but delivery dates set for 2003. This was intended to use the new "Government supplied" warhead (apparently the 1000 lb version of the BLU-116) also designed for the GBU-32 smart bomb. Warhead development would have been completed well before 2001**. It seems likely that at least prototype versions of the Tactical Tomahawk Penetrator Version were used in sea-to-shore Tomahawk attacks early in the Afghan war.** Over 50 Tomahawks were fired in the first week according to the Centre for Defense Information website. **Tactical Tomahawk is another suspected DU warhead weapon**. Some reports indicate that earlier Tomahawks contained **30 kg of DU** as "ballast" see http://www.aeronautics.ru/archive/du-watch/us_gov_about_du.htm
"Ballast" sounds benign. But this would be about the weight needed for the casing or liner of earlier shaped charge warheads. The advanced penetrator warhead is estimated to contain **250+ kg of DU** - if DU is the mystery dense metal involved.

The UK/French **Storm Shadow** missile (with the BROACH hard target warhead) was scheduled for delivery by December 2001. On 6 December UK Government defence spokesman Mr Ingram said that "The BROACH MWS is not forecast to enter service before August 2002". (Hansard, see page 69). If true this means that Storm Shadow is 8 months behind schedule, originally planned for December 2001. Also what has happened to the BAE-RO contract to supply BROACH warheads for the **AGM-154C** hard target upgrade, due to be operational in 2001? (see page 87). I suspect that at least prototype versions of Storm Shadow and the AGM-154C have been tested in Afghanistan. These highly inconsistent statements need investigation.

The timing of development and approval of several of the suspected DU guided weapons identified in Part 3 seems to fit in conveniently with opportunities for combat testing in Iraq, the Balkans and Afghanistan. The deployment of US and UK forces to the Gulf / southern Asia region in Summer 2001 was planned up to 2 years ago, possibly in anticipation of the opportunity to launch the Afghan war. So weapons manufacturers had a combat testing target date to work towards. It seems unlikely that they would have wanted to miss this opportunity to test and demonstrate the effectiveness of new weapons to improve future government orders and export opportunities.

Ongoing US and UK bombing in **the Iraq no-fly zone** has provided a low profile opportunity to field test prototype and upgraded guided weapons for several years. Refer this quote re the AGM-154A in *The Weaponeer* on 4 February 1999 at http://www.fas.org/man/dod-101/sys/smart/docs/990204-jsow_FA18.htm

> **JSOW scores first combat success**
> By Kathi Ramont, Associate Editor
>
> Three successful Joint Stand-Off Weapon (JSOW) AGM-154A missions were conducted in the Persian Gulf area during the week of Jan. 24 (1999) by an on-station Carrier Air Group. "The revolution in strike warfare has begun," wrote NAWCWD's new commander Capt. Bert Johnston, who is also the program manager for Conventional Strike Weapons, in a message to the JSOW Team. "Three JSOW were launched against targets in Iraq, and reports are that all were successful."

On 7th March 2001 the UK Government replied to a question about suspected DU bombing in the Iraqi no-fly zone (see page 60) thus: "None of the weapons dropped by the RAF on Iraqi installations since the UK began patrolling the no-fly zone have depleted uranium tips". This answer was technically correct because the "tips" of most hard target guided weapons contain their guidance systems. Hard target warheads are usually contained in the centre section e.g. in the AGM-65G Maverick (see diagram on page 88) and the AGM-154 JSOW.

It is essential that investigations of the use of all suspected DU weapon include the periods of prototype testing in all active combat zones (e.g. the Iraq no-fly zone) , and in non-combat training areas like the US training ground in Vieques (Puerto Rico). Targets in all these areas may have been subjected to DU contamination from new hard target warheads.

Possibly the most serious case of **suspected DU propaganda in the Afghan War** concerns reports of **Al Qaeda's "dirty bombs".** (See DU scenarios on pages 94-95). This was quoted from US intelligence sources in the International Herald Tribune on 5 December **New evidence is adding to US fears of a Qaida 'Dirty Bomb'**. See http://www.iht.com/cgi-bin/generic.cgi?template=articleprint.tmplh&ArticleId=40891

> "U.S. intelligence agencies have recently concluded that Osama bin Laden and his Qaida terrorist network may have made greater strides than previously thought toward obtaining plans or materials to make a crude radiological weapon that would use conventional explosives to spread radioactivity over a wide area, according to U.S. and foreign sources.

> A radiological bomb, also known as a "dirty bomb," could be made by taking highly radioactive material, such as spent reactor fuel rods, and wrapping it around readily available conventional high explosives. The device is designed to kill or injure not through its explosive force but by creating a zone of intense radiation that could extend several city blocks. A large, highly radioactive bomb could affect a much larger area."

I sent a message to DU researchers to watch for reports that stocks of DU had been "found" in Al Qaeda weapon stores. This came through at the end of December e.g. Vivienne Walt's report in USA Today **Uranium reportedly found in tunnel complex** See http://www.usatoday.com/news/attack/2001/12/24/uranium-usat.htm#more

There were several possible explanations for these reports. First they may be true and Al Qaeda did possess stocks of DU but did not construct or use dirty bombs. Second that they had DU and used dirty bombs in a scorched earth retreat. Third that US bombs have inadvertently hit Al Qaeda stocks of DU resulting in DU contamination. Fourth that these reports were launched as a cover story in the event that the media start to question suspected use of DU weapons in the Afghan bombing, or that UNEP surveys find evidence of DU contamination from US bombs. (DU scenarios, page 95).

The latest news about **suspected Al Qaeda use of DU** was the statement on 16 January by Defense Secretary Donald Rumsfeld. This is covered in the Reuters / Yahoo report **US says more weapons sites found in Afghanistan** .see http://dailynews.yahoo.com/htx/nm/20020116/ts/attack_military_dc_234.html

> "WASHINGTON (Reuters) - U.S. forces in Afghanistan found more evidence Osama bin Laden's al Qaeda network was seeking chemical, biological and nuclear weapons, and the number of sites to inspect is growing, Defense Secretary Donald Rumsfeld said on Wednesday. …
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> The United States does not have evidence that al Qaeda has acquired weapons of mass destruction but the materials indicate they wanted to use such deadly items, he said. …
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> The number of suspected chemical, biological and nuclear weapon sites in Afghanistan is growing and U.S. forces are now targeting more than 50, about 10 more than they have already inspected, Rumsfeld said. **…**
>
> **One site registered an elevated level of radioactivity but it appeared to be a result of depleted uranium on some warheads and not from any nuclear or radiological weapon of mass destruction**, Rumsfeld said. …
>
> U.S. forces found some missiles with depleted uranium warheads in the Kandahar area near the end of December, Thomas said. It was not known where al Qaeda obtained those weapons."

From this report it seems unlikely that there is evidence of Al Qaeda actually using dirty bombs or this should have been broadcast and obvious precautions would have been to evacuate a large area. This has not been reported. The first alleged discovery of DU could have been genuine, planted or simply a hoax. The Afghans who reported the discovery would have had no way of confirming that they had found DU except by a name label on a container. It was removed by US troops. It still seems possible that these reports are part of a contingency plan to divert blame for any DU contamination that is discovered following US bombing.

The reference to **an elevated level of radioactivity at one site** is very important and ambiguous. In the context of the report it implies warheads in Al Qaeda weapons. The "missiles" referred to by Thomas may be Milan anti-tank weapons mentioned in a previously unconfirmed Internet report several weeks ago. Or it could be the first acknowledgement that some US warheads contain depleted uranium. The reference seems remarkably low key, perhaps on the assumption that DU is safe whereas they were looking for signs of enriched uranium for nuclear weapons.

Donald Rumsfeld's statement needs very careful investigation by all countries sending personnel to the Afghan peacekeeping project. It is the first official statement report that radiation hazards associated with DU have been detected in Afghanistan. This indicates that that the **UNEP PCAU** study is justified to include DU surveys in its environmental assessments with the best available alpha radiation detection equipment, despite UK Government denials that DU has been used in Afghanistan.

The Dirty Bomb reports in December were briefly picked up by the international media and sustained **international anxiety** about the risk of terrorist attacks in other countries. Were they being used to justify the ongoing war against terrorism or as the first stage of covering up widespread use of DU?

The reference to over 50 suspected chemical, biological and nuclear weapon sites in Afghanistan is likely to match the number of sites attacked by US forces with hard-target guided weapons. This may give the UNEP PCAU an idea of how many potentially DU contaminated locations they need to inspect.

The location of these targets is essential for provisional estimates of potential DU contamination to towns, villages and water supplies. As in 1999 the United Nations needs another DU target map from the US Government. Will UN member states tolerate another one-year delay before the Afghan DU map is released?

The UNEP PCAU needs the Afghan "NBC" target map WITHIN THE NEXT 7 DAYS to plan their surveys. They will also require many times more resources than they were given in Kosovo, and fast.

If the dirty bomb reports were fabricated by US sources for propaganda purposes this was an incredibly hazardous issue to raise. Though the report referred to use of "spent reactor rods" to create crude bombs it also highlighted the widespread availability of depleted uranium metal in civilian applications as a potential terrorist material. Yet on 19 December the UK Government appeared unconcerned about the trading of DU metal that could be adapted for terrorist bombs: "Data on imports of depleted uranium and depleted uranium products since 1985 are not readily available and could only be obtained at disproportionate cost." (Hansard 19 December 2001, see page 71).

If governments are concerned about use of dirty bombs by terrorist groups they need to track down and control ALL sources of DU metal. Environmentally there is little difference between the hazards created by detonating and igniting DU metal in a guided weapon warhead or in a terrorist bomb. Either would be a radioactive "dirty bomb". This raises serious questions about the availability of DU in civilian as well as military applications. The radiation hazards associated with its use in aircraft counterweights have been recognised from airport fire instructions in the 1980's to a Boeing maintenance procedure circular PRO-1861 in July 2001. See http://groups.yahoo.com/group/du-watch/files/PRO-1861.pdf There is clearly a conflict of interest between genuine concern to restrict terrorist resources and the nuclear industry's wish to market DU products widely into civilian applications.

Statements from the UK Government (in Part 2) and these statements from US government sources in the last three months suggest **a systematic approach to mislead the public about the suspected use of DU in hard target weapon systems on both sides of the Atlantic**. They have deterred media and hence public concern about potential widespread use of DU in Afghanistan and recent conflicts and reduced public and media vigilance about the hazards of DU in military or civilian use. **At worst Donald Rumsfeld's statement on 16 January may be a prelude to discovery that significant amounts of DU contamination from US weapons will be found in Afghanistan.**

These statements increase my concern for human welfare in Afghanistan. **The danger of this culture of deception concerning Depleted Uranium weapons is that it will be used to subdue political and media debate, and hence to delay, limit, or distort systematic environmental and health assessments for DU in Afghanistan.**

I hope that independent political, scientific and media organisations in every country providing troops or civilian support will realise the importance of supporting the **UNEP PCAU**. Any attempt to interfere with fast, thorough and independent assessment of potential DU risks in Afghanistan should given the widest exposure.

The pressure and support needed for the **UNEP PCAU** to investigate DU hazards rigorously should also be offered to the **World Health Organisation**. The WHO needs to establish fast and thorough **medical monitoring** with immediate effect - not in 6, 12 or 18 months time. Robert James Parsons report **DU Balkans cover-up** questioned the relationship between the **International Atomic Energy Authority** (representing the nuclear industry) and the **WHO**'s responsibilities to investigate major health risks if these include suspected radiation hazards. So **any post-conflict health assessment project undertaken by the WHO needs international support and vigilance.**

Any interference or restriction on WHO investigations of radiation-related health disorders should be a matter for international concern and full debate in the United Nations. Continuing delays to WHO investigations into DU health effects in Iraq are a matter of grave concern to DU researchers and human rights groups concerned for civilians in Iraq

If there is **evidence of DU weapons being used in Afghanistan**, despite categorical denials by UK Government ministers, then this will have **international political and legal implications**. For example:

- Did the US and UK Governments fully inform European and other governments (e.g. Australia and Turkey) of potential DU weapons use in Afghanistan prior to winning their co-operation to staff up the Afghan clean-up and peacekeeping operation?
- If such briefings did occur were all political parties fully informed e.g. when the Green Party in Germany supported intervention?
- If DU is proved to have been used in hard target guided weapons then where else have they been used - e.g. in Bosnia, Iraq and the Balkans war?
- If so were other Nato countries informed of their use and of locations in the Balkans when KFOR troops were sent in? The highest incidence of Leukaemia cases seems to have been for Italian, Spanish and Portuguese troops assigned to western Kosovo - one of the heaviest bombing locations. US and UK troops were allocated to less heavily bombed regions. Was this taken into account in the health studies done in 2000-2001 by most European countries (except UK)?

If DU has been used in old or new hard target guided weapons at any time since 1990 there may be many further legal and political repercussions. International lawyers have already expressed concern about the potential significance of DU munitions as **weapons of indiscriminate effect**.

The US Government has recently announced **plans and budget commitments to replace and increase its inventory of hard target guided weapons** following the Afghan bombing. They offer tactical military justifications for such weapons in regions suspected of having many underground weapons stores and command centres e.g. in Iraq and North Korea.

But **if DU is used in large hard target warheads these are likely to dissipate low level nuclear waste over large areas and across national boundaries**. For example if they have been extensively used in Afghanistan the DU fallout is bound to spread to northern Pakistan and western China given prevailing wind directions. This has long term implications for pollution of land and water supplies serving very large populations.

There are **alternatives to DU** for hard target warheads e.g. Tungsten for unitary penetrators and other metals in shaped charge warheads. Shaped charge warhead technology and high kinetic energy created by increased missile velocity rather than high density materials appears to offer scope for more powerful weapons without the radiation hazards associated with DU. In effect DU warheads are already obsolete.

These developments, and the widespread proliferation of anti-tank and hard target guided weapons to over 30 countries, indicates an **urgent need for international arms control to ban the current and potential use of DU in weapons** of all kinds from cluster bombs and cruise missiles to very large bunker busters.

The existing inventory of suspect DU weapons identified in Part 3 are worth billions of dollars, though many have been used in the last 3 months. New hard target weapons currently under development by the US, UK, France, Israel and potentially Pakistan, India and China are also involved. DU weapons may have become a low-level nuclear arms race over the last 5 years.

This development has been fuelled by the nuclear industry that sees DU weapons as a profitable way of disposing of nuclear waste. 99% of Uranium waste from the nuclear industry is depleted uranium - U238. But very few members of the public are likely to make that connection without more rigorous media coverage.

The commercial nuclear agenda spreads further. In 2001 sustained scientific and political propaganda has successfully created the public impression that DU is not hazardous - even in military applications. This is closely tied in with clear plans by the nuclear industry to disperse DU products into the public environment. These include dilution of DU in other recycled metals (e.g. as found in Aluminium alloys) and by creating DU oxide aggregates (e.g. DUcrete) for the international construction industry.

New legislation in the US in recent months is seeking to deregulate control of DU products for use in civilian applications. If successful this will enable existing DU stockpiles (500,000+ tons in the US, and other large quantities in Russia and Europe - see WISE at http://www.antenna.nl/wise/uranium/eddat.html) to be disposed of and for the businesses concerned to make a profit in the process. Previously DU had to be stored and contained as low level nuclear waste.

The long term environmental implications of DU reinforced concrete are equivalent to the use of Asbestos to reinforce building materials (e.g. interior rendering) in the 1950's. The potential environmental impact of this for future generations can be seen in the dust contamination problems associated with the tragic destruction of the World Trade Centre's Twin Towers.

Depleted Uranium has some valuable uses e.g. in radiation shielding but only under the strictest health, safety and environmental controls. But its use in any context has to take account of the full long term human and environmental cost of using it - in military or civilian applications.

The perils of the unrestricted use of DU in military applications are already obvious in Iraq and beginning to emerge in parts of the Balkans, despite official research and political propaganda which minimises DU hazards. These may also become obvious by August 2002 in Afghanistan, much faster than in the Balkans, if large quantities of DU weapons have been used. Hence the title of this report ***Mystery Metal Nightmare in Afghanistan?***
