Laid to Waste

Depleted uranium contaminated military scrap in Iraq

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Colophon

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An Iraqi tank, riddled with holes during the Gulf War and spray painted with the letters 'DU,' referring to depleted uranium, lies rusting November 5, 2002 in a scrapyard.
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NORWEGIAN MINISTRY OF FOREIGN AFFAIRS

Contents

Executive summary

The lack of a clear strategy to deal with the legacy of the use of depleted uranium (DU) munitions in Iraq, from either the Coalition Forces, the Coalition Provisional Authority or the Iraqi government, has resulted in the continued exposure of civilians to DU. Conservative estimates suggest that more than 440,000kg of DU was fired in both Gulf Wars in 1991 and 2003 by the United States (US) and the United Kingdom (UK) armed forces. DU use has been documented against tanks, armoured vehicles, unmounted troops and buildings in populated areas. Long after each conflict, military remnants destroyed with DU could be found in towns, cities and rural areas.

While some material was collected and stored on scrap metal sites, these were often accessible to local communities and were viewed as a resource for the unregulated trade in scrap metal. Little information was provided to Iraqi civilians or local authorities on the potential hazards associated with exposure to contaminated wreckage. This report will examine international standards for how these contaminated military remnants should have been dealt with; the type of work Coalition Forces and the Iraqi government undertook to reduce DU exposure risks and will document the concerns of Iraqi civilians, government officials and humanitarian demining organisations over the legacy of DU in Iraq.

The aim of this report is to demonstrate the difficulty of preventing civilian exposure to DU in States recovering from armed conflict, with a focus on contaminated military scrap metal. These difficulties are compounded where DU users are reluctant to disclose information on where the munitions are used. The report explores the limited efforts by the Iraqi government to effectively tackle the issue, and the resulting impact on civilians.

Summary of key findings

1. **Poor post-conflict management of DU contaminated scrap metal:** Coalition Forces were reluctant to extend their clean-up operations beyond their own bases, or to share information on DU with the Iraqi government. Together with the Iraqi government's limited technical capacity and low prioritisation of the problem, this has led to the ineffective management of DU contaminated scrap. These factors have significantly increased the likelihood of civilian exposure to DU; they have led to contaminated scrap being exported to neighbouring countries; the improper management and monitoring of scrap metal collection sites; and to DU destroyed tanks and other military wreckage being left in city centres, towns and villages, with local people stripping them for valuable parts and children using them as playgrounds.

2. **International regulations for dealing with radioactive waste were not applied to DU:** International regulations that provide guidelines on how DU, which can be labelled as Low, or Intermediate Level Radioactive Waste, should be dealt with, were not applied in Iraq. Safe storage, monitoring and disposal mechanisms should have been implemented, yet failed to be part of the work undertaken by either the Coalition Provisional Authority or the Iraqi government.

3. **Long-term strategy for clean-up and remediation:** In spite of repeated assessments by UN agencies and calls for support, no long-term strategy was devised to address the identification and removal of contaminated scrap or the monitoring of scrap metal sites and other affected areas. DU has been raised in numerous Iraqi government and UN reports as a concern that should be dealt with, yet a lack of sufficient funding, combined with political ambiguity around the issue, has hampered the necessary clean-up.

4. **Civilian concerns over DU are mounting:** Civilians living near contaminated sites, workers on scrap metal sites, Iraqi doctors and researchers have repeatedly voiced their concerns over the potential effects of DU on health and the environment. Clearly, the knowledge that there might be toxic and radioactive substances present in the soil you live on, the air you breathe and the water you drink, affects the wellbeing of communities. Though a lack of data on the current extent of contamination makes it difficult to make clear statements over the risks involved, these concerns are there, and must be addressed.♦

Scrap metal being recycled by Kurdish workers, Qushtapa, road in between Kirkuk and Arbil, Kurdistan Region, Iraq, September 2003. The tanks were imported from southern Iraq.

1. Introduction

The wars in Iraq in 1991 and 2003 have left deep scars on the country and its people. In addition to the devastation wrought by the war with Iran, these wars and the impact of the economic sanctions still echo through Iraq. Since the formal end of the 2003 war, the Iraqi government has been struggling to rebuild its infrastructure, restart its economy and provide long-term solutions to deal with the legacies of the destruction wrought upon the land and its population.

Beyond the thousands of innocent civilians killed or wounded during the wars and the insurgency that followed, the long-term impact on public health and the environment has surfaced as an emerging issue and has been the cause of major concern. One cause of concern is pollution from the use of depleted uranium (DU) weapons by Coalition Forces and other toxics remnants of war generated by the conflict and the instability that followed. In our previous report *In a State of Uncertainty*[1], we outlined the impact and implications of the use of DU munitions. The report demonstrated the use of DU against non-armoured targets and in densely populated areas. As a result, it is likely that civilians were, and continue to be, exposed to toxic and radioactive DU because of the indiscriminate nature of the residues its use generates. Moreover, a lack of transparency from Coalition Forces hampered efforts to assess civilian exposure risks and implement remediation work. The cost for cleaning-up the more than 300 known contaminated sites is estimated to be between US$30-45m, placing a significant burden on the Iraqi government.

[1] Zwijnenburg, W. (2013) In a State of Uncertainty. Impact and implications of the use of depleted uranium in Iraq. PAX, The Netherlands. Accessed at http://www.paxvoorvrede.nl/media/files/in-a-state-of-uncertainty.pdf

A number of important questions remain about the legacy of DU contamination, questions that go to the heart of the debate over the acceptability of DU munitions:

- Coalition Forces were aware of the potential health and environmental impact of DU munitions, yet refrained from undertaking the necessary clean-up of DU outside their own bases.
- With thousands of DU contaminated vehicles left in cities, towns and in rural areas, and thousands of DU munitions in the soil, as no legal obligation to remove this contamination exists, where does responsibility lie for remediation?
- There are clear international standards for dealing with Low and Intermediate Level Radioactive Wastes, such as DU and DU contaminated scrap, yet following conflict, and in the absence of a fully functioning government, how can they be met?
- Iraqi civilians have been forced to live and work in a contaminated environment. Communities and medical professionals have reported an increase in health problems, problems readily associated with exposure to conflict pollutants. What then, has been the impact of the use and inadequate management of DU on both the health and psycho-social wellbeing of Iraqi civilians?

This report will address these questions and demonstrate the complexity involved in cleaning-up DU sites, managing and monitoring military scrap metal sites and the impact it has had on civilians living and working near these sites. More importantly, the report will seek to examine fundamental obligations for clean-up under these circumstances. It will also highlight the need for support from the international community for the Iraqi government and relevant expert organisations to remediate affected areas, as well as seeking ways to stop the further use of these weapons.

1.1 Background

The use of DU munitions in conflict has proved controversial and problems associated with their use have been highlighted by governments, UN agencies, civil society and veterans' groups. Despite laboratory research and testing of DU ammunition by the States that use it, no substantive research has been undertaken on the long-term impact on civilian health and the environment in post-conflict settings, especially in Iraq where more than 440,000kg of DU was fired.

Coalition Forces were aware of the potential health and environmental impact of the use of DU munitions, and while the consequences of its use could be foreseen to a degree, limited data were available on its potential legacy following its widespread use under Iraq's environmental conditions. Moreover, it was expected that Iraq would be responsible for dealing with the clean-up of DU, although as occupying powers after the 2003 invasion, there was a clear obligation to protect the health and wellbeing of Iraqi civilians.

The US and UK armed forces have faced similar problems with monitoring and cleaning-up DU at domestic and foreign bases and ranges. Such operations have cost millions of dollars and have had to follow clear guidelines. Operations have involved soil, air and water sampling; the safe storage and disposal of contaminated materials and soil and the ongoing monitoring of sites. Furthermore, and following the publicity around Gulf War Illness, the UK and US applied stringent precautionary measures to reduce DU exposure risks to their personnel, as did States supporting the US in Iraq, such as the Netherlands, Denmark and Italy[2].

Without a functioning government able to address the complexity of the socio-economic rebuilding of Iraqi society, and without the funding and expertise necessary for implementation, the removal of war remnants, landmines, UXOs, cluster munitions and the safe management of hazardous industrial and military sites was delayed for years after the conflict. This left Iraqi civilians at risk from the hazards of both toxic and explosive remnants of war.

DU contamination was suspected to be widespread, yet there was no control over the export of contaminated scrap. But without detailed information on DU strike sites, quantities and target information, and without equipment or expertise, how could Iraq be expected to undertake even minimal assessments to ensure the protection of its own citizens?

DU users downplay the risks associated with its use, particularly when it comes to civilian exposure risks. Although the UK provided a limited amount of funding for capacity building initiatives undertaken by United Nations Environment Programme (UNEP), the UK and the US refuse to provide critical support and funding for wide-scale clean-up efforts and actively obstruct those organisations seeking to examine the impact of DU on health and environment. The World Health Organisation (WHO) in Iraq wanted to start a full scale investigation in 2003 to assess the health impact of DU, but calls for funding were obstructed in the UN Security Council by the US and the UK. The capacity building work by UNEP was also a slimmed down version of the initial widescale assessment plan, which also faced opposition by the same States.

When the bans on landmines and cluster munitions were achieved, demining organisations and civil society pushed for transparency over the past use of these weapons in order to facilitate clearance. Although not a State Party to these treaties, the US provided targeting data on the use of cluster munitions in Iraq and funded clean-up operations. However, requests for the release of DU targeting data have so far been met with a wall of silence.

Regardless of one's position on DU's potential health impact, radiation protection norms require that sites be assessed and managed and exposure risks be reduced. Iraqi civilians have legitimate concerns, concerns that have been present for decades and which require answering. Pregnant women worry if their newborn babies might be affected. Parents worry about their children growing up in a polluted environment, with few options available to protect them. Whatever age, people associate their health problems with exposure to conflict pollutants. In an age of growing awareness of the impact of conflict on human health and the environment, States and the international community must address the long-term public health legacy of military operations.

[2] Zwijnenburg, W. (2012) Hazard Aware. Lessons learned from military field manuals on depleted uranium and how to move forward for civilian protection norms. PAX. Accessed at http://www.paxvoorvrede.nl/media/files/hazard-aware.pdf

1.2 Aim of the report

To improve the protection of civilians against exposure to DU, it is of paramount importance to rapidly assess and, where necessary, isolate and remediate contaminated sites and military wreckage. This report will assess the extent to which Coalition Forces and the Iraqi government have dealt with the toxic legacy of DU. The main focus will be on the identification of contaminated sites, clean-up efforts and the storage and (re)processing of military scrap metal. The report aims to demonstrate that the use of DU has serious implications for States recovering from armed conflict and for the prevention of environmental and health consequences for civilians resulting from conflict. Concerns over the potential health effects for civilians living and working in or near contaminated sites have been documented and form a crucial part of the debate over the acceptability of DU. The report provides recommendations on how to properly address the complexity of managing and remediating contaminated hotspots, which should form the basis of a rigorous post-conflict environmental and humanitarian-focused clean up-strategy.

The research for this report is based on two field trips to Iraq in November 2013 and January 2014 and data from previous research in Iraq in 2012. During these trips, a number of contaminated scrap metal sites were visited and interviews held with people living and/or working near these sites. Further information was provided during consultations with Iraqi government officials from the Ministry of Environment (MoE) and the Ministry of Science and Technology (MoST) and analysis of open source data from relevant international organisations such as the International Atomic Energy Agency (IAEA), WHO and UNEP, legislation and strategic plans from the Iraqi government and newspaper reports. Additional information on the use of DU was obtained through Freedom of Information (FoI) requests in the Netherlands and the United Kingdom.

1.3 What is DU?

DU is a chemically toxic and radioactive heavy metal that was developed for use in armour-piercing munitions by the US, and later by other States, because of its high density (1.7 times denser than lead). DU is used in kinetic energy penetrators and upon impact DU fragments ignite, creating a secondary incendiary effect inside the armoured target. After the impact, DU dust and fragments will contaminate the target. Those that miss will end up on the ground surface or soils, where they can corrode, potentially polluting groundwater.

Over the last three decades, DU has been used in several conflicts. The US Air Force, operating under NATO auspices, used 12,600kg of DU in the Balkans (Bosnia Herzegovina 1994-95, Serbia and Montenegro and Kosovo 1999). The UK and US are thought to have used at least 440,000kg In Iraq and Kuwait in 1991 and 2003. Though not confirmed, there are indications that DU was also used in Somalia (1992-1993) and Afghanistan (2001-2006) by the US. DU has also been used on firing and testing ranges in Japan, Puerto Rico, Kuwait and Egypt, as well as domestic ranges in the US and UK. Domestic opposition to test ranges has been consistent and vocal. Six States are known to produce DU ammunition and around 20 States are thought to have DU in their arsenals[3].

[3] A list of users and States with DU in their stockpiles can be accessed at http://www.bandepleteduranium.org/en/users

Debate over the health hazards of DU has been ongoing since reports on a possible link between its use and a rise in cancers and congenital birth defects (CBDs) in Iraq began to appear in the mid-90s. Health concerns originated from both Iraqi civilians and US veterans and fuelled international debate over DU's acceptability; DU's use in the Balkans and in the 2003 Iraq War catalysed opposition further.

1.4 Health impact

Inside the body, DU's hazards are its chemical toxicity and radioactivity. DU primarily emits alpha radiation, although beta and gamma are also emitted from uranium's decay products. Inside the body, alpha radiation can disrupt cellular process and damage DNA, which can lead to an increased risk of developing different types of cancer, depending on which organ is exposed. DU is also a heavy metal and therefore chemically toxic. More information on research and reported health effects can be found in the *In a State of Uncertainty* report.

Exposure pathways are crucial for identifying risks to civilians living near or working on scrap metal sites. Contaminated military scrap metal and soils provide a source of exposure for civilians, since DU dust and fragments can be found on, in and around destroyed military equipment. This dust can be inhaled, ingested or enter the body through wounds. Civilian exposure to DU could occur under different circumstances, by picking up penetrators left in the soil or in and around attacked buildings. Children at play and scrap metal collectors and workers risk inhaling or ingesting DU dust when inside or in close proximity to contaminated vehicles.

A number of reports issued by international organisations such as the WHO and the IAEA, as well as military field manuals on DU, have issued warnings on these types of exposure. The WHO states that: *"Young children could receive greater depleted uranium exposure when playing within a conflict zone because of hand-to-mouth activity that could result in high depleted uranium ingestion from contaminated soil. This type of exposure needs to be monitored and necessary preventative measures taken*[4]*"*. The IAEA warned that: *"Dust inside abandoned vehicles which have been hit by DU munitions is not likely to be quickly dissipated, since in most cases there is no effective dispersion mechanism, for example, compared with the effect of wind in open locations. If such vehicles are entered by persons, the contaminated dust will be resuspended by their movements inside the vehicle, and if the persons are not wearing protective masks, the radiation doses received by them due to inhalation could be significant*[5]*."*

Militaries have issued warnings to their troops on how to deal with DU if it is encountered during or after combat operations. Precautionary measures include warnings to cover exposed skin, wear NBC masks to protect the respiratory system, stay upwind from burning or contaminated vehicles, washing hands and dusting off shoes and uniforms and limiting time in contaminated areas. If soldiers are suspected of being exposed, bio samples should be taken so their health

[4] WHO (2001) Depleted uranium: Sources, Exposure and Health Effects.
Accessed at http://www.who.int/ionizing_radiation/pub_meet/en/DU_Eng.pdf

[5] IAEA (2010) Radiological Conditions in Selected Areas of Southern Iraq with Residues of Depleted Uranium.
Accessed at http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1434_web.pdf

Living with contaminated scrap metal

During the fighting in and around Basrah, Coalition Forces used DU against a wide range of targets. On the road from Basrah to Um Qasr, the biggest port in southern Iraq, dozens of tanks, armoured vehicles and trucks were hit by DU during intense battles and airstrikes. Most of the remnants remained there for years, while some were collected and stored in the small towns near the road.

Close to Abu Ghasib is a small village called Abu Flus, which was home to a huge scrap metal collection point. Several sources told us that severe DU contamination was detected at this site. Upon visiting the site, we found that all the military scrap metal had been removed. Some local boys, who had a clear recollection of what had happened, invited us to speak with their family. The father of the household was willing to discuss the site's history and its impact on his family. He had lived there his whole life, and until 2013, the area was full of contaminated military scrap. In 2004, the MoE inspected the site and measured high levels of radiation, and warned the locals not to come close to the site. Despite these warnings, the site was not fenced off, and children from the neighbourhood used it as a playground. Only in mid-2013 did the MoE return to thoroughly clean up the site. After measurements were taken, the contaminated scrap was separated and loaded onto lorries. It was wrapped in canvas and water was sprayed over it to prevent the resuspension of dust during transport to a storage site. The destination was apparently the State Company for Iron and Steel (SCIS) Melting Factory in Al Zubayr. After removal of the contaminated scrap, the MoE then removed the top 50cm of soil from the storage sites, as recommended by international guidelines.

In the years prior to the removal of the scrap, the health of his son had deteriorated with doctors diagnosing him with necrosis in his leg. He grew suspicious over a possible link with exposure to scrap and sent in a formal request to the MoE for financial support. The MoE confirmed that DU was found at the scrap metal site and provided him with 500,000 Iraqi Dinars, about US$440, in compensation. Unfortunately, and after a visit to a Baghdad hospital, doctors informed him that his son's illness required special treatment in Kurdistan. The cost of the treatment far exceeded the amount offered in compensation so he is currently caring for his son at home. Meanwhile, his wife also became ill and required a hysterectomy after doctors discovered a tumour in her womb.

Although it is difficult to say with any certainty whether the family's health problems were related to their exposure to DU or other toxics present at the site, their concerns over the health risks posed by the scrap were very real. Such anxieties demonstrate the necessity of taking swift action to isolate contaminated military scrap and remediate storage or dump sites as a means of reducing civilian exposure risks. ♦

can be monitored to ensure they will get the proper treatment[6]. Needless to say, civilians living or working in contaminated areas do not have access to this information, nor the right equipment to protect themselves from exposure.

In the years following the 1991 Gulf War, Iraqi physicians reported an increase in cancers[7] and CBDs. This led to a request for research on any link between them and DU exposure by the WHO. However, a lack of funding and political pressure prevented the WHO from implementing the programme. The WHO's former director in Iraq, Neel Mani, submitted a proposal to the UN Security Council to fund the health survey, the proposal was rejected by DU user States. He recalls that:

> *"Before the 2003 invasion, the cynicism demonstrated by certain member states of the Security Council towards the post-conflict health conditions in southern Iraq was appalling. Following regime change, the attitude of the Coalition Provisional Authority just added arrogance to the cynicism. The funds from the OFP [Oil for Food Programme] belonged to the Iraqi people, yet the Security Council responded with little alacrity to any attempt to release Iraqi money to finance research into the legacy of conflict on cancer rates in the south. Political sensitivity over the legacy of the use of depleted uranium munitions may have helped catalyse Security Council objections to the research into the public health legacy of the conflict...The people of Iraq, as with all communities caught up in war deserve to know whether environmental contamination from conflict presents a long-term threat to their health. Their governments, and those of the states that contributed to the damage, share an obligation with the international community as a whole in ensuring that the protection of civilians during and after conflict remains paramount.[8]"*

From 2005, the WHO began to invest in improvements to Iraq's cancer registries in order to gather baseline data on cancer rates. Meanwhile, doctors and environmental experts in Basrah began their own study, the Basrah Cancer Research Group (BCRG), to collect, analyse and monitor data on increases of cancers. The outcome of this research[9] was that there had been an increase in various types of cancers, which they sought to account for by several factors, yet the numbers were below the average for other Arab states. The group acknowledged that environmental factors could have played a role but stressed that follow-up research would be needed to clarify the link. An increase in leukaemia and lymphoma was of particular interest for further research. The WHO has also acknowledged concerns over the increase in cancers in Iraq, noting that: *"The number of cancer cases is expected to rise in the future, mainly due to the*

[6] Zwijnenburg, W. (2012) Hazard Aware. Lessons learned from military field manuals on depleted uranium and how to move forward for civilian protection norms. PAX.

[7] Peterson, S. (1999) DU's fallout in Iraq and Kuwait: a rise in illness? The Christian Science Monitor. Accessed at http://www.csmonitor.com/1999/0429/p14s1.html; Chulov, M. (2010) Research links rise in Fallujah birth defects and cancers to US assault The Guardian. Accessed at http://www.guardian.co.uk/world/2010/dec/30/faulluja-birth-defects-iraq; Simpson, J. (2010) Falluja doctors report rise in birth defects. BBC. Accessed at http://news.bbc.co.uk/2/hi/8548707.stm

[8] Neel Mani (2013) Iraq: Politics and Science in Post-Conflict Health Research. Huffington Post. Accessed at http://www.huffingtonpost.co.uk/neel-mani/iraq-politics-and-science_b_4098231.html

[9] Omran S. H., Al-Ali J. K., Al-Wiswasi M K, et al. (2007) Cancer Registration in Basrah 2005; Preliminary Results. Asian Pacific Journal of Cancer Prevention., 8:187-190; Basrah Cancer Research Group (2009). Cancer in Basrah 2005- 2008. Basrah: Dar Alkutub for Press & Publication, University of Basrah.

[10] WHO (2013) Country Cooperation Strategy for WHO and Iraq 2012–2017. Document WHO-EM/PME/004/E/07.13 Pg 9. Accessed at http://applications.emro.who.int/docs/CCS_Iraq_2012_EN_14959.pdf

Iraqi boy in front of military scrap metal dump along the road in Shat'l Arab, southern Iraq, January 2004.

ageing population, widespread tobacco consumption and exposure to environmental hazards[10]."
The other major concern related to DU exposure are CBDs. Anecdotal evidence has suggested for years that there was a sharp increase in southern Iraq and Fallujah. Research based on hospital records from 2011[11], 2012[12] and 2013[13] indicated an increase in the Basrah Governorate and Fallujah, though some researchers have questioned the results, stating that:

> *"As not enough data on pre 1991 Gulf War prevalence of birth defects in Iraq are available, the ranges of birth defects reported in the reviewed studies from Iraq most probably do not provide a clear indication of a possible environmental exposure including DU or other teratogenic agents although the country has faced several environmental challenges since 1980[14]."*

After many years of delay, the WHO and Iraqi Ministry of Health finally initiated a nationwide household survey to determine the prevalence of CBDs. Their preliminary findings were published in September 2013, and concluded that: *"The rates for spontaneous abortion, stillbirths and congenital birth defects found in the study are consistent with or even lower than international*

[11] Alaani et al (2011) Four Polygamous Families with Congenital Birth Defects from Fallujah, Iraq. Int. J. Environ. Res. Public Health 2011, 8, 89-96.

[12] Al Sabbak et al (2012) Metal Contamination and the Epidemic of Congenital Birth Defects in Iraqi Cities Bulletin of Environmental Contamination and Toxicology November 2012, Volume 89, Issue 5, pp 937-944.

[13] Alborz, A. (2013) Environmental characteristics and prevalence of birth defects among children in post-war Iraq: implications for policies on rebuilding the Iraqi education system. In: Medicine, Conflict and Survival, 29:1, 26-44.

[14] 2 Al-Hadithi et al (2012) Birth defects in Iraq and the plausibility of environmental exposure: A review. In: Conflict and Health 2012, 6:3.

estimates. The study provides no clear evidence to suggest an unusually high rate of congenital birth defects in Iraq[15]". However, the study's methodology and opacity was met with severe criticism by experts. British medical journal *The Lancet* consulted peer reviewers of the report and a former WHO scientist, they questioned the methodology used by the WHO, particularly the decision not to include hospital records from areas where doctors have reported an increase in CBDs[16]. The full report and dataset has yet to be published, and Fallujah paediatrician Dr. Alaani has led a worldwide call for full disclosure of the research data in an open access journal. A petition to the WHO and the Iraqi Ministry of Health attracted more than 55,000 signatures[17].

Nevertheless, and despite the absence of a causal link between the health of Iraqi civilians and DU, or studies into exposure rates – both of which have been obstructed by a lack of targeting data, the need to safely manage the legacy of DU in Iraq in accordance with international recommendations remains. The complexity of public health research in unstable post-conflict settings is rarely discussed by DU users, yet it underscores the necessity for precautionary action to counter an established contamination problem.♦

[15] WHO (2013) Congenital birth defect study in Iraq - update 11 September 2013. Accessed at http://www.emro.who.int/images/stories/iraq/documents/Congenital_birth_defects_report.pdf

[16] Webster, Paul C. (2013) Questions raised over Iraq congenital birth defects study. In The Lancet, Volume 382, Issue 9899, Pages 1165 - 1166, 5 October 2013. Accessed at http://www.thelancet.com/journals/lancet/article/PIIS0140-6736(13)61812-7/fulltext

[17] See World Health Organisation and Iraqi Ministry of Health: #Act4Iraq and release birth defect data. Accessed http://www.change.org/en-GB/petitions/world-health-organisation-and-iraqi-ministry-of-health-act4iraq-and-release-birth-defect-data

Scrap metal being recycled by Kurdish workers, Qushtapa, road in between Kirkuk and Arbil, Kurdistan Region, Iraq, September 2003.

The tanks were imported from southern Iraq.

2. Consequences of the use of depleted uranium

Table 1.
Depleted uranium in weapon systems

Weapon systems	Ammunition	Amount of DU in each round
M1 tank	M900 105 mm	3.83 kg
M1A1 tank	M829 / M89A1 120 mm	3.94 kg / 4.64 kg
Challenger tank	L27 120 mm	4.5 kg
A10 Jet	PGU-14 30 mm	302 grams
AV-8B	PGU/20 25 mm	150 grams
AFV Bradley	M919 25 mm	98 grams

2.1 Introduction

The conflicts in 1991 and 2003 left thousands of tanks, armoured vehicles, artillery pieces and trucks destroyed and abandoned on the battlefield, inside urban areas and along roads. The US and UK deployed a range of platforms[18] that utilise DU munitions. DU was used against military armoured vehicles, trucks, unmounted troops and civilian objects such as buildings.

To provide an overview of the scale of DU use and resultant contamination, this chapter will briefly review the information available on locations where DU was used. The scale of contamination varies between weapon systems, depending on the quantity of DU in each ammunition type, the number fired and target characteristics. (See Table 1.)

Tank rounds contain larger quantities of DU; multiple rounds may be used for each target and may leave a more intense contamination footprint on destroyed vehicles and buildings in comparison with the medium calibre munitions. However, the A10 and AV/8 are capable of firing 10s and 100s of rounds during an attack. This can result in a larger contaminated area, since most of the rounds won't hit the target and end up in the soil or in buildings. While the M242 Bushmaster cannon in the Bradley AFV, is more discriminating, it too is capable of firing 200 rounds per minute.

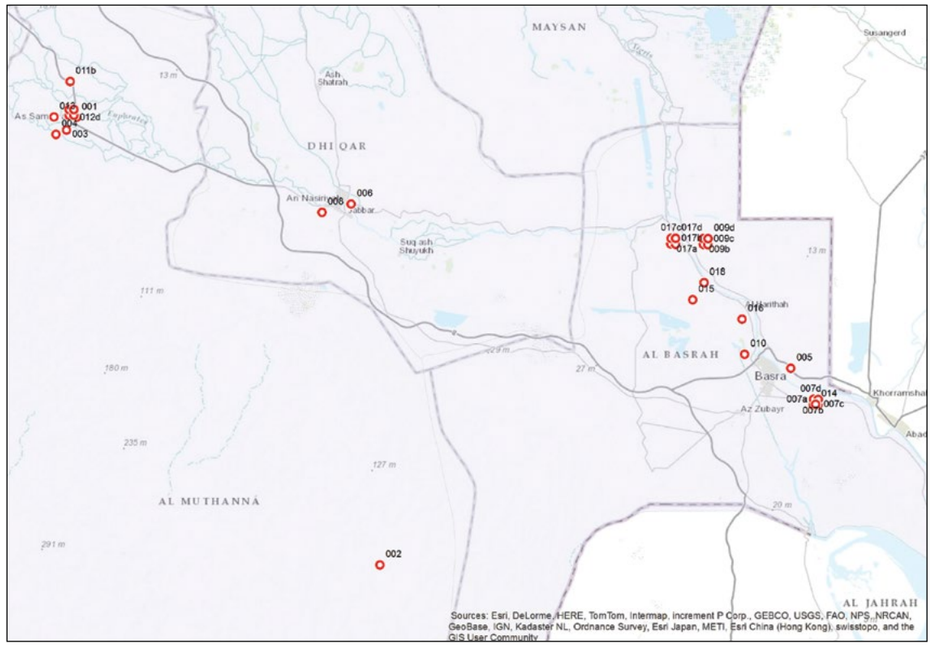
Determining the precise number of military vehicles destroyed in 1991 and 2003 is difficult. However, data available provides an indication of the scale of destruction that take took place during both wars. The figures vary from source to source, and there are few specifics on which weapon system was responsible. According to US Central Command, the Iraqi army lost 3,700 of their 4,280 tanks, 2,400 of their 2,880 armoured personnel carriers and 2,600 of their 3,100 artillery pieces in 1991[19]. Wreckage was subsequently stored in tank graveyards in the Iraqi desert near the Kuwait border and in Kuwait itself. Others were stored at scrap metal sites near Kuwait City, for example at Al Jahrah.

The number of military vehicles destroyed in 2003 is unclear but it seems that a majority of Iraq's remaining military vehicles were destroyed. Most of the battles during the first days of the invasion involved tanks and armoured vehicles and took place in Basrah, Najaf, Kerbala, As Samawah, Nasiriyah and in and around Baghdad. The military remnants were either left in the cities, or stored on sites in or near these cities and surrounding towns, for example on huge scrap metal sites at Ouireej district south of Baghdad, and Taji, north of Baghdad. Other destroyed tanks, APCs and anti-aircraft guns were left in the streets and in rural areas in and around Basrah. This wreckage continued to pose a health hazard for local civilians and took years to be removed and stored in remote locations. Scrap metal storage and management will be discussed in Chapter 3 of this report.

[18] For a full overview of weapon systems that have deployed DU, see the In a State of Uncertainty report.

[19] Number found on http://www.gulflink.osd.mil/timeline/fast_facts.htm, but a specific source for these numbers is not given.

British MoD expert measures a DU contaminated anti-aircraft gun near Basrah.



DU Ammo Location | 1 cm = 13,604 meters. Source: Norwegian People's Aid.

2.2 Update on contamination

Since the publication of the *In a State of Uncertainty* report in March 2013, new information on the location of contaminated sites has been collected. These data provide fresh insight into the scale of contamination caused by attacks on sites in southern Iraq, both by direct attacks as well as contamination from the storage of military scrap metal. The report stated that there are between 300-365 known contaminated sites, all with various levels of contamination. One major step forward in transparency was the release of firing coordinates by the Dutch Ministry of Defence through a FoI request. In 2013, the Dutch army was based in Al Muthanna Governorate as part of the Coalition, and had a small group of trainers stationed in Basrah. Concerns over DU expressed by both Members of Parliament and military personnel resulted in the Dutch MoD providing clear guidelines and precautionary measures for troops in the event that they came across DU during their operations. After a request by the Dutch MoD, the US forces provided them with a list of targets, GPS coordinates and quantities of 30mm rounds fired by the A-10 Warthog, 120mm DU rounds fired by the Abrams M1A1 tank, and 25mm rounds fired by the Bradley AFV. Considering that the A-10s during operation Iraqi Freedom were equipped with a standard combat mix of the PGU-13 High Explosives (HE), and the PGU-14/B Armour Piercing Incendiary (API) DU round, it is to be expected that the amounts given by the US included DU rounds fired.

As can be seen on the map and in Table 2 on page 24 and 25, a considerable number of 25mm, 30mm and 120mm rounds were fired in or near populated areas such as As Samawah, Nasiriyah and Basrah. Of particular note is the fact that DU was fired at troops. This is particularly interesting, as DU was specifically designed as an anti-armour munition, and a legal review by the US Air Force stated that:

> *"For reasons related to the prohibitions against unnecessary suffering and poison, the following specific restriction on use should be adopted for this munition. 'This munition is designed for use against tanks, armoured personnel carriers or other hard objects. Use of this munition solely against personnel is prohibited if alternative weapons are available[20].'"*

While the A-10 can be deployed with both a non-DU HE 30mm payload, or the standard combat mixture of API and HE ammunition, it is not able to switch between ammunition types while in flight. This renders the alternative weapons caveat meaningless in settings where A10's will attack a range of opportunistic targets. The review also expressed concern over the indiscriminate nature of the weapons, particularly when used in urban operations, leading the USAF lawyers to suggest that:

> *"These munitions are incendiary in nature. Accordingly, they may cause fires which spread thereby causing potential risks of disproportionate injury to civilians or damage to civilian objects. Precautions to avoid or minimize such risks shall be taken in the use of this weapon or alternate available weapons should be used[21]."*

[20] US Air Force (1975) Environmental Assessment Depleted Uranium (DU) Armor Penetrating Munitions for the GAU-8 Automatic Cannon, Development and Operational Test and Evaluation, Office of the Air Force Surgeon General (AF/SGPA), April 1975.

[21] ibid

Table 2.
Location of DU strikes in Dutch area of operation

Ser. Nr.	Accuracy	Location MGRS	Location WGS 84 UTM	Nr & type of ammo	Target
001	+/- 200 m	38RNV 276640	38R 0527650 3464050	5 x C792 M1A1 130 x A986 M2	Obj. Chatham Obj. Chatham
002	+/- 200 m	38RPU 345100	38R 0634550 3310050	3 x C792 M1A1 150 x A986 A2	
003	+/- 200 m	38RNV 244596	38R 0524450 3459650	30 x C792 M1A1 450 x A986 M2	
004	+/- 20 m	38RNV 20805819	38R 0520805 3458195	200 x 30 mm A-10	
005	+/- 20 m	38RQU 76808120	38R 0776805 3381205	100 x 30 mm A-10	
006	+/- 20 m	38RPV 22993500	38R 0622995 3435005	150 x 30 mm A-10	AAA
007a 007b 007c 007d	Within boundaries of grid +/- 200 m	38RQU 849686 38RQU 849706 38RQU 865686 38RQU 865706	38R 0784950 3368650 38R 0784950 3370650 38R 0786550 3368650 38R 0786550 3370650	200 x 30 mm A-10	Troops
008	+/- 20 m	38RPV 12953205	38R 0612955 3432055	1170 x 30 mm A-10	Building
009a 009b 009c 009d	Within boundaries of grid +/- 20 m	38RQV 45282319 38RQV 45282519 38RQV 46882319 38RQV 46882519	38R 0745285 3423195 38R 0745285 3425195 38R 0746885 3423195 38R 0746885 3425195	130 x 30 mm A-10 900 x 30 mm A-10	Truck APC
010	+/- 20 m	38RQU 60558557	38R 0760555 3385575	200 x 30 mm A-10	Truck
011a 011b	From To	38RNV 27956451 38RNV 25637632	38R 0527955 3464155 38R 0525635 3476325	600 x 30 mm A-10	Moving trucks
012a 012b 012c 012d	Within boundaries of grid+/- 200 m	38RNV 253647 38RNV 253667 38RNV 269647 38RNV 269667	38R 0525350 3464750 38R 0525350 3466750 38R 0526950 3464750 38R 0526950 3466750	No Data	
013	+/- 20 m	38RNV 20136423	38R 0520135 3464235	1300 x 30 mm A-10	Troops
014	+/- 200 m	38RQU 857689	38R 0785750 3368950	300 x 30 mm A-10	Armor

Table 2. (Continued)
Location of DU strikes in Dutch area of operation

Ser. Nr.	Accuracy	Location MGRS	Location WGS 84 UTM	Nr & type of ammo	Target
015	+/- 200 m	38RQV 420040	38R 0742050 3404050	1000 x 30 mm A-10	Artillery
016	+/- 200 m	38RQU 593977	38R 0759350 3397750	670 x 30 mm A-10 1150 x 30 mm A-10	Armor Depot
017a 017b 017c 017d	Within boundaries of grid +/- 200 m	38RQV 340230 38RQV 356230 38RQV 340250 38RQV 356250	38R 0734050 3423050 38R 0735650 3423050 38R 0734050 3425050 38R 0735650 3425050	1650 x 30 mmA-10	Tanks
018	+/- 200 m	38RQV 458100	38R 0745850 3410050	200 x 30 mm A-10 200 x 30 mm A-10	Tanks APC

A 30mm DU penetrator found in Iraq, 1993.

The data released through FoI indicates that the suggested prohibition against attacks on troops and warnings over DU use in populous urban areas was largely ignored. This has implications for the acceptability of DU munitions use by the A10. Even though the release of this information is a useful first step towards greater transparency, the quantity of 30mm ammunition provided in the document, some 9520 rounds is a fraction of the total of 782,414 rounds fired in 1991, and the more than 300,000 rounds fired in 2003.

New reports by Iraqi researchers and NGOs have also documented contaminated sites in Iraq, and concerns over health problems in these areas. Researchers from Basrah University sampled soil and air on known contaminated sites and scrap metal yards in 2009. The article, *Levels of Radioactivity emitted from some Military Wastes and Urban Soils at Basra City, Southern Iraq,* was published in 2013 [22] and identified 11 sites in and around Basrah, including tanks, anti-aircraft guns, military scrap yards and a radio tower, based on information provided by local researchers. Even though their research included GPS coordinates, the exact locations could not be determined as their equipment was unable to provide eight digit coordinates [23].

The local Radiation Protection Centre (RPC) in Basrah, which is part of the MoE, has also provided an overview of known contaminated sites. This was shared among members of a new commission established by the Prime Minister's office to address concerns over the link between DU and health effects [24]. They list 18 sites in Basrah where samples were taken and DU was found, as well as two in Missan province, 60 in Thi-Qar, and two in Muthanna. However, the GPS coordinates provided in the document were not sufficient to pinpoint the exact coordinates, missing one crucial digit [25]. All the data has been included in a Google Maps overview of DU contamination in Iraq [26].

A number of sources, including firing data provided by the British MoD, UNEP data and data from researchers, both governmental and academic, as a whole, provide an initial overview of known contaminated sites in southern Iraq. Yet it should be noted that there is likely some overlap in sample areas and reported contaminated sites.

The absence of full transparency over firing coordinates and quantities of DU fired continues to severely limit clean-up and remediation operations. The data provided by the Dutch MoD is an important first step towards a necessary overview that will enable researchers and local authorities to address the issue. To what extent there is continued monitoring of soil, water and air samples in and around these sites remains unknown. Previous research by universities has used different sample methods, analysis and techniques, which has implications for harmonising results.

[22] Shukri Al-hassen, Rita Adam, Faris Al-Imarah (2013) Levels of Radioactivity emitted from some Military Wastes and Urban Soils at Basra City, Southern Iraq. In: Basra Studies Journal, VOl.8, No.15 (2013): pp.1-16.

[23] Correspondence with author.

[24] This commission, The Commission on the spread of Cancer Diseases and Other Tasks, was set up in August 2013 by the Ministry of Environment, and was joined by several experts from the Ministry of Science and Technology, the Ministry of Environment, the Ministry of Health, two Members of Parliament, a member of the Prime Minister's office and a non-governmental organisation.

[25] All relevant documents can be accessed on depleted uranium section on http://www.paxforpeace.nl

[26] The overview of DU contaminated sites can be accessed here: http://goo.gl/maps/q3QkN

Scrap metal being recycled by Kurdish workers, Qushtapa, road in between Kirkuk and Arbil, Kurdistan Region, Iraq, September 2003. The tanks were imported from southern Iraq.

2.3 Clearing battlefields and contaminated areas

The decades of war also left Iraq with a legacy of landmines, unexploded ordnance, cluster munitions and other explosive remnants of war (ERW). It is estimated that 1,730 square kilometres of land are contaminated by landmines and unexploded ordnance, impacting the livelihoods and safety of more than 1.6 million Iraqis [27]. Since the end of major hostilities, international humanitarian and commercial demining organisations initiated survey and clearance work around heavily impacted areas, especially around Basrah and Baghdad. US and UK air raids from both the 1991 and 2003 Gulf War resulted in widespread cluster munition contamination, and the fighting between Coalition Forces and the Iraqi army left the battlefield littered with ERW. Moreover, minefields across the country contributed on a daily basis to the rise in civilian casualties, while abandoned ammunition storage places posed serious dangers in terms of ammunition safety, looting and the use of explosives for IEDs.

Prior to the invasion, a set of meetings was organised in Cyprus where a variety of demining organisations, NGOs and the UN Mine Action Service (UNMAS) started laying out plans for setting up a strategy to deal with the range of explosive contamination in Iraq. With lessons learned from the Kosovo War, demining organisations and UNMAS were better prepared to initiate their programme. However, after the start of the conflict, the US sent in civilian experts to discuss the model prepared by this group, and refused to recognise the UN as the head of

[27] Voegel, M. (2008) Iraq Mine and UXO Clearance Organization. Journal of Mine Action. Accessed at http://www.jmu.edu/cisr/journal/12.1/feature/voegel/voegel.shtml

mine action in Iraq. As a result, little data on the weapon types deployed was shared with the coordinated efforts set up by UNMAS and the demining organisations active in Iraq for the first two years after the invasion[28].

Those demining organisations active in the chaotic post-conflict period put most of their emphasis on the clearance of explosive hazards that posed a direct threat to civilians. The technical experts of humanitarian demining organisations had their focus on cluster munitions, and to some extent the clearance of munitions depots, tanks and armoured vehicles. The use of DU in Kosovo and the subsequent clean-up challenges led to improved knowledge among demining experts on DU, which resulted in the International Mine Action Standard Technical Note on DU in 2001, providing information on how to recognise and deal with DU during clearance operations[29]. According to various sources known to the author, demining personnel in Iraq were well informed about how to recognise DU and handle it, or rather to not handle it. A former demining expert active in Baghdad in 2003 explained that they were instructed to mark the area where DU had been found, note the GPS coordinates and provide the data to the US, who were specialised in dealing with DU clearance. No information is available on what the US actually did in terms of clean-up.

Although Coalition Forces and their allies had knowledge about the use of DU during their operations, and therefore could implement precautionary measures, demining organisations often had little information on what type of ammunition was used and to what extent they could expect to run into cross contamination during the course of their work. An initial assessment by the United Nations Development Programme in 2003 outlined the following concerns with DU.

> *"On the 26 March 2003 the US Central Command confirmed that DU was used by Coalition Forces. The following are the potential risks: inhalation of DU at time of the munitions impact, widespread low level contamination of the ground surface by DU, presence of DU penetrators or fragments which may be handled by unprotected individuals, and the possible migration of DU into ground water. DU was reportedly used extensively in Basrah in 1991. Environment assessments and follow on clean up or public awareness campaigns may be required.... Sites and military equipment targeted by DU materials will need special attention and an assessment of the hazards caused by this material should be initiated[30]."*

Most of the demining staff interviewed for this report noted that their main concern was on the explosive hazards of ERW, and although they were aware of DU and how to recognise it, it wasn't considered a high priority for clearance amidst the hundreds of thousands of explosives lying around. The main course of action was to note the location and put up provisional warning signs or inform Coalition Forces about its presence. Current demining operations could still run into cross contamination during the course of battle area clearance, especially at sites where tank battles took place and where A-10 strikes occurred. ♦

[28] According to a source involved in demining operations prior and after the invasion.

[29] GICHD (2013) Clearance of Depleted Uranium (DU)Hazards. Technical Note 09.30 /02 Version 2.0 Amendment 1, July 2013. Accessed at http://www.mineactionstandards.org/fileadmin/user_upload/MAS/documents/technical-notes/TN_09.30_02_2001_Clearance_of_DU_Hazards_V.10_Amd_1_01.pdf

[30] United Nations/ World Bank (2003) Joint Iraq Needs Assessment: Mine Action. Accessed at http://iraq.undg.org/uploads/doc/MINE%20ACTION%20final%20sector%20report%2016%20October.pdf

Scrap metal being recycled by Kurdish workers, Qushtapa, road in between Kirkuk and Arbil, Kurdistan Region, Iraq, September 2003.

The tanks were imported from southern Iraq.

The Unknown DU Factor

Norwegian People's Aid (NPA) established an operational clearance project in Missan Governorate, southern Iraq in January 2013. The Governorate has a severe level of contamination from unexploded ordnance, mines and cluster munitions; the legacy of more than thirty years of conflict. An estimated 5 million landmines were laid along its eastern border with Iran by the Iraqi military alone. The scale of the problem is reflected in the 6000 registered mine/UXO survivors in Maysan.

The full scope of the contamination in the Governorate is still not fully known and so for the last 12 months, NPA have been conducting a Non-Technical Survey (NTS) using three nationally trained teams. To date, 292 communities have been questioned in detail on known or suspected hazards in and around their villages. This equates to about 30% of the Governorate. One of the unknown factors during this NTS has been the locations of DU strikes, specifically from 30mm DU cannon rounds fired from the A-10 Thunderbolt II aircraft.

Above: Missan Governorate highlighted in orange.

The NTS teams have reported that some individuals and communities have expressed general concerns over the subject of DU contaminated areas. Some claim that after the 2003 Gulf War they were warned by "foreigners" to keep away from specific areas and that some destroyed tanks or APC's had been marked with a painted symbol and the locals told to keep away.

The information available to the general public as to where DU ammunition was fired by Coalition Forces in Iraq is scarce and at present, we have no ability to confirm or disprove the presence of DU on some of our planned future clearance tasks. Cross-contamination is one of our biggest concerns and sadly we have very limited knowledge as to the risks related to the exposure of DU and the safety measures we might need to employ for our clearance teams in the field. Nor do we have knowledge about how DU can be discovered, whether a Geiger counter would register contamination, what depth into the ground it could be found, and how the DU rounds deteriorate over time in the soil conditions found in Iraq.

In order to deal with this issue, the first step would be to have a clearer picture of the cross contamination in southern Iraq. This would require the DU firing coordinates to be released by those countries responsible. The data would be shared with the Iraqi government and other stakeholders and inputted in to the national mine action database. This would help provide a clearer picture of DU contamination in relation to communities and existing recorded hazardous areas. Following the data release, we would then need equipment such as radiation detectors, accompanied by a training package for our operational team leaders and managers, so they can safely and accurately sample and record their findings from suspected DU sites.

To remove the problem from Iraq, a detailed clearance strategy will have to be prepared with all stakeholders, funding allocated for the clearance, removal and disposal of the DU found and lastly, regional risk education will have to be provided for local communities to alleviate their concerns. Without the necessary knowledge, equipment and initial training, the planning and selection of NPA's humanitarian clearance tasks is made not only very difficult but potentially hazardous to its employees in the long-term.

Ed Rowe, Programme Manager Humanitarian Disarmament Programme Iraq
Norwegian People's Aid

3. From theory to practice

3.1 Introduction

This chapter will analyse existing practices, guidelines and safety procedures for radioactive waste management, and explore the work by both Coalition Forces and the Iraqi government to clear-up, transport, store and remediate contaminated military scrap metal and sites. The analysis will discuss the complexity of dealing with radioactive (and chemically toxic) DU waste in a post-conflict environment, and demonstrate the burden and responsibilities its management places on States recovering from armed conflict. The huge gap on what **should have been done** and **what has been done** underlines the gulf between policy and practice. The chapter concludes by exploring the concerns of the civilian population in affected areas.

DEFINITIONS

DU, a by-product of uranium enrichment, is categorised by the IAEA as Low Level Radioactive Waste (LLW):

> LLW: Waste that is above clearance levels, but with limited amounts of long lived radionuclides. Such waste requires robust isolation and containment for periods of up to a few hundred years and is suitable for disposal in engineered near surface facilities. This class covers a very broad range of waste. LLW may include short lived radionuclides at higher levels of activity concentration, and also long lived radionuclides, but only at relatively low levels of activity concentration[31].

As the radioactivity of DU can be 75% of natural uranium due to the ingrowth of decay products following enrichment, the term 'slightly less radioactive uranium' has been coined to describe DU[32]. This level of activity classifies solid DU metal as Intermediate Level Waste, which has stricter regulations for storage and disposal:

> ILW: Waste that, because of its content, particularly of long lived radionuclides, requires a greater degree of containment and isolation than that provided by near surface disposal. However, ILW needs no provision, or only limited provision, for heat dissipation during its storage and disposal. ILW may contain long lived radionuclides, in particular, alpha emitting radionuclides that will not decay to a level of activity concentration acceptable for near surface disposal during the time for which institutional controls can be relied upon. Therefore, waste in this class requires disposal at greater depths, of the order of tens of metres to a few hundred metres[33].

Applying these definitions to military DU contamination would typically see contaminated scrap, soils and rubble classified as LLW, while solid penetrators and fragments would be classified as ILW.

3.2 International standards for dealing with radioactive waste

The IAEA's Basic Safety Standards, are exposure guidelines and codes of conduct that establish key principles for regulations governing the management of radioactive materials in order to protect human health and the environment. They accept the Linear No-Threshold Dose principle – i.e. that any exposure to radiation carries with it some risk but aim to provide a framework that allows some civil and medical use of radiation, providing that the societal benefits accrued from any use outweigh the health and environmental costs. The standards are intended to reduce radiation exposures 'to the lowest extent reasonably achievable' and presume that a competent radiation protection authority is in place to ensure their effective implementation. The underlying notion behind the standards is that radioactive materials can be used safely with the correct principles and guidelines in place.

> *"Standards are only effective if they are properly applied in practice. The IAEA's safety services encompass design, siting and engineering safety, operational safety, radiation safety, safe transport of radioactive material and safe management of radioactive waste, as well as governmental organization, regulatory matters and safety culture in organizations[34]."*

[31] IAEA (2009) Classification of Radioactive Waste. IAEA Safety Standards Series No. GSG-1. Vienna.

[32] Weir, D. (2012) Precaution in Practice. Challenging the acceptability of depleted uranium weapons. ICBUW.

[33] IAEA (2009) Classification of Radioactive Waste. IAEA Safety Standards Series No. GSG-1. Vienna.

[34] IAEA (2011) Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards INTERIM EDITION. Pg.

The uncontrolled release of DU into the environment during conflict raises profound questions for these radiation protection norms. States recovering from conflict rarely have effective civil radiation protection architecture in place, moreover any societal benefit associated with the use of DU munitions and the dispersal of radioactive materials lies solely with the militaries that employ the weapons.

DU use creates respirable dusts, shrapnel fragments and contaminated objects and soils. Human exposure can occur through the resuspension of dusts, storing scrap in accessible sites and the reuse and melting of contaminated scrap. DU penetrators can be collected by civilians, and soil contamination can spread to water sources. As the WHO noted in their report to the UN Secretary General on DU in 2008:

> *"The area contaminated with armour, tanks, shrapnel, etc. should be monitored. Where justified and possible, clean-up operations in impact zones should be undertaken if there are substantial numbers of radioactive projectiles remaining and where qualified experts deem contamination levels to be unacceptable. If high concentrations of depleted uranium dust or metal fragments are present, then areas may need to be cordoned off until removal can be accomplished. Such impact sites are likely to contain a variety of hazardous materials, in particular unexploded ordnance. Due consideration needs to be given to all hazards, and the potential hazard from depleted uranium kept in perspective. In general, disposal of depleted uranium should follow appropriate national or international recommendations.*
>
> *"Risk communication campaigns may be needed in the affected areas to educate local populations on potential hazards and risks for their health. This is especially important in areas where scrap metal is collected and melted for sale. This may impose a significant risk to health of people and especially children due to the inhalation of toxic vapours resulting from metal melting. National authorities for the affected post-conflict zones should be advised to take action to control and regulate such activities in local communities[35]."*

Clearly then, prevention of exposure to DU is warranted. And while military DU use is at odds with the core principles of the BSS, the IAEA and others have issued a series of relevant guidelines that could help inform a post-conflict management response. These include guidelines on the transportation, safe storage, recycling and disposal of radioactive materials. Of particular interest are those applicable to DU contaminated scrap metal, which is currently the most visible exposure hazard in Iraq.

At present, limited information is available on the fate of DU penetrators fired by A-10 and AV-8B aircraft and Bradley AFVs, despite the enormous numbers fired during both conflicts. In comparison with DU assessment and clearance activities in the Balkans, which were undertaken by UNEP and the Serbian government and where hundreds of DU rounds were recovered, little data is available on recovered penetrators in Iraq[36]. In Kuwait, DU penetrators were found on the surface of strike sites 10 years after the end of the 1991 Gulf War[37], demonstrating that the movement of sands by wind can lead to buried DU penetrators resurfacing.

The IAEA has established 10 Fundamental Safety Principles[38], which define risks, responsibilities and health protection principles. These principles should guide any future DU management plan, particularly the *principles of responsibility* and the *limitation of risk* to individuals. These principles state that any entity responsible for 'any activity that gives rise to radiation risks... has the prime responsibility for safety' and that 'measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm.' However, as there was no functioning governmental capacity or regulatory body in place in Iraq after the 2003 Gulf War capable of fulfilling these responsibilities, it is hard to see how DU use could be construed as being in accordance with these norms.

The IAEA's *principle of protection of present and future generations* establishes that radiation risks can persist for long periods of time. On radioactive waste it states that:

> *"Radioactive waste must be managed in such a way as to avoid imposing an undue burden on future generations; that is, the generations that produce the waste have to seek and apply safe, practicable and environmentally acceptable solutions for its long term management. The generation of radioactive waste must be kept to the minimum practicable level by means of appropriate design measures and procedures, such as the recycling and reuse of material."*

Other IAEA documents of particular relevance include *The Safety Case and Safety Assessment for the Predisposal Management of Radioactive Waste* (GSG-3), *Control of Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries* (SSG-17) and *Remediation of Areas contaminated by Past activities and Accidents* (WS-R-3). These documents lay out specific guidelines and responsibilities on handling radioactive materials and sources in waste management, for example, GSG-3 provides authorities with clear requirements for the assessment of hazardous waste.

Although action was undertaken to deal with Iraq's nuclear enrichment facilities, such as Al-Tuwaitha and other nuclear decommissioned nuclear reactors, where the looting of barrels of processed 'yellow cake' uranium oxides created a direct threat to public health, the 440,000kg of DU received far less attention.

Without clear legal obligations, where does responsibility lie for the clean-up of DU? The States that use DU argue that responsibility lies with the affected State. Yet from the Balkans to Iraq, affected States have rarely had the capacity, expertise, regulatory frameworks or funding in place to effectively manage DU contamination. From a civilian protection perspective, one could reasonably argue that the responsibility lies with those who choose to deploy the weapons, particularly where they claim the benefits from their use.

[35] World Health Organisation's view on depleted uranium to the Secretary General. Found in: UNGA A/63/170. Effects of the use of armaments and ammunitions containing depleted uranium Report of the Secretary-General. Accessed at http://www.bandepleteduranium.org/en/docs/52.pdf

[36] Cullen, D (2010). A Question of Responsibility: depleted uranium weapons in the Balkans. ICBUW

[37] IAEA (2003) Radiological Conditions in Areas of Kuwait with Residues of Depleted Uranium. Report by an international group of experts. Pg. 23.

[38] IAEA (2006) Fundamental Safety Principles. IAEA Safety Standards Series No. SF-1.

Responsibility aside, it is important that a clear action plan be established to identify, remove, store, and monitor contamination, especially with regard to DU-contaminated scrap metal, in order to prevent the continued exposure of civilians and workers.

IAEA guideline SSG-17 sets out a framework for addressing military scrap. Although DU is not a highly radioactive source [39], but rather a source of radiation, these guidelines can nevertheless function as a tool for dealing with contaminated scrap metal. The IAEA reported concerns over the re-melting of contaminated military scrap metal in their 2010 report on DU in southern Iraq [40]. (See Box 2)

The guide stresses that the regulatory body, which in the case of Iraq would have been the CPA and later the Iraqi government: *'should ensure that during any cleanup or decontamination activities appropriate precautions are taken to protect workers, members of the public and the environment from radiation hazards'* [41]. Contaminated equipment should have warning signs visible while hazardous sites require specific monitoring before being remediated. Importantly, the guide also refers to the provision of information to the public, an issue that will be touched upon later in this report.

Remediation of contaminated sites is crucial for preventing exposure of scrap metal collectors, the public and DU's further dispersal into the environment [42]. Efforts should be undertaken to identify historical temporary scrap metal storage sites and DU strike sites, be they military vehicles or buildings. In the vicinity of military targets struck with medium calibre ammunition, tens to hundreds of DU rounds could still be present in the soil, as the IAEA's Kuwait research demonstrated. Sites in or near populated areas should be prioritised while significant quantities of soil may also need to be removed from sites to prevent the further dispersal of contamination. For storage sites, DU dust may be found near stored vehicles and dispersed during any sub-sequent transport. Therefore the proper assessment of temporary scrap storage and transit sites should be undertaken before they are released for other uses.

DU contaminated vehicles are classified as LLRW by the IAEA and require specific treatment:

> *"If military vehicles which have been hit by DU munitions are reprocessed for scrap, exposure may occur during the various scrap metal handling and treatment processes. For this reason, metal from vehicles hit by DU munitions should not be used as scrap metal unless specially equipped melting facilities are available. Rather, the vehicles should be directly disposed of (i.e. without decontamination) as LLRW* [43]*."*

[39] For a full overview of definitions see: IAEA (2003) Categorization of radioactive sources.
Accessed at http://www-pub.iaea.org/MTCD/publications/PDF/te_1344_web.pdf

[40] IAEA (2010) Radiological Conditions in Selected Areas of Southern Iraq with Residues of Depleted Uranium.
Accessed at http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1434_web.pdf

[41] IAEA (2012) Control of Orphan Sources and Other Radioactive Material in the Metal Recycling and Production Industries.
Specific Safety Guide SSG-17, paragraph 3.25, pg. 20.

[42] IAEA (2011) Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards GSR-3.

[43] IAEA (2010) Radiological Conditions in Selected Areas of Southern Iraq with Residues of Depleted Uranium.
Accessed at http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1434_web.pdf

Box 2. Consideration of the possible hazards associated with the re-melting of scrap metal from dismantled military vehicles

The radiological concern in melting radioactive contaminated metal scrap is that the melting process can create potential exposure pathways. Four main possibilities exist in the melting of ferrous scrap:

(1) The contaminant element can stay in the metal (e.g. cobalt and ruthenium).

(2) The contaminant element can enter the slag (e.g. lanthanides and actinides).

(3) The contaminant element can become associated with the furnace dust and be collected with the fly ash (e.g. caesium).

(4) The contaminant element can pass through all filtration/retention processes to enter the air in the local environment (e.g. iodine) [23]. In the case of uranium, about 95% of it by weight goes into slag and about 5% accompanies the furnace dust or fly ash. Thus, radiation exposure may occur during: the transport of the metal to the melter; the cutting process; the transfer of off-gases to the bag house; the processing of the dust; and the processing of the slag.

For ensuring radiation protection, it is important that the melting facilities are properly equipped so that radiation exposure is minimized. This requires special facilities and equipment that is not likely to be present in normal scrap metal melters. For these reasons, it is not advisable for metal from vehicles hit by DU munitions to be used as scrap metal unless such special facilities are available. In the absence of such facilities, direct disposal as LLRW (without any decontamination) is to be preferred from a radiological perspective, since it is associated with fewer potential exposure pathways.

In reality this would mean burying these vehicles and contaminated parts in designated landfill sites. Procedures by the IAEA, outlined in *Disposal Approaches for Long Lived Low and Intermediate Level Radioactive Waste*[44] provide detailed steps for ensuring that these sites fit the geological and socio economic conditions necessary to ensure health and environmental protection, for example considering soil and rock formations, climatic conditions, and the vicinity of (ground) water sources. Furthermore, it highlights the hazardous mixtures likely to be encountered in wastes, in the case of military scrap metal; this includes PCBs, fuels and asbestos. Specific proposals to safely store contaminated vehicles and soil were proposed by researchers at Lulea University in Sweden during a 2011 workshop, attended by the Iraqi Minister of Environment, Sargon Lazar Slewa, and provide a good starting point for dealing with LLW/ILW from DU contamination[45].

While international radiation protection frameworks can inform post-conflict management practices, many States recovering from conflict are poorly placed to implement these measures. The lack of obligations for dealing with DU ensures that financial and specialist technical support is not available. As a result there remains a significant gap between theory and practice which manifests itself through increased risks of civilian exposure to DU.

As for the use of DU munitions itself, and in light of the principle of justification promoted by the IAEA: *"the standards are also conditional upon a society deciding that the risks from exposure to a radiation source are outweighed by the potential benefits, particularly as the prevailing consensus is that any exposure carries it with it some risk. Civilians living with DU contamination might well struggle to recognise the benefits from its use... So, by almost any measure, international radiation protection norms are at odds with the military use of DU munitions, especially where civilians face exposure and any resulting health impact[46]."*

3.3 Coalition Forces assessments and remediation efforts

Having established how DU contamination should have been dealt with, efforts by the US and UK army, the CPA and the Iraqi government to remove and store contaminated scrap metal and remediate sites will now be reviewed. The occupying forces had the knowledge, expertise and to a certain extent, the capacity to locate, remove and safely store DU munitions and contaminated military remnants. As occupying powers they also had an obligation to protect Iraqi civilians from the humanitarian consequences of the invasion. Some of these approaches undertaken could be instrumental in defining which course of action is to be undertaken on a practical and political level regarding clean-up, risk education, as well as addressing the issue with DU contamination on a wider international level.

As concern over the health risks of DU intensified amongst veterans after the 1991 Gulf War, the US and the UK sought to increase awareness raising and monitoring of troops. Precautionary guidelines were introduced to inform troops about the health risk when encountering vehicles struck by DU, as well as safety procedures for clean-up[47].

[44] IAEA (2009) Disposal Approaches for Long Lived Low and Intermediate Level Radioactive Waste. IAEA Nuclear Energy Series No. NW-T-1.20

[45] A full overview of the papers presented on this subject can be found at http://www.ltu.se/research/subjects/Geotechnical-engineering/Konferenser/Landfillworkshop-2011/Papers

[46] Weir, D. (2012) Precaution in Practice. Challenging the acceptability of depleted uranium weapons. ICBUW. Pg. 14-15.

Concerns over DU were also present among other Coalition partners. The Dutch army conducted support operations in the aftermath of the conflict in Al Muthanna province, and provided additional training support in Basrah. Concerns over the use of DU and possible exposure led to a request to the US CENTCOM, which in turned provided the Dutch with a limited amount of firing coordinates. The Dutch base in As Samawah was regularly checked for radiation levels and other hazards such as asbestos[48] and awareness sheets were distributed among troops. On one occasion, a contaminated T-62 tank was encountered at a train station in As Samawah. Measurements showed that the tank was indeed hit by DU. The area was sealed off and troops involved in the incident were monitored for 10 days[49].

Another incident involved a 30mm round that resurfaced during in situ destruction of UXOs, which turned out to be a DU round and was subsequently removed by US specialists. It is notable that there was a difference of opinion between the Dutch EOD experts and the general position of the army regarding the hazards of DU, as revealed by a confidential document obtained under FoI. The EOD staff stressed that that DU ammunition and remnants needed to be cleared from the battlefield, arguing that it presented a hazard for both military personal and civilians. However, troops were instructed only to mark the locations of DU ammunition, and that clearance could only be done by a designated contractor. In the meantime, the DU would remain a hazard for the local population, therefore the EOD proposed to at least remove it, in order to prevent further exposure. As DU was labelled as LLRW, this would require more efforts by the Dutch army to provide safe storage facilities before a specialised contractor could collect and dispose it in a proper way. The individual highlighting this problem urged the Dutch Central Command to make a decision. The outcome of the conversation was not provided[50].

3.4 Clean-up in southern Iraq

The southern part of Iraq fell under the responsibility of the UK until the Iraqi Interim Government was formed on June 28th, 2004. Disquiet over the use of DU had triggered debate in the UK, and the British Royal Society was tasked with reviewing the scientific literature on DU. Their final recommendations stressed the need for environmental assessment and remediation of DU strike sites:

> *"Large amounts of DU are introduced into the environment during military conflicts where DU munitions are deployed. Initially this results in exposure of the local inhabitants to DU by inhalation of deposited particles of DU oxides that have been resuspended into the air from soil. Contamination of soil and plants by DU particles will also result in contamination of food and surface waters, and contaminated soil can be ingested inadvertently by infants and children. In the longer term these particles will be removed from the upper layers of the soil, and the environmental movement of soluble*

[47] Ministerie van Defensie (2004). Rapportage A&A Bezoek HPG. 1 (NL) CONTCO SFIR 3; Rapportage Ioniserende Straling Al Khdir Camp Al Mokhajem El Salaam. NLBG SFIR3. Available on www.paxforpeace.nl

[48] Internal MoD documents. Documents available on www.paxforpeace.nl

[49] Ministerie van Defensie (2003) Nota Overzicht Asbest en verarmd uranium incidenten tijdens SFIR. April 7, 2004. Document obtained through FoI request.

[50] Internal Confidential Communication, Letter to the Deputy Staff CONTCO, August 5, 2005. Subject: Nederlands policy omtrent DU. 13 (NL)BG SFIR 4/2004/NBC 001.

uranium from these particles, and from the corrosion of buried DU penetrators, could lead to contamination of local water supplies[51]*."*

The report called for the clean-up of DU penetrators and contaminated soil. In a stark example of how little was known about DU's potential risks, even as it was being deployed in 2003, the UK MoD viewed Iraq as a research opportunity: *"the availability of DU impacted vehicles in the UK Area of Operations offered a unique opportunity to address the identified data gaps and obtain additional information to support assessments of the potential risks from the combat use of DU munitions*[52]*."*

The MoD initiated a survey on four contaminated tanks and one anti-aircraft gun in and near Basrah city, where they took smear, air and soil samples from targets probably hit by 105mm or 120mm rounds. The researchers noted that *"The operational requirement is to prevent the equipment from being re-used and protect the local civilian population who place themselves at risk of death or injury by "cannibalising" damaged vehicles which present risks from booby-traps, unexploded ordnance and other health and safety hazards. By the time of the visit in June 2003, the majority of such vehicles had been removed to a number of storage locations and so it was not normally possible to identify the precise geographical location where a target had been hit."* The survey demonstrated the importance of rigorously assessing vehicles before removal to a safe storage facility.

The extent to which further clean-up operations were carried out by the UK remains unclear. Repeated requests for information by the UK Campaign Against Depleted Uranium were met with claims that no information was recorded or could be found in the archives. However three UK vehicles contaminated in friendly fire incidents were shipped back to the UK and are currently stored at the Eskmeals firing range in Cumbria[53]. Levels of DU in the damaged Challenger 2 tank were far higher than anticipated and it is unclear what their eventual fate will be.

Accounts by mine action staff revealed that in Missan Province, more than 200 30mm DU rounds were found and handed over to a UK base, and the UK distributed general information on the dangers of UXOs and damaged vehicles[54]. According to a local Iraqi official in Basrah, the British were aware of the contaminated tanks in Abu Ghasib in 2003 but refused to move the scrap metal from residential areas, saying that specialist equipment was needed to collect, transport and store the military scrap. Only in 2013 did the Iraqi Radiation Protection Centre remove the contaminated scrap[55]. Although the British MoD acknowledged a 'moral obligation' to clean up DU[56], this did not result in a substantial effort to identify, clean-up or monitor DU contaminated sites.

[51] The Royal Society Institute (2002) The health hazards of depleted uranium munitions: Part II. Accessed at http://royalsociety.org/uploadedFiles/Royal_Society_Content/policy/publications/2002/9954.pdf

[52] Smith, D. (2003) Radiological Assessment of Depleted Uranium Impact Locations in Iraq.

[53] Request "DU contaminated vehicle disposal". Found at https://www.whatdotheyknow.com/request/du_contaminated_vehicle_disposal#incoming-284522

[54] See: In a State of Uncertainty, pg. 30.

[55] Interview with the Director of the NGO Directorate of the Basrah Governorate, November 24, 2013.

[56] BBC News (2003) UK to aid Iraq DU removal. April 23, 2003. Accessed at http://news.bbc.co.uk/1/hi/sci/tech/2970503.stm.

An Iraqi tank destroyed with DU being examined by British MoD/DSTL experts, near Basrah airport, 2003.

A further FoI request revealed that the British Forces EOD Desk Divisional Engineering Group distributed a procedure[57] among Dutch, Danish and Italian troops and the Regional Mine Action Centre. The procedure provides contact details and guidelines for the disposal of DU ammunition, stating that DU 'requires specialist disposal'. The clean-up operations for DU were outsourced to the US Army Contaminated Equipment Retrograde Team (ACERT), who specialise in the clean-up of toxic and radiological substances.

The full extent of ACERT's operations in Iraq is unclear. But they were involved in the clean-up of DU contaminated vehicles and DU ammunition and were active on a Kuwaiti firing range that was used for training prior to the 2003 invasion:

"Metcalf and his team reconned Udari Range #8, in preparation of removing 120mm depleted uranium (DU) rounds and 30mm "penetrators." Because of training requirements, clean-up was postponed until Oct. 2003. The ACERT submitted clean-up requirements, provided support cost estimates and prepared work plans. ACERT conducted battle damage assessment, surveying vehicles, including tanks, twice for radioactive contamination. A vehicle collection point was established so contaminated equipment could be shipped to the U.S. to be disposed of. Metcalf said unexploded rounds could just be picked up; it was the exploded rounds that "crapped stuff up," as he put it[58]*."*

[57] MND(SE) Procedure For The Disposal of Depleted Uranium Ammunition. EO Desk Divisional Engineering Group. Headquarters Multinational Division (South East). Available on www.paxforpeace.nl

[58] The Iowa Militiamen, Fall 2003. Accessed at http://www.iowanationalguard.com/Militiaman/2003%20Fall.pdf

Interestingly, this shows that indeed, work was undertaken in removing DU penetrators in preparation for building Army bases. The US was inclined to focus mostly on their own contaminated equipment, as concerns amongst troops were of prime importance. The question of civilian protection through rigorous assessment and remediation seems to fell on deaf ears. Only if material could be used for 'dirty bombs' (unlikely in the case of DU), was immediate clean-up executed.

According to the US Army, ACERT *"performed radiation surveys of 259 vehicles and aircraft last year alone. This included 147 Bradley fighting vehicles, 107 Abrams tanks and five OH-58 Kiowa helicopters*[59]*."* No mention was made of the assessment or management of contaminated Iraqi vehicles. When suspicious material was encountered, a set of regulations for dealing with radioactive contaminated equipment were implemented, which laid out a clear set of responsibilities and procedures[60] to protect US soldiers against exposure to radiation.

Evidently Coalition Forces were aware of the potential hazards resulting from DU use, and instigated efforts to protect their own troops from exposure by removing contaminated tanks and DU munitions from military compounds, is part of standard clean-up practices relating to DU contamination. Yet, no accounts of clean-up in civilian areas have so far been found, nor is it likely that they would have been implemented on a scale necessary scale to avoid civilian exposure in the aftermath of the conflict.

3.5 Regulating and managing scrap

After the end of major hostilities in 2003, the CPA was confronted with the problem of managing the remnants of war. Aside from the ammunition storage facilities and abandoned munitions that could be used for IEDs, there was little control over industrial sites, resulting in the looting of chemical and nuclear materials from factories and research laboratories. This serious threat to health and the environment was highlighted by UNEP's Environmental 'Hot Spot's' report, as was the collection, management and monitoring of contaminated military scrap metal[61].

The use and trade in scrap metal was a major source of income for many Iraqis, struggling to survive in a broken economy. The US commander in Iraq, General Petraeus, estimated that Iraq's scrap metal market was worth US$16bn[62] with US$75m needed to clean it up. The Ministry of Industry and Minerals, which was responsible for scrap metal, had insufficient funding for this and instead chose to privatise the market. In the meantime, export of scrap to neighbouring countries led to new problems, as contaminated scrap found its way into smelters in Jordan, halting imports from Iraq[63]. The *New York Times* reported that: *"radiation detectors at Iraq's borders had repeatedly picked up generally weak radioactive emissions from deep within loads of scrap,"*[64] at the Jordanian, Lebanese, Kuwaiti and Turkish borders. Not only tanks, but also electronics from surface-to-air missiles and other type of military equipment was found between the hundreds of truckloads that arrived in Jordan on a daily basis. In India, even in, 2014, explosives were found amongst 443 tons of imported Iraqi scrap[65].

The CPA took notice of these concerns and attempted to regulate the trade in scrap metal in coordination with the Iraqi provisional government. This resulted in draft guidelines for the export of scrap metal in February 2004[66]. The guidelines sought to establish licensed scrap exporters and registered dealers. The new law placed severe restrictions on the export of scrap metal in order to halt exports of hazardous materials from Iraq's booming scrap metal market. However, Iraq's scrap collectors and exporters sought ways to circumvent the regulations, on the basis that: *"There's so much money in scrap*[67]*"*. Unfortunately, the presence of hazardous substances in military scrap was of less concern to scrap dealers and the authorities, leaving workers and civilians at risk of exposure.

At the time, the CPA were supporting the Iraqi government in capacity building to set up an Iraqi Radiological Source Regulatory Agency, that would oversee operations in the event that radioactive sources were encountered. The US DoD was mostly concerned about highly radioactive sources from decommissioned nuclear facilities, research and medical laboratories, concluding that: *"In June 2004, DOD removed about 1,000 of the 1,400 radiological sources collected in Iraq and sent them to the United States for disposal. DOD left in place approximately 700 additional sources that it had judged were adequately secured and being used properly by Iraqis. According to DOD and Department of State officials, however, the total number of radiological sources in Iraq remains unknown*[68]*."*

In southern Iraq, concerns were mounting among Iraqi officials and experts over contaminated military remnants. In 2004, UN news reports reported concerns in southern Iraq. Dr. Vartanian, one of the RPCs experts on radiation said: *"According to local residents, the area was a military target during the 1991 Gulf war and again in 2003, when it came under heavy fire from US aircraft. Wartanian took a radiation reading of 0.6 mR/h on one tank and 0.5mR/h on the other. "This is 1,000 times more radioactive than average background radiation," the researcher said. He also checked radiation levels in nearby residential areas and found they were worryingly high. In the home of Abdel-Zahra Shindy, a resident living near the polluted site, he took a reading of 0.2 mR/h-0.3 mR/h, compared with normal levels of 0.008R/h*[69]*".*

The absence of swift action by the government to clean-up contaminated debris in populated areas was criticised by experts but the lack of security in the 2004-2007 period, funding, equipment and the crucial target coordinates prevented the local authorities from undertaking the necessary operations. A MoE employee said: *"Local residents, unaware of the radiation danger, cut scrap metals from DU-polluted tanks and sell them...scrap metal plants may also*

[59] Brown, M. (2008) Got contamination' Call the ACERT. Accessed at http://www.army.mil/article/8292/Got_contamination__039___Call_the_ACERT/

[60] US Army (2002) Management of Equipment Contaminated with Depleted Uranium or Radioactive Commodities. Army Regulation 700-48. Accessed at http://www.apd.army.mil/jw2/xmldemo/r700_48/main.asp#p01-5

[61] UNEP (2005) Assessment of Environmental 'Hot Spots' in Iraq. Accessed at http://postconflict.unep.ch/publications/Iraq_ESA.pdf

[62] Woodward, B. (2008) The War Within: A Secret White House History, 2006-2008. Simon & Schuster.

[63] Haaretz (2004) Jordan denies entry to Iraqi trailers carrying contaminated scrap metal. May 28, 2004.

[64] Glanz, J. (2004) The Struggle for Iraq: the new looting; In Jordan's Scrapyards, Signs of a Looted Iraq. New York Times, May 28, 2004.

[65] The Times of India (2014) Imported scrap: Old explosives of 2004 Iraq war kept as scrap adds to police work. February 20, 2014.

[66] CPA (2004) Draft Guidelines for the Export of Scrap metal. Accessed at http://govinfo.library.unt.edu/cpa-iraq/pressreleases/20040301_scrap_metal.html

[67] Shiskin, P. (2007) With Much of Iraq Turned Into Scrap, A Market Heats Up. he Wallstreet Journal, November 23, 2007.

[68] GAO (2005) Radiological Resources in Iraq: DOD Should Evaluate Its Source Recovery Effort and Apply Lessons Learned to Future Recovery Missions. Report to Congressional Committees. GAO-05-672 Government Accountability Office.

[69] IRINNews (2004) Iraq: High Levels of radioactive pollutions seen in the South. Basrah, 18 November 2004.

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Iraqi men recover metal parts from a T-55 Soviet-made tank in a wreckage dump on the outskirts of Baghdad, May 25, 2003. The vehicles brought here were destroyed when U.S.-led strikes used depleted uranium shells against tanks and other armoured vehicles.

have released contaminants from destroyed military vehicles". Even with the new law on scrap exports in place, questions were raised over its enforcement given the lawlessness in Iraq [70].

In a meeting with the US embassy in 2006, the local director of the MoE, expressed: *'anxiety of the lack of monitoring of the military debris in the [Basrah] area'* [71]. Fortunately, UNEP succeeded in acquiring funding for DU work in Iraq in 2005 and began preparing the urgent assessment work. This resulted in a range of workshops [72] for staff of the RPC on sampling and monitoring of contaminated soil and scrap, which also provided the RPC with more monitoring and reporting capabilities. However, the deteriorating security situation prevented UNEP providing training in Iraq, hence Iraqi employees were trained in Geneva and Jordan. From 2007 onwards, a limited number of RPC staff started reporting on the sampling of hazardous scrap and sites in the Basrah region.

Reporting on the assessment and monitoring of contaminated scrap and sites became part of the MoE's annual environmental reports. The MoE's focus was on providing licenses to certified dealers, surveying suspected contaminated scrap metal sites, and bombed sites where the presence of DU was suspected, as well taking soil samples for analysis [73]. As the MoE noted in its 2006 report:

> *"One of these important problems is the problem of depleted uranium contamination, as this subject greatly resonates with the local, regional and international arena and due to the importance of having an accurate scientific assessment for this problem, away from all the speculations, and due to the scarcity of technical and financial capabilities, this problem needs the international support from organisations [74]."*

The support given by UNEP resulted in improvements in the RPC's capacity for analysis and monitoring. In 2007, a special focus was put on Thi-Qar Province, where the RPC pursued the following aims:

- To determine the site of contamination through conducting radiation survey.
- To take measurements through radioactive survey for the contaminated areas, which were determined before, and documenting all the readings.
- To monitor the decontamination process by the responsible institution and to give the required recommendations for this by offering the necessary precautions for radiation prevention to minimise the spreading of the contamination to larger areas.
- To monitor the process of moving the contaminated vehicles (the scrap) which have been determined, sorted, and isolated by the centre. Also making sure of the existence of all radioactive prevention conditions in the transportation process.
- To determine the contaminated areas of the soil from which the vehicles are moved which were not determined before due to the difficulty in reaching them because of the random collection of the scrap over a wide area. This done by radiation survey and defining the places using wooden wedges.
- To monitor the decontamination process for the defined areas.
- To conduct radiation surveys after the decontamination process of the defined areas and issuing a decision on whether the measured results are within the allowed ranges and giving the required directions of how it works and what necessary steps should be followed for applying the means of radiation prevention [75].

The outcome, scale and costs of the programme are not available.

Other annual environmental reports prior to 2012 were not available at the time of writing. However the impact of hazardous waste on health and the environment was highlighted in Iraq's Ministry of Planning National Development Strategy 2010-2014. This reported an absence of sufficient means to properly assess the impact of conflicts on the environment, which: *"has led to clear and tangible pollution of all environmental elements, namely, air, water, and soil. This has been compounded by use of banned weapons in wars, particularly radioactive uranium, as well as bombing and destruction of military installations"*. In relation to solid waste disposal, the plan noted:

> *"Lack of technical facilities dedicated to transport, storage, processing, burying, and burning hazardous waste in provinces. Indeed, according to reports from provinces, hazardous waste has accumulated in Iraq in places not intended for storage or at sites where it remains for many years, waiting to find successful solutions for disposal. This creates significant health and environmental risks that lead to polluted air, soil, and water...The pollution of all environmental elements, especially in major cities, and the absence of comprehensive monitoring, control, and follow-up systems that can precisely determine the reality of environmental damage, including radioactive contamination [76]."*

Similar concerns were also voiced by the UN Development Assistance Framework for Iraq 2011-2014. It focused on the mitigation of environmental issues, highlighting the devastating effect of the Iraq War on health and the environment:

> *"Other man-made disasters include depleted uranium, sulphur dioxide release from sulphur stockpiles, air and surface water contamination from oil spills and fires, and landmines and other remnants of war that threaten the safety of communities and impede the productive use of arable lands [77]."*

[70] ibid.

[71] Wikileaks Cable (2006) Environmental Issues In Basrah. Accessed at http://www.cablegatesearch.net/cable.php?id=06BASRAH107

[72] UNEP (2007) Technical Report on Capacity Building for the Assessment of Depleted Uranium in Iraq.

[73] The sampling execsise was undertaken in cooperation with UNEP, and the results formed the bases for the IAEA 2010 Iraq report.

[74] Ministry of Environment (2006) Annual Report State of the Environment in Iraq. Chapter 8 (translated).

[75] Ministry of Environment (2007) Annual Report State of environment in Iraq, Chapter 7 (translated).

[76] Ministry of Planning (2010) National Development Plan 2010-2014. Accessed at http://planipolis.iiep.unesco.org/upload/Iraq/Iraq_National_Development_Plan_2010-2014.pdf

[77] UNDAF (2010) United Nations Development Assistance Framework for Iraq 2011-2014. Accessed at http://planipolis.iiep.unesco.org/upload/Iraq/Iraq_UNDAF_2011-2014.pdf

In 2013, the Iraqi government, in cooperation with UNEP, UNDP and WHO, published the National Environmental Strategy and Action Plan for Iraq [78] (NESAPI). This plan includes a strategic analysis of the environmental sector, focusing on both man-made and natural causes of environmental pollution and outlines strategic objectives across a range of environmental pollution and degradation issues. It addresses issues such as population growth, desertification, urbanisation, the lack of environmental awareness and the impact of wars on the environment. With regard to the latter, the MoE clearly recognises the problems associated with hazardous conflict waste management and *"seeks to develop solid and hazardous waste management and assess the pollution of former military manufacturing sites and conflict zones, especially the remnants of weapons contaminated with depleted uranium."*

The NESAPI's ambitions are set high, and based on their strategic objectives, will require vast amounts of funding, capacity and expertise to undertake all the assessments, clean-up, storage and monitoring of both the environment and the affected populations in contaminated areas. Components I to V of strategic objective VIII cover *Knowledge and Communication Management, Radioactively Contaminated Areas, Transfer of Radioactive Materials and Wastes, Depleted Uranium and Radioactive Contamination and Contingency Plans.* (See Box 3.)

However, when it comes to a concrete action strategy to fulfil the set strategic goals under the 'Programs, Performance, Indicators and Projects' summarised at the end the NESAPI report, no projects are mentioned that deal with DU-related contamination problems. Of the 10 strategic goals, and the identified sub-programmes, the DU issue is the only programme that lacks any planned activities. While other planned projects under components I to III, and V, are likely to cover some activities relating to DU, the overall DU focus remains unclear. Similar references can be found in the Ministry of Planning's National Development Plan 2013-2017 [80]. (See Box 4 on page 50.)

In January 2014, the Iraqi government, with the support of UNEP and UNDP, published their annual *'The State of Environment and Outlook Report'* promoted as a landmark agreement between UNEP and the Iraqi government that 'aims to speed up recovery and support peace-building'. The report noted the impact of war on health and the environment, stating that: *"Years of conflict and violence resulted in chemical pollution and unexploded ordnances, which is affecting the safety and lives of an estimated 1.6 million Iraqis* [81]. Although that number mainly refers to the victims of UXOs, landmines and cluster munitions, there are serious concerns over the long-term impact of environmental pollution on the health of Iraqi civilians, ranging from access to clean drinking water, the collapse of waste management, and exposure to a range of chemical pollutants:

[78] Ministry of Environment (2013) The National Environmental Strategy and Action Plan for Iraq (2013 – 2017). Accessed at http://www.mop.gov.iq/mop/resources/IT/pdf/789.pdf

[80] Ministry of Planning (2013) National Development Plan 2013-2017. Baghad, January 2013. Pg. 321. Accessed at http://www.mop.gov.iq/mop/resources/IT/pdf/789.pdf

[81] UNEP (2014) Landmark Agreement Sets in Motion Action to Restore Iraq's Environment as New Study Outlines Magnitude of Deterioration. Accessed at http://www.rona.unep.org/documents/news/Landmark%20Agreement%20Sets%20in%20Motion%20Action%20to%20Restore%20Iraq.pdf

Box 3.

Goal Eight: Limiting Radiation Pollution
Means of achieving the goal:

- Building a database on sources of radiation in Iraq.
- Training programs for technical teams responsible for radiation surveys, investigation, evaluation, and methods of protecting against radiation.
- Evaluating and monitoring the radiation pollution situation, especially depleted uranium.
- Determining landfill sites and treating radioactive waste and developing suitable technology for such.
- Issuing and updating legislation on the regulation of radioactive waste treatment.
- Approving a principal of granting licenses to control movement of sources of radiation.
- Establishing national radiation environmental determinants based on global determinants.

> *"Iraq's wars have resulted in a large number of remnants (scrap) such as tanks, armoured vehicles and other military materiel remnants, some of them contaminated with radiation. There are no accurate statistics about the quantity of these remnants and they are dealt with by isolating in special locations such as quarries far from residential areas, this after measuring the level of radiation till the means of dealing with the scrap is determined by the relevant ministry...War remnants that have been destroyed by missiles containing depleted uranium cause health problems for the residents of affected areas. The Radiation Protection Centre indicates that there are 47 sites contaminated with radiation, some of them are close to residential areas* [82]*."*

Of these 47 scrap metal sites, 74% are located in the Basrah Governorate, the other sites are in the Thi-Qar, Missan, Al Anbar, Al Muthanna and Ninewa Governorates. The MoE claim that they are struggling to address this issue because of a lack of capacity and equipment among regional authorities. They specifically mention that radioactive contamination remains a challenge. The MoE claims to have surveyed 500,000 tons of scrap and found 1250 tons to be contaminated. Concrete actions to deal with this contaminated scrap are absent from the report.

DU has been on the agenda of the Iraqi government and UN agencies since 2004. This has resulted in limited capacity building work for the RPC in the monitoring and clean-up of contaminated areas. Key environmental problems resulting from the war and their likely impact on

[82] Ministry of Environment (2014) The State of Environment and Outlook Report. Pg. 140-141 (Arabic only). Link to the report can be found at http://www.unep.org/newscentre/Default.aspx?DocumentID=2758&ArticleID=10701&l=en

Box 4.

Component II: Radioactively contaminated areas İssues and proposed solutions

1. Evaluating and monitoring radioactively contaminated locations

İt's necessary to regularly and intensively conduct surveys of contaminated locations and testing samples of soil, water and grass to measure radioactivity, collect information and map locations contaminated with depleted uranium or any other isotope depending on the international navigation system.

2. İdentifying radioactive waste landfills and treatment locations

İt's crucial to identify proper landfills and treatment locations; develop relevant technology; promote public awareness and participation to handle radioactive waste, especially the military equipment or scrap iron; and update the related legislations to organize treatment operations.

Component III: Transfer of radioactive materials and wastes İssues and proposed solutions

1. Licensing

Movement of radiation sources inside İraq should be controlled by licensing the radiation sources' disposal activities and following up proper channels during the process to prevent any possible radioactive leak.

2. Technical systems and control system over border crossings

Control over border crossings should be increased to reduce logistic and technical problems, and it's necessary to secure technical equipment and devices and highly trained cadres to ensure the effectiveness of the radioactive materials control system.

3. Monitoring of individual exposure

Radioactive materials are of multiuse; thus, it requires monitoring the individual exposure of those working in the radiation field through providing protection requirements while observing scientific and basic rules and highlighting the importance of conducting medical tests to follow-up future effects.

Component IV: Depleted uranium

İssues and proposed solutions

1. Radioactive surveying of contaminated areas

Some areas were hit by depleted uranium shells; therefore, the principle of integrated radioactive surveying of affected areas and vehicles should be adopted while designing special mechanisms to identify these sites.

2. Removing radioactive contamination from affected vehicles and areas

Radioactive contamination with depleted uranium should be removed from affected vehicles and areas using modern techniques and technologies, and specialized technical and engineering cadres should be trained to conduct similar operations. This shall be combined with maximum utilization of CSOs and media in addition to specialized environmental awareness and information regarding the risks of tampering with those vehicles or presence within those sites.

Component V: Radioactive contamination contingency plans

İssues and proposed solutions

1. Setting radioactive determinants

Cases of radioactive contamination are hard to evaluate due to lack of national radioactive environmental determinants and dependence only on international determinants as a legislative reference to identify infringements and ways to address them[79].

[79] Ministry of Environment (2013) The National Environmental Strategy and Action Plan for Iraq (2013 – 2017)

health and the environment have been identified. However, there are serious concerns over the government's long-term commitments and ability to resolve these issues, in part due to a lack of funding, capacity and competing priorities.

3.6 Local DU management and clean-up practices

To gain a clearer understanding of scrap metal management practices on the local level, the author visited Iraq in November 2013 and January 2014 to interview governmental and academic experts, NGOs, residents living near scrap and DU strike sites and to visit a number of the scrap metal storage facilities. During field trips in 2012 for the *In a State of Uncertainty* report, the author identified numerous sites with contaminated military remnants. During 2013, utilising local contacts, a number of other sites were identified and visited.

Current practices are a useful means of exploring the complexities that will be involved in the eventual delivery of the outcomes proposed by the Iraqi government. During 2012's visit to the State Company for Iron and Steel (SCIS) Melting Factory near Al Zuybair in southern Iraq, tens of contaminated tanks and parts were located outside the official storage areas. They were fenced off with little more than low hanging barbed wire, and marked as contaminated. Scrap metal collectors were nevertheless still stripping parts and components from the tank remnants. However, by November 2013, all the scrap had been removed from the site, which was now a solid waste dump, littered with household waste and oil pollution. The scrap had likely been moved to the nearby SCIS factory.

This SCIS melting factory, built with a capacity for processing 440,000 tons of metal per year, was recently reopened as part of a US$700m deal between the Ministry of Industry and Minerals (MIM) and the Turkish company United Brothers Holding. The goal is to upgrade to a 1.2m tons capacity in 2016[83]. However, due to regional political disagreement, the plans are currently on hold[84]. The SCIS has been a collecting site for industrial, household and military scrap. A 2008 report by the Iraqi MIM states that there are currently more than 100,000 tons of steel scrap present at the site[85].

Thousands of destroyed or scrapped military vehicles are stored in an area adjecent to the SCIS, sealed off with a 3 metre deep canal and a 3 metre high sand barrier. Local residents had been warned not to enter the premises 'or they would get cancer'[86]. However, looters still enter the area to strip vehicles of parts and components. According to factory staff, 17 employees were diagnosed with cancers, two of whom had leukaemia, and expressed concern over the presence of contaminated materials. However, they mentioned that it became standard practice at the factory to check all the scrap for contamination before it enters. If radiation is detected, the scrap is taken to a storage site in the desert in Al Muthanna province and buried in the ground[87].

[83] Iraq Business News (2013) Details of $700m Upgrade to Basra Steel Plant. Accessed at http://www.iraq-businessnews.com/tag/state-company-for-iron-and-steel-scis/

[84] Iraq Business News (2013) Basra Steel Plans "on Hold". Accessed at http://www.iraq-businessnews.com/2013/09/12/basra-steel-plans-on-hold/

[85] MIM (2008) Industrial Investment Opportunities in Iraq. Accessed at http://www.oecd.org/mena/investment/39989879.pdf

[86] Local residents received this warning from the MoE employees when they inspected the site.

[87] Interview with employees at the SCIS plant, November 25, 2013.

A vast metal scrap yard is seen from a Royal Navy Sea King Helicopter over the Umm Qasr area of southern Iraq, March 29, 2003.

In principle, the MoST is responsible for dealing with radioactive contaminated materials. During a meeting with MoST experts in Basrah, it was noted that there are serious problems with the management and monitoring of contaminated scrap metal sites. At the moment, they lack the equipment to measure contamination due to budget constraints, which hinders the highly needed operations to control scrap for radiation. More importantly, there is a lack of oversight on scrap metal sites and military scrap near or in villages remained accessible to civilians for years after the war ended. Tanks were sold for US$400 to local scrap metal dealers, and reportedly, civilians took scrap and stored it or used parts as building materials in their houses. Several incidents were reported where military scrap was removed from scrap metal sites without the necessary permits. One of the challenges mentioned was the difference in controls between government controlled and commercial scrap metal sites, as the latter often lack any oversight for procedures to detect contaminated scrap. Worryingly, they stated that they have little idea of what happens with the scrap and to their knowledge, none of the commercial scrap metal dealers are using any form of preventive procedures during collection and processing of scrap metal, which continues to be standard practice upon today.

The MoST have registered 22 scrap metal sites in Basrah, four within the city, a couple in the Rumaila oil fields area, and a large military scrap metal dump in the desert near the Kuwait-Saudi border, which stores most of the contaminated scrap from the Gulf War. The experts were confident that all the contaminated scrap had been removed from Basrah city, but that a considerable amount of military scrap can be found in villages and in rural areas, which has less priority for removal as it is less visible[88].

The US Army funded a major scrap clean-up operation in Iraq in 2010 in Basrah, collecting more than 6000 tons from the city centre. They reported that they scanned the scrap for radiation but could not detect any elevated levels[89]. However, the MoST experts stated that during the CPA period, the US and UK cooperated with a number of ministries on the clean-up of all kinds of hazardous materials and research, but made clear to the MoST that they should not publicise any information on contamination, so as avoid fear of radiation among civilians. In addition, when the MoE warned that some sites in Basrah that were prepared for a housing project were known to be contaminated, the government decided to ignore these warnings and continued with the project[90].

Little is known about the fate of contaminated military remnants in Iraq. UNEP reported on one of the largest known scrap metal sites in their *Environmental ´Hot Spots´* report. Ouireej is located near Baghdad, and UNEP specifically warned about the hazards of DU. Other sources mention dozens of scrap metal sites in the governorates of Diyala, Babylon, Wasit, Missan and Muthanna. In total, Iraqi researchers have identified 143 contaminated scrap metal sites. A full overview of concerns around the clean-up of these sites can be found in the *In a State of Uncertainty* report. It bears repeating however, that experts highlighted the difficulties in assessing the scale of contamination, and that the absence of firing coordinates, funding and equipment seriously impaired the necessary remediation work.

It is difficult for relevant Iraqi ministries to maintain full oversight and implement policies for the protection of workers and civilians. A lack of clear responsibilities, sufficient funding and capacity for the ministries involved in the identification, clean-up and monitoring of contaminated scrap hinders the safe management of contaminated scrap metal. As a result, scrap continues to be exported and re-used by dealers and civilians.

Does this resemble the safe storage, management, monitoring and transport procedures for LLW as set out in the IAEA's guidelines? Hardly. Or does this merely demonstrate the complexities experienced by States recovering from armed conflict in overseeing a near impossible task of controlling the legacy of the use of DU munitions?

[88] Interview with four experts of the Ministry of Science and Technology, January 20, 2014.

[89] US Army (2010) Scrap project beautifies Basra. Accessed at http://www.army.mil/article/37224/Scrap_project_beautifies_Basra/

[90] Interview with NGO directorate, Basrah, November 24, 2013.

DU contamination in Hamdan district

Former DU contaminated scrap metal site still littered with UXOs, Hamdan District, Basrah. November 2013

Hamdan district is an industrial area a few kilometres outside Basrah. The area hosts car workshops, stone carvers, a grain mill and numerous small entrepreneurs who process all kinds of materials. On the outskirts of the district, a solid waste dump had been used to store a wide range of industrial and military scrap. Research by RPC radiation expert Dr. Vartianian in 2005 had located contaminated tanks on the roadside on the outskirts of the district. It is likely that these had been transported to the scrap metal site. As part of a German TV documentary on DU in 2013, Vartanian took the reporters to the Hamdan area, and measured high levels of radiation on the tank remnants stored at the site. Today, most of the military scrap has been removed but the area is still littered with small calibre anti-aircraft munitions, rocket parts, empty 81mm and 50mm mortar rounds and artillery shells. Our measurements with a Geiger counter did not pick up elevated levels of radiation.

We met with a number of residents who had been working in the area for years. One worker from a marble workshop mentioned that the military scrap had been stored there since 2003. During the last few years a Kurdish company had visited the site and scanned the scrap metal for contamination, collecting scrap that was considered clean. Local people have been spotted collecting spare parts from vehicles and removing parts of tank turrets and tracks. According to one of his colleagues the turrets are popular as they can be used for grinding wheat. The workers jokingly asked if they could be measured with the Geiger counter in order to see if they were contaminated. The US Army reportedly visited the site in 2012 to collect UXOs and rockets, which were also stored at the site

Another worker from a shop adjacent to the site had witnessed the MoE collecting the scrap metal. Wearing hazard suits, masks and gloves they had measured the contamination and marked hotspots with white paint. Later, the scrap was loaded onto trucks and reportedly taken to the SCIS in Al Zubayr. Apparently, no soil was removed, nor were the local residents informed about the risks. ♦

Children playing on scrap metal tanks, Qushtapa, road in between Kirkuk and Arbil, Kurdistan Region, Iraq, September 2003. The tanks were imported from southern Iraq.

4. Conclusions

More than two decades after the first use of DU in Iraq, contaminated scrap metal remains a burden for the Iraqi government. In the aftermath of the conflict, thousands of military and civilian objects hit with DU presented a risk of exposure for the civilian population. Despite the fact that Coalition Forces were in possession of targeting data and the necessary expertise to remediate affected sites, potentially limiting civilian exposure, they chose to limit their clean-up to their own bases. Iraq's slow progress in building up governmental capacity, research capabilities and in locating sufficient funding for the effective post-conflict management of a range of explosive and toxic hazards, demonstrates the complexity of dealing with DU in post-conflict settings.

The situation in Iraq further underlines that, in spite of the existence of international standards for dealing with radioactive materials, post-conflict settings present a challenge to their implementation. Fulfilling radiation protection norms requires equipment, technical capacity and a range of competent institutions. Crippled by wars and facing competing humanitarian priorities, States recovering from armed conflict are rarely able to fulfil these standards.

Furthermore, the question of where responsibility lies for DU clearance needs to be answered. DU users together with their Coalition partners, had a responsibility to provide all the necessary information and support to reduce civilian exposure risks. However, based on the information retrieved, a picture emerges where priority was given to their own troops, in spite of these States being fully aware of the risks associated with DU exposure. It took years before the Iraqi government was able to start assessing hotspots of contamination and set in motion limited clean-up efforts. Even then, these were often hindered by the lack of information on DU strikes and the funding necessary to remediate affected sites and safely store contaminated soils and military scrap.

The deteriorating health situation in Iraq has aggravated concerns among civilians over the health and environmental impact of DU. Propaganda by the Saddam regime, combined with the knowledge that they live in a polluted environment, where military remnants remind them on a daily basis of the effects of the war, has also helped to increase anxiety among Iraqi civilians. The visibility of the DU issue, and conflict pollution as a whole, creates the conditions where potential DU exposure is linked to the growing number of birth defects and other health problems. Yet the lack of comprehensive health and environmental monitoring make it impossible to determine the extent of any link. Such justified concerns over environmental pollution and its link to health problems are not particular to DU but they do reinforce the need to ensure an adequate response for affected communities, such as the clean-up of suspected sites, risk education and health monitoring.

Proponents of DU would argue that these are economically costly operations for a risk that has not been clearly defined. But the reality is that the use of toxic and radioactive substances in a widespread, uncontrolled manner and in densely populated or rural, agricultural areas will result in risks to civilians. These risks will vary depending on the characteristics of each location and this makes generalised statements difficult to justify. The stark contrast between peacetime and civil management of DU and its irresponsible military use during conflict further underscores its fundamental unacceptability.

Key findings

1. **Poor post-conflict management of DU contaminated scrap metal:** Coalition Forces were reluctant to extend their clean-up operations beyond their own bases, or to share information on DU with the Iraqi government. Despite having crucial data on quantities of DU fired, target coordinates and efforts undertaken to clean-up, store and transport DU munitions and DU contaminated vehicles, DU clearance received little or no attention after the end of major hostilities, thereby extending civilians' risk of exposure for more than a decade.

   Together with the Iraqi government's limited technical capacity and low prioritisation of the problem, this has led to the ineffective management of DU contaminated scrap. These factors have significantly increased the likelihood of civilian exposure to DU and led to contaminated scrap being exported to neighbouring countries. Improper management and monitoring of scrap metal collection sites also increased the likelihood of exposure to DU dust, fragments and contaminated soil. An absence of clear regulations and oversight for scrap metal storage sites has resulted in the exposure of workers and scrap metal collectors. DU destroyed tanks and other military wreckage continued to pose a threat to the health of civilians after being left in city centres, towns and villages, where local people stripped them for valuable parts and children used them as playgrounds.

2. **International regulations for dealing with radioactive waste were not applied to DU:** International regulations that provide guidelines on how DU, which can be labelled as Low, or Intermediate Level Radioactive Waste, should be dealt with, were not applied in Iraq. These regulations are crucial for reducing exposure to sources of radiation. International radiation protection standards

assume that any exposure carries with it some risk but are a payoff based on the societal benefits the use of radiation should provide. They are also contingent on there being an effective system of radiation protection in place. This is rarely the case in chaotic post-conflict environments and Iraq's civilians may struggle to appreciate the benefits of DU use.

International norms establish that the responsibility for mitigating the impact of radioactive releases lies with the polluter, yet the lack of clear obligations relating to the use of DU weapons has allowed the US and UK to abrogate this responsibility. Safe storage, monitoring and disposal mechanisms should have been implemented, yet failed to be part of the work undertaken by either the Coalition Provisional Authority or the Iraqi government.

3. **Long-term strategy for clean-up and remediation:** In spite of repeated assessments by UN agencies and calls for support, no long-term strategy was devised to address the issue of the identification and removal of contaminated scrap, or the monitoring of scrap metal sites and other affected areas. Even before the 2003 Iraq War, the potential impact of DU on health and the environment had been raised by UN agencies, most notably the WHO and UNEP.

   A lack of sufficient funding, combined with political ambiguity around the issue, has hampered the necessary clean-up. Humanitarian demining organisations, local branches of the Ministry of Environment and the Ministry of Science and Technology, as well as local civil society groups are currently assessing the full impact of DU.

4. **Civilian concerns over DU are mounting:** Civilians living near contaminated sites, workers on scrap metal sites, Iraqi doctors and researchers have repeatedly voiced their concerns over the potential effects of DU on health and the environment. Clearly, the knowledge that there might be toxic and radioactive substances present in the soil you live on, the air you breathe and the water you drink, affects the wellbeing of communities. Hospital reports indicate that environmental pollution due to the wars continues to impact the health and wellbeing of civilians in Iraq, yet little work is being done to address this. Though a lack of data on the current extent of contamination makes it difficult to make clear statements over the risks involved, these concerns are there, and must be addressed.♦

DU contaminated tank parts on a dump site near the SCIS factory in Al Zubayr. October 2012.

5. Recommendations

Tank cemetery with DU contaminated tanks, Al-Zubayr.

Preventing the exposure of civilians, workers, demining personnel and soldiers to DU contaminated vehicles and materials should form the basis of post-conflict DU response. The identification, remediation, transport, and safe storage of DU contaminated scrap requires considerable expertise, capacity and funding, as well as the close cooperation of governmental bodies.

Most importantly, transparency over the use of DU is needed to be able to identify locations where DU has been used, in order to instigate assessments. The following recommendations to both the international community and the Iraqi government would improve the safety of both civilians and workers on and near DU contaminated sites.

- Full transparency by DU user states over GPS coordinates of firing data, target data, quantities and types of DU ammunition fired.
- Transparency over any historical work undertaken to clean-up DU ammunition and contaminated military scrap by Coalition Forces and any subsequent awareness-raising work.
- Assistance from the international community for affected States in building capacity and expertise of relevant governmental bodies for conducting assessment and remediation operations.
- The immediate removal, safe transport and safe storage of contaminated military scrap metal from populated areas, in line with international guidelines for LLRW/ILRW management.
- Affected State authorities should produce historical maps of scrap metal sites, train and equip local workers to measure radiation and provide personal protection equipment.
- The identification and construction of safe landfill sites where contaminated scrap metal can be stored in line with international guidelines.
- The health monitoring of populations and workers living and working on or near DU contaminated sites.
- The monitoring of soil, water and air in populated areas where DU contamination is suspected.

6. Civilian-centered strategies for post-conflict DU management

Following the use of depleted uranium contamination may be present in and around vehicles, buildings and infrastructure. Surface contamination may comprise of dusts, fragments and intact penetrators. Air launched DU rounds will lead to subsurface soil contamination.

Assessment: users should rapidly transfer detailed quantitative and geographic firing data to key stakeholders including government entities, demining organisations and authorities and civil society. Affected areas should be rapidly assessed in order to ascertain the likelihood of civilian harm at each target location. Results should inform an action plan to prioritise clean-up.

Clean up: programmes should be developed in cooperation with experts for the safe removal and long-term storage or contaminated soils and materials. The international community should assist where necessary to ensure sufficient capacity and funding is in place to complete the work. Local communities should be engaged before, during and after projects

Marking: Areas where DU has been used should be marked and secured to reduce public exposure until remediation can take place.

Monitoring: Long term monitoring of soils, water and biological indicators such as vegetation and milk should be undertaken to gather data on the environmental behaviour of DU under different conditions. Civilians at high risk should be offered effective urine testing for DU.

Awareness-raising: Communities in areas with DU contamination should be informed about the potential risks from DU, with particular focus on high risk groups such as scrap metal collectors and children.

Scrap metal being recycled by Kurdish workers, Qushtapa,
road in between Kirkuk and Arbil, Kurdistan Region, Iraq,
September 2003. The tanks were imported from southern Iraq.

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