

THE LEGALITY OF DEPLETED URANIUM MUNITIONS UNDER INTERNATIONAL HUMANITARIAN LAW

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This paper examines the legality of the use of depleted uranium ('DU') munitions under international humanitarian law. It will do so by first providing an overview of the substance 'depleted uranium' and explaining how and why this substance is used in munitions. It will also explore the proliferation of these munitions and the armed conflicts in which they have been used. Following the overview of DU munitions, this paper will further explore the environmental and health consequences of the use of DU munitions in armed conflicts. Utilising this information, this paper will consider the legality of DU munitions under international humanitarian law. Ultimately, this paper argues that although it is becoming increasingly clear that the use of DU munitions in armed conflicts may have environmental and health implications, DU munitions are nonetheless legal under international humanitarian law. Their use may, however, be restricted by the 'precautionary principle'. This paper further argues that a regulatory treaty should be developed in order to minimise the environmental and health risks of DU munitions and clarify their legal position.

I INTRODUCTION

Since their first major use in the Gulf War, depleted uranium ('DU') munitions have been hailed as a masterpiece of military technology. The unique properties of DU enable DU munitions to pierce tanks, armoured vehicles and bunkers with unprecedented efficiency. However, concerns have been raised about possible adverse environmental and health effects caused by the use of DU munitions in armed conflicts. This has led to academic and political debate over the legality of these weapons under international law and in particular, international humanitarian law ('IHL'). This paper seeks to analyse the legality of the use of DU munitions under IHL.

Ultimately, this paper argues that although it is becoming increasingly clear that the use of DU munitions in armed conflicts may have environmental and health implications, DU munitions are nonetheless legal under IHL. Their use may, however, be restricted by the 'precautionary principle'. This paper further argues that a regulatory treaty should be developed in order to minimise the environmental and health risks of DU munitions and clarify their legal position. In order to demonstrate this thesis, this paper will first provide an overview of the substance known as depleted uranium, and explore how and why this substance is used in munitions. The proliferation of DU munitions and their use in armed conflicts will also be explored. Following this overview of DU munitions, this paper will investigate the competing views on the environmental and health effects of DU munitions, followed by an analysis of the legality of DU munitions under IHL. Finally, this paper will conclude with a proposed regulatory framework for DU munitions.

II DEPLETED URANIUM MUNITIONS

A What is Depleted Uranium?

Naturally occurring uranium consists of three main radioactive isotopes: uranium 238 (U-238), uranium 235 (U-235), and uranium 234 (U-234).¹ These three radioactive isotopes respectively comprise 99.27%, 0.72% and 0.0054% of the mass of naturally occurring uranium.² When naturally occurring uranium is enriched for use in

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¹ Nuclear Policy Research Institute, *Depleted Uranium: Scientific Basis for Assessing Risk* (2003) 4.

² World Health Organization, *Depleted Uranium: Sources, Exposure and Health Effects*, UN Doc WHO/SDE/PHE/01.1 (April 2001) 3.

nuclear fuel rods and nuclear weapons, the enrichment process leaves a by-product known as depleted uranium.³ DU is 'depleted' because it is largely comprised of the less radioactive and non-fissionable isotopes of uranium (99.8% U-238).⁴ DU is approximately 60% as radioactive as naturally occurring uranium, but it is nonetheless a toxic heavy metal.⁵ DU is very dense (65% denser than lead), has a high melting point, and is highly pyrophoric (it ignites spontaneously in air).⁶

B *How and Why is Depleted Uranium Used in Munitions?*

DU has a number of civilian applications, including use in drilling equipment for the petroleum industry, ballast in commercial aircraft, and radiation shields for radiotherapy units.⁷ However, beyond these civilian applications, DU also has military applications in both munitions and tank armour.⁸ Whilst there are health and environmental concerns about the use of DU in tank armour, this paper will only concern itself with the legality of DU munitions under IHL.

DU munitions are armour-piercing shells designed to destroy tanks and armoured vehicles, as well as reinforced bunkers.⁹ They are not equipped with an explosive charge like other shells; rather, they pierce the target and create fires through the pyrophoric release of heat energy.¹⁰ These fires are likely to cremate the occupants of the targeted object from the inside, or in the case of armoured vehicles and tanks, ignite the fuel tanks and create an explosion.¹¹ They come in two main forms: 1) a traditional armour-piercing shell with a DU cone encased in aluminium (or some other light metal); and 2) a kinetic energy penetrator ('KEP')¹² with a penetrator made from DU.¹³ These weapons can be employed through a number of weapons systems, including tanks, ships, and aircraft.¹⁴

The military utility of using DU in munitions is threefold. Firstly, as DU has a greater density in comparison to other metals such as tungsten, steel or lead (all commonly used in munitions), it is able to penetrate deeper and cause more damage than other armour-piercing shells.¹⁵ This is because DU's higher density equates to a greater mass for the same volume of substance (when compared to an alternative substance). This greater mass will produce a greater amount of kinetic energy prior to impact and as a result, hit a target with a greater force.¹⁶ Secondly, DU is used in munitions as it is pyrophoric. As DU munitions are pyrophoric, the tip of the shell will begin to burn in the air and on impact.¹⁷ This burning allows DU munitions to self-sharpen through the air and on impact, and ensures that DU munitions are able to pierce targets effectively.¹⁸ It also allows DU munitions to burn through armour and spark fires within the target.¹⁹ Finally, DU is used in munitions as it is inexpensive and abundant. Countries that use DU munitions usually have nuclear energy programs, and will therefore have an abundant supply of low-cost (often free) DU to use in munitions.²⁰ Additionally, the use of DU in munitions helps governments minimise the difficult public policy issue of nuclear waste management.²¹

³ Jason A Beckett, 'Interim Legality: A Mistaken Assumption? – An Analysis of Depleted Uranium Munitions under Contemporary International Humanitarian Law' (2004) 3(1) *Chinese Journal of International Law* 43, 47.

⁴ Owen Thomas Gibbons, 'Uses and Effects of Depleted Uranium Munitions: Towards a Moratorium on Use' (2004) 7 *Yearbook of International Humanitarian Law* 191, 194.

⁵ *Ibid* 195.

⁶ Dan Fahey, 'Depleted Uranium and its Use in Weapons' in Avril McDonald, Jann K Kleffner and Brigit Toebes (eds), *Depleted Uranium Weapons and International Law: A Precautionary Approach* (T M C Asser Press, 2008) 3, 4.

⁷ Nuclear Policy Research Institute, above n 1, 5-6; Robert Thompson, 'Radioactive Warfare: Depleted Uranium Weapons, the Environment, and International Law' (2006) 36(6) *Environmental Law Reporter* 10474, 10475.

⁸ Fahey, 'Depleted Uranium and its Use in Weapons', above n 6, 5.

⁹ Avril McDonald, 'Depleted Uranium Weapons: The Next Target for Disarmament?' (2008) 3 *Disarmament Forum* 17, 17.

¹⁰ *Ibid*; Ifesinachi Okafor-Yarwood, 'Use of Depleted Uranium Weapons in Contemporary Military Interventions' (2014) 2(1) *Asian Journal of Peacebuilding* 111, 113.

¹¹ McDonald, 'Depleted Uranium Weapons', above n 9, 17; Okafor-Yarwood, above n 10, 113.

¹² Kinetic energy penetrators somewhat resemble a dart and are a type of armour-piercing shell. The 'penetrator' is a metallic rod running through core of the KEP, and is the first part of the KEP to hit the target.

¹³ Gibbons, above n 4, 196; Karen Hulme, 'Radiation Warfare: A Review of the Legality of Depleted Uranium Weaponry' (2005) 43 *Canadian Yearbook of International Law* 197, 207-10.

¹⁴ Hulme, above n 13, 207-10.

¹⁵ Nuclear Policy Research Institute, above n 1, 6; Hulme, above n 13, 206.

¹⁶ Hulme, above n 13, 206.

¹⁷ Nuclear Policy Research Institute, above n 1, 6.

¹⁸ Hulme, above n 13, 206.

¹⁹ *Ibid* 207.

²⁰ Nuclear Policy Research Institute, above n 1, 6; Okafor-Yarwood, above n 10, 113.

²¹ Hulme, above n 13, 207.

C Proliferation of Depleted Uranium Munitions

There are an estimated 1.2 million tonnes of DU available to states that produce or use nuclear energy.²² However, the number of DU munitions worldwide and the number of states that have DU munitions in their arsenals is unknown.²³ It is estimated that at least 15–20 states possess DU munitions, though this number could be as high as 40.²⁴ Known possessors include the permanent five members of the United Nations Security Council (United States, United Kingdom, Russia, China and France), as well as other states such as Turkey, Israel, Pakistan and Saudi Arabia.²⁵

D Use of Depleted Uranium Munitions in Armed Conflicts

The first recorded use of DU munitions in an armed conflict occurred in 1985, when the Israeli Navy fired DU munitions at a boat of Palestinian commandos off the coast of Israel.²⁶ However, the first major use of DU munitions occurred in the 1991 Gulf War. In that conflict, between 260 and 320 tonnes of DU were fired in munitions by US and UK forces.²⁷ DU munitions gained notoriety after this conflict, with accusations that they caused ‘Gulf War Syndrome’²⁸ in Coalition troops.²⁹ However, no causal link has ever been established between DU munitions and Gulf War Syndrome.³⁰ In the Bosnian War, NATO forces fired an estimated 3.2–3.3 tonnes of DU³¹; whilst in the Kosovo War, NATO forces fired an estimated 9–11 tonnes of DU.³² In the 21st century, DU use statistics are less clear. It is unknown whether NATO used DU munitions in the 2001 War in Afghanistan. Aircraft and armoured vehicles capable of firing DU munitions were used by NATO forces in Afghanistan, but there is no evidence to show that DU munitions were used.³³ With regard to the 2003 Iraq War, at least 100 tonnes of DU were fired during the 2003 invasion, though that number could be as high as 2000.³⁴ The amount of DU used after the initial invasion through to the end of the war in 2011 remains unclear.³⁵

III ENVIRONMENTAL AND HEALTH EFFECTS OF DEPLETED URANIUM MUNITIONS

A Environmental Effects of Depleted Uranium Munitions

Over the course of an armed conflict, DU can enter the environment in three different ways. Firstly, DU can enter the environment through the release of DU dust. When a DU penetrator hits its target, around 20% of the penetrator will aerosolise on impact.³⁶

This creates DU dust that contaminates the impact site and can spread to the wider environment.³⁷ Secondly, DU can enter the environment through the corrosion of DU munitions and fragments buried in the earth.³⁸ Finally, DU can also enter the environment through munitions fires.³⁹

Once released into the environment, DU has the capacity to contaminate air, soil and water. In the case of air contamination, most airborne DU dust created on impact with a target is likely to reach ground level within

²² Okafor-Yarwood, above n 10, 112.

²³ Hulme, above n 13, 204.

²⁴ Fahey, ‘Depleted Uranium and its Use in Weapons’, above n 6, 8-9; Jeffrey S Morton, ‘Depleted Uranium Munitions: Legal Analysis of a Threat to Human Security’ (2006) 2(1) *Australasian Journal of Human Security* 19, 21.

²⁵ Fahey, ‘Depleted Uranium and its Use in Weapons’, above n 6, 8-9; Morton, above n 24, 21; Hulme, above n 13, 204; International Coalition to Ban Uranium Weapons, *Users* (2014) <<http://www.bandepleteduranium.org/en/users>>.

²⁶ Fahey, ‘Depleted Uranium and its Use in Weapons’, above n 6, 12.

²⁷ Gibbons, above n 4, 197; Thompson, above n 7, 10476; Fahey, above n 6, 13; Rob White, ‘Depleted Uranium, State Crime and the Politics of Knowing’ (2008) 12(1) *Theoretical Criminology* 31, 34.

²⁸ Gulf War Syndrome is a chronic multi-symptom illness affecting a number of Gulf War Veterans. Its causes remain unknown.

²⁹ Lesley Wexler, ‘Limiting the Precautionary Principle: Weapons Regulation in the Face of Scientific Uncertainty’ (2006) 39(2) *University of California Davis Law Review* 459, 511.

³⁰ *Ibid.*

³¹ Thompson, above n 7, 10476; Fahey, above n 6, 13; Nuclear Policy Research Institute, above n 1, 9.

³² Thompson, above n 7, 10476; Fahey, above n 6, 13; Nuclear Policy Research Institute, above n 1, 9; White, above n 27, 34.

³³ Fahey, ‘Depleted Uranium and its Use in Weapons’, above n 6, 19-20; Nuclear Policy Research Institute, above n 1, 9.

³⁴ Fahey, ‘Depleted Uranium and its Use in Weapons’, above n 6, 21; Nuclear Policy Research Institute, above n 1, 9; White, above n 27, 34.

³⁵ Fahey, ‘Depleted Uranium and its Use in Weapons’, above n 6, 23.

³⁶ Dan Fahey, ‘Environmental and Health Consequences of the Use of Depleted Uranium Munitions’ in McDonald, Kleffner and Toebes (eds), above n 6, 29, 30-3.

³⁷ *Ibid.*

³⁸ Wexler, above n 29, 470-1; Thompson, above n 7, 10476; United Nations Environment Programme, *Depleted Uranium in Serbia and Montenegro: Post-Conflict Environmental Assessment in the Federal Republic of Yugoslavia* (2002) 16.

³⁹ Fahey, ‘Environmental and Health Consequences’, above n 36, 32-3.

200–500 metres of impact.⁴⁰ Conversely, airborne DU created from munitions fires can spread up to two kilometres from the site of the fire before falling to the ground.⁴¹ In both situations, this DU can be resuspended in the air through wind or human activity.⁴² Post-conflict studies by the United Nations Environment Programme (‘UNEP’) in the Balkans have tested the air for DU contamination. These studies ultimately found low-level DU contamination at two of six testing sites in Bosnia and Herzegovina, and at two of six testing sites in Serbia and Montenegro.⁴³ UNEP also conducted tests on lichens, as they are useful ‘bio-indicators’ of airborne DU contamination.⁴⁴ In Bosnia and Herzegovina, three of 11 sample sites had low-level DU contaminated lichens, whilst in Serbia and Montenegro, three of six sample sites had low-level DU contaminated lichens.⁴⁵ With regard to soil contamination, DU can enter the soil through corroding penetrators, as well as through the settlement of DU dust from impact or munitions fires.⁴⁶ The International Atomic Energy Agency (‘IAEA’) took soil samples from seven sites in Kuwait, ultimately finding that five of them were contaminated with small amounts of DU.⁴⁷ Similarly, the UNEP investigations of the Balkans found a number of localised contaminations (mostly near corroding DU munitions), but none of these were of a significant or widespread nature.⁴⁸ Finally, DU can contaminate surface water or leech into groundwater via the soil.⁴⁹ However, UNEP studies in Kosovo and Serbia and Montenegro found no indication of water contamination.⁵⁰ Only the UNEP study in Bosnia and Herzegovina found any evidence of water contamination – a ‘low and insignificant contamination’ at one of 11 testing sites.⁵¹

B Health Effects of Depleted Uranium Munitions

DU can enter the human body in one of four ways: 1) inhalation of DU dust; 2) ingestion of DU contaminated food or water; 3) embedment of DU shrapnel or dust in a wound; or 4) dermal absorption of DU dust.⁵² Those at particular risk of exposure include soldiers in armoured vehicles penetrated by DU munitions, people working in and around DU impacted sites, children playing in contaminated soil, and people who consume DU contaminated food.⁵³ Once DU is internalised, approximately 90% of it will be excreted after a few days, whilst the remaining 10% will be excreted over a time period ranging from a few months to several years.⁵⁴

Whilst it is well established that DU can be internalised by human beings, the health effects of its use in armed conflicts are contentious. Concerns about the health effects of DU munitions arise as a result of its toxicological and radiological nature.⁵⁵ Laboratory studies on rats and monkeys have indicated that DU can cause cancer, developmental abnormalities, kidney damage, reproductive problems, and diseases of the nervous system.⁵⁶ Both the World Health Organization (‘WHO’) and the Royal Society found that although exposure to large quantities of DU dust is likely to increase the incidence of cancer in humans, such a quantity is unlikely to be found on the battlefield.⁵⁷ Furthermore, the WHO found no evidence to indicate that DU could lead to an increased risk of kidney damage, reproductive problems, or diseases of the nervous system.⁵⁸ However, despite

⁴⁰Hulme, above n 13, 227-8.

⁴¹Royal Society, *The Health Hazards of Depleted Uranium Munitions: Part II* (2002) 90.

⁴²Fahey, ‘Environmental and Health Consequences’, above n 36, 34.

⁴³United Nations Environment Programme, *Depleted Uranium in Serbia and Montenegro*, above n 38, 30; United Nations Environment Programme, *Depleted Uranium in Bosnia and Herzegovina: Post-Conflict Environmental Assessment* (2003) 36.

⁴⁴United Nations Environment Programme, *Depleted Uranium in Serbia and Montenegro*: above n 38, 30-1; United Nations Environment Programme, *Depleted Uranium in Bosnia and Herzegovina*, above n 43, 193.

⁴⁵United Nations Environment Programme, *Depleted Uranium in Serbia and Montenegro*, above n 38, 30-1; United Nations Environment Programme, *Depleted Uranium in Bosnia and Herzegovina*, above n 43, 198-9.

⁴⁶Fahey, above n 36, 34-5.

⁴⁷International Atomic Energy Agency, *Radiological Conditions in Areas of Kuwait with Residues of Depleted Uranium: Report by an International Group of Experts* (2003) 50-1.

⁴⁸Fahey, ‘Environmental and Health Consequences’, above n 36, 36-7.

⁴⁹Thompson, above n 7, 10476.

⁵⁰United Nations Environment Programme, *Depleted Uranium in Serbia and Montenegro*, above n 38, 29; United Nations Environment Programme, *Depleted Uranium in Kosovo: Post-Conflict Environmental Assessment* (2001) 32.

⁵¹United Nations Environment Programme, *Depleted Uranium in Bosnia and Herzegovina*, above n 43, 35-6.

⁵²Fahey, ‘Environmental and Health Consequences’, above n 36, 42; Hulme, above n 13, 219.

⁵³Fahey, above n 36, 45-7.

⁵⁴World Health Organization, *Depleted Uranium: Sources, Exposure and Health Effects*, UN Doc WHO/SDE/PHE/01.1 (April 2001) 64-5.

⁵⁵Okafor-Yarwood, above n 10, 115.

⁵⁶Fahey, ‘Environmental and Health Consequences’, above n 36, 55-60; Hulme, above n 13, 222; Charli Carpenter, ‘Vetting the Advocacy Agenda: Network Centrality and the Paradox of Weapons Norms’ (2011) 65(1) *International Organization* 69, 90.

⁵⁷Gibbons, above n 4, 203.

⁵⁸World Health Organization, *Depleted Uranium: Sources, Exposure and Health Effects*, UN Doc WHO/SDE/PHE/01.1 (April 2001) 144-5.

these statements, actual testing of human beings has remained scarce and subject to criticism. The United States Department of Veterans Affairs conducted a major study on Gulf War veterans and ultimately found no causal link between DU contamination and cancer.⁵⁹ This study has come under scrutiny as it was small (in terms of the number of veterans assessed) and excluded veterans with health problems.⁶⁰ A non-peer reviewed (but widely reported) study by Iraqi scientists highlighted a spike in the number of birth deformities and childhood cancers in Basra, and linked this to the use of DU munitions west of Basra.⁶¹ The results of this study are also questionable, as an inconsistent diagnosis method was used and only one hospital in Basra was assessed.⁶² Similarly in Fallujah, where US forces engaged in heavy fighting with Iraqi insurgents in 2004, a questionnaire study found ‘alarmingly high’ increases in cancer and infant mortality rates.⁶³ However, the study acknowledged that there were numerous structural issues with the use of questionnaires, and that the study itself drew no conclusions as to the cause of these concerning statistics.⁶⁴ Furthermore, there is no conclusive proof that the US used DU munitions in the battle for Fallujah.

IV INTERNATIONAL HUMANITARIAN LAW AND DEPLETED URANIUM MUNITIONS

A *Specific Weapons*

There is no treaty directly prohibiting the use of DU munitions in an armed conflict. However, it has been argued that DU munitions fit within other categories of specific weapons prohibited or restricted under IHL. This section analyses whether DU munitions can fit within any of these categories; namely, nuclear, radiological, chemical and incendiary weapons.

1 *Are Depleted Uranium Munitions Nuclear Weapons?*

There is no treaty ban on the use of nuclear weapons; however, in its advisory opinion on the *Legality of the Threat or Use of Nuclear Weapons* (*Nuclear Weapons Advisory Opinion*), the International Court of Justice (‘ICJ’) concluded that the use of nuclear weapons was ‘scarcely reconcilable’ with the basic IHL principles of distinction and avoidance of unnecessary suffering.⁶⁵ Nonetheless, the ICJ ruled that there is no complete prohibition on the use of nuclear weapons under IHL and that their use may be legal in ‘an extreme circumstance of self-defence’ where a state’s survival is at stake.⁶⁶ The ICJ also stated that nuclear weapons are ‘explosive devices whose energy results from the fusion or fission of the atom’ and that these weapons ‘release not only immense quantities of heat and energy, but also powerful and prolonged radiation.’⁶⁷ DU munitions clearly do not fit within this definition, as they are not explosive devices.⁶⁸ As such, DU munitions cannot be considered to be nuclear weapons.

2 *Are Depleted Uranium Munitions Radiological Weapons?*

Radiological weapons are ‘weapons specifically designed to employ radioactive material by disseminating it to cause destruction, damage or injury by means of the radiation produced by the decay of such material.’⁶⁹ Similar to nuclear weapons, there is no treaty prohibiting the use of radiological weapons in an armed conflict. Nonetheless, it is difficult to envisage when the use of a radiological weapon could be legal in an armed conflict, as a weapon specifically designed to spread radioactive material is not justified by military necessity and causes unnecessary suffering. With this in mind, DU munitions are not specifically designed to disseminate radioactive material – this is a mere side-effect. Therefore, they are not radiological weapons.

⁵⁹ Fahey, ‘Environmental and Health Consequences’, above n 36, 59.

⁶⁰ Ibid 66.

⁶¹ Kimberly Bernard et al, *DU: Health and Public Health Issues Arising from the Use of Depleted Uranium Munitions* (Physicians for Social Responsibility, 2005) 14-15.

⁶² Ibid 15.

⁶³ Chris Busby, Malak Hamdan, and Entesar Ariabi, ‘Cancer, Infant Mortality and Birth Sex-Ratio in Fallujah, Iraq 2005–2009’ (2010) 7(7) *International Journal of Environmental Research and Public Health* 2828, 2836.

⁶⁴ Ibid.

⁶⁵ *Legality of the Threat or Use of Nuclear Weapons (Advisory Opinion)* [1995] ICJ Rep 226, 262.

⁶⁶ Ibid 262-3.

⁶⁷ Ibid 243.

⁶⁸ McDonald, ‘Depleted Uranium Weapons’, above n 9, 18.

⁶⁹ Jozef Goldblat, *Arms Control: The New Guide to Negotiations and Agreements* (Sage Publications, 2nd ed, 2002) 163.

3 Are Depleted Uranium Munitions Chemical Weapons?

Chemical weapons are similar to DU munitions as they both have chemically toxic effects. Under the *Chemical Weapons Convention*,⁷⁰ the production, acquisition and use of chemical weapons is prohibited. Article II(1)(b) of the *Chemical Weapons Convention* states that a ‘chemical weapon’ includes:

Munitions and devices, specifically designed to cause death or other harm through the toxic properties of those toxic chemicals specified in subparagraph (a), which would be released as a result of the employment of such munitions and devices.⁷¹

For a substance to be considered a ‘toxic chemical’, it must be listed within the schedules in the annexure to the Convention.⁷² DU is not listed within that annexure. Furthermore, even if DU was listed within the annexure as a ‘toxic chemical’, DU munitions could not be considered a ‘chemical weapon’, as they are not specifically designed to cause death or other harm through their (low-level) toxic properties.⁷³ Rather, they are designed to pierce armour through impact.

In addition to the *Chemical Weapons Convention*, the 1925 *Geneva Protocol*⁷⁴ prohibits the wartime use of ‘asphyxiating, poisonous or other gases, and all analogous liquids, materials and devices.’ In its *Nuclear Weapons Advisory Opinion*, the ICJ ruled that the prohibition on poisonous weapons only applies to weapons whose primary effect is to poison.⁷⁵ As previously mentioned, the primary effect of DU munitions is to pierce armour. As such, they cannot be considered poisonous weapons.

4 Are Depleted Uranium Munitions Incendiary Weapons?

Protocol III to the *Convention on Certain Conventional Weapons* (‘*Protocol III*’)⁷⁶ limits the circumstances in which incendiary weapons may be used. An incendiary weapon is a ‘weapon or munition primarily designed to set fire to objects or to cause burn injury to persons through action of flame, heat, or a combination thereof, produced by a chemical reaction of a substance delivered on the target.’⁷⁷ However, art 1(1)(b)(ii) of *Protocol III* states that this definition of incendiary weapons does not include:

Munitions designed to combine penetration, blast or fragmentation effects with an additional incendiary effect, such as armour-piercing projectiles, fragmentation shells, explosive bombs and similar combined-effects munitions in which the incendiary effect is not specifically designed to cause burn injury to persons, but to be used against military objectives, such as armoured vehicles, aircraft and installations or facilities.⁷⁸

DU munitions will fit within the art 1(1)(b)(ii) exception, as their primary purpose is to pierce armour, with only an additional side-effect of starting fires and causing burns.

B Unnecessary Suffering

In its *Nuclear Weapons Advisory Opinion*, the ICJ noted that it is a well-established principle of customary IHL that ‘it is prohibited to cause unnecessary suffering to combatants.’⁷⁹ Complementing this under treaty law, art 35(2) of *Protocol Additional to the Geneva Conventions* (‘*Additional Protocol I*’) states that, ‘[i]t is prohibited to employ weapons, projectiles and material and methods of warfare of a nature to cause superfluous injury or unnecessary suffering.’⁸⁰ Before analysing whether DU munitions cause unnecessary suffering, it is important to

⁷⁰ *Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on Their Destruction*, opened for signature 3 September 1992, 1974 UNTS 45 (entered into force 29 April 1997).

⁷¹ *Ibid* art II(1)(b).

⁷² *Ibid* art II(2).

⁷³ Hulme, above n 13, 244.

⁷⁴ *Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare*, opened for signature 17 June 1925, 94 LNTS 65 (entered into force 8 February 1928).

⁷⁵ *Legality of the Threat or Use of Nuclear Weapons (Advisory Opinion)* [1995] ICJ Rep 226, 248.

⁷⁶ *Protocol III to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to Have Indiscriminate Effects*, opened for signature 10 October 1980, 1342 UNTS 137 (entered into force 2 December 1983) art 2.

⁷⁷ *Ibid* art 1(1).

⁷⁸ *Ibid* art 1(1)(b)(ii).

⁷⁹ *Legality of the Threat or Use of Nuclear Weapons (Advisory Opinion)* [1995] ICJ Rep 226, 257.

⁸⁰ *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, opened for signature 8 June 1977, 1125 UNTS 3 (entered into force 7 December 1978) art 35(2).

ascertain whether the principle can operate to prohibit anti-materiel weapons (weapons used against buildings or vehicles). A number of state military manuals, including the United States Army Field Manual, limit their examples of weapons that cause unnecessary suffering to anti-personnel weapons.⁸¹ Such a position is understandable, given that a tank or a bunker cannot ‘suffer’.⁸² However, the occupants of a tank or bunker can nonetheless suffer.⁸³ A more logical interpretation of the principle is that it will apply to anti-materiel weapons to the extent that what the anti-materiel weapon is designed to target will ordinarily have a person or persons within it.

State practice indicates that assessing what is ‘unnecessary’ will require a balancing test that weighs up the suffering of the combatant victim against the military utility of the weapon.⁸⁴ Zwanenburg comments that, on balancing these two factors, the suffering will be unnecessary if it is ‘manifestly disproportionate’.⁸⁵ With regard to the suffering of the victim, a combatant within a targeted vehicle or bunker may suffer in one of four ways: 1) death by asphyxiation, explosion or burning; 2) burns; 3) limb or organ damage from embedded shrapnel; and 4) possible long-term medical problems as a result of DU’s radiological and toxicological properties.⁸⁶ The first three of these are commonplace forms of possible suffering for any person within a vehicle or bunker struck by a shell, whilst the accuracy and extent of the fourth form of suffering is subject to ongoing debate. Conversely, with regard to the military utility of DU, this paper has highlighted that DU is favoured by a number of states because it is dense, pyrophoric, inexpensive and abundant. It is also important to an assessment of military utility to consider whether there are any viable alternatives available.⁸⁷ The most widely touted alternative is tungsten; however, DU is superior to tungsten in that it self-sharpens and will have a 5–20 percent better penetration on impact.⁸⁸ It is clear from this information that the military utility of DU munitions far outweighs the contentious amount of suffering inflicted upon the combatant victim. As such, DU munitions cannot be considered illegal under the principle against unnecessary suffering.

C Distinction and Proportionality

The principle of distinction between civilian and military targets is deeply rooted in both customary IHL⁸⁹ and *Additional Protocol I*.⁹⁰ One embodiment of this principle can be seen in the prohibition on indiscriminate attacks. Amongst other definitions, art 51(4)(c) of *Additional Protocol I* defines indiscriminate attacks as:

Those which employ a method or means of combat the effects of which cannot be limited as required by this Protocol; and consequently, in each such case, are of a nature to strike military objectives and civilians or civilian objects without distinction.⁹¹

This prohibition and definition is reaffirmed under customary IHL.⁹² In his dissenting opinion in *Yugoslavia v Belgium*⁹³, Judge ad hoc Kreća noted that DU dust has no limitation ‘in either space or time’. Indeed, it can spread 200–500 metres from the target area post-impact,⁹⁴ and when used near civilian areas there will be a high chance of exposure.⁹⁵ However, the health effects of DU exposure remain contentious, and will be dependent on a number of factors, including the route and magnitude of exposure, as well as the resulting

⁸¹ Marten Zwanenburg, ‘The Use of Depleted Uranium and the Prohibition of Weapons of a Nature to Cause Superfluous Injury or Unnecessary Suffering’ in McDonald, Kleffner and Toebes (eds), above n 6, 111, 116-17.

⁸² Gibbons, above n 4, 213.

⁸³ Ibid.

⁸⁴ Hulme, above n 13, 246.

⁸⁵ Zwanenburg, above n 81, 119.

⁸⁶ Hulme, above n 13, 253.

⁸⁷ Robin Borrmann, ‘The Use of Depleted Uranium Ammunition under Contemporary International Law: Is There a Need for a Treaty-Based Ban on DU Weapons?’ (2010) 26(4) *Medicine, Conflict and Survival* 268, 272.

⁸⁸ Hulme, above n 13, 257.

⁸⁹ *Legality of the Threat or Use of Nuclear Weapons (Advisory Opinion)* [1995] ICJ Rep 226, 257.

⁹⁰ *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, opened for signature 8 June 1977, 1125 UNTS 3 (entered into force 7 December 1978) art 48.

⁹¹ Ibid art 51(4)(c).

⁹² Jean-Marie Henckaerts and Louise Doswald-Beck, *Customary International Humanitarian Law* (International Committee of the Red Cross, 2005) vol1,37-43.

⁹³ *Legality of the Use of Force (Yugoslavia v Belgium) (Order on the Indication of Provisional Measures)* [1999] ICJ Rep 124, 224.

⁹⁴ Borrmann, above n 87, 271.

⁹⁵ Hulme, above n 13, 227-228.

toxicological/radiological dose.⁹⁶ As a result of this uncertainty regarding the health effects of DU munitions, article 51(4)(c) and its customary IHL equivalent will not prohibit the use of DU munitions.

In addition to arts 51(4)(c) and 51(5)(b) of *Additional Protocol I* states that ‘indiscriminate attacks’ also include:

[A]n attack which may be expected to cause incidental loss of civilian life, injury to civilians, damage to civilian objects, or a combination thereof, which would be excessive in relation to the concrete and direct military advantage anticipated.⁹⁷

This provision reflects the customary IHL principle of proportionality,⁹⁸ and requires a balancing test between the civilian damage caused and the military advantage gained.⁹⁹ As noted previously, the health effects of DU munitions on civilians remain contentious. When compared to the demonstrable military utility of DU munitions, it is clear that art 51(5)(b) and its customary IHL equivalent will not prohibit the use of DU munitions.

D *Environmental Protections of International Humanitarian Law*

Article 35(3) of *Additional Protocol I* states that:

It is prohibited to employ methods or means of warfare which are intended, or may be expected, to cause widespread, long-term and severe damage to the natural environment.¹⁰⁰

Furthermore, art 55(1) states that:

Care shall be taken in warfare to protect the natural environment against widespread, long-term and severe damage. This protection includes a prohibition of the use of methods or means of warfare which are intended or may be expected to cause such damage to the natural environment and thereby to prejudice the health or survival of the population.¹⁰¹

Whilst these provisions appear similar, art 55(1) has the additional requirement that the ‘widespread, long-term and severe damage’ to the natural environment threatens human health.¹⁰² Importantly, the ICJ stated in the *Nuclear Weapons Advisory Opinion* that these provisions are not customary IHL,¹⁰³ meaning that these provisions will not apply to states such as India, Israel, Turkey or the United States. Nonetheless, it appears that the customary IHL principles of military necessity and proportionality, combined with a growing state desire to protect the environment, may at least place some restrictions on excessive environmental damage in armed conflicts.¹⁰⁴ DU from DU munitions will remain in the environment for a long period of time and certainly has the capacity to cause widespread contamination (though this has not been evidenced in any post-conflict studies in the Balkans).¹⁰⁵ However, there is little indication at this point in time that this contamination will lead to severe damage¹⁰⁶ and, as such, the environmental protections of IHL will not render DU munitions illegal.

E *The Precautionary Principle*

In light of Part IV A–D of this paper, it is clear that the use of DU munitions in an armed conflict is currently legal under IHL. However, this use may be restricted by the ‘precautionary principle’. This principle is expressed in art 57(2)(a)(ii) of *Additional Protocol I* which states that:

⁹⁶ Jann K Kleffner and Theo Boutruche, ‘The Use of Depleted Uranium and the Principles of Distinction, Proportionality and Precaution’ in McDonald, Kleffner and Toebes (eds), above n 6, 125, 141.

⁹⁷ *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, opened for signature 8 June 1977, 1125 UNTS 3 (entered into force 7 December 1978) art 51(5)(b).

⁹⁸ Borrmann, above n 87, 271.

⁹⁹ Gibbons, above n 4, 217–8.

¹⁰⁰ *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, opened for signature 8 June 1977, 1125 UNTS 3 (entered into force 7 December 1978) art 35(3).

¹⁰¹ Ibid art 55(1).

¹⁰² Erik V Koppe, ‘The Use of Depleted Uranium and the Direct Protection of the Environment under Jus in Bello’ in McDonald, Kleffner and Toebes (eds), above n 6, 161, 163.

¹⁰³ *Legality of the Threat or Use of Nuclear Weapons* (Advisory Opinion) [1995] ICJ Rep 226, 242.

¹⁰⁴ Koppe, above n 102, 174.

¹⁰⁵ Wexler, above n 29, 485.

¹⁰⁶ Hulme, above n 13, 282.

[T]hose who plan or decide upon an attack shall... take all feasible precautions in the choice of means and methods of attack with a view to avoiding, and in any event to minimizing, incidental loss of civilian life, injury to civilians and damage to civilian objects.¹⁰⁷

The need to take precautions to protect civilians and civilian objects lies at the very heart of IHL¹⁰⁸. As such, this broadly worded provision is considered customary IHL. The scope of this precautionary principle depends on the interpretation of the word 'feasible'. Beckett asserts that 'feasible' includes a state taking all feasible precautions to prove a weapon's legality and disprove any serious accusations of illegality.¹⁰⁹ This interpretation places the burden of proof on the party seeking to use a contentious weapon and renders a contentious weapon (such as DU munitions) illegal until it is proven that it complies with IHL.¹¹⁰ The *Lotus* principle of international law, expressed by the Permanent Court of International Justice, states that 'restrictions upon the independence of states cannot... be presumed.'¹¹¹ In its most common interpretation, this means that sovereign states may do as they wish, as long as their conduct is not prohibited by international law. In the *Nuclear Weapons Advisory Opinion*, the ICJ did not rule on whether this means a weapon is inherently legal until customary or treaty IHL proves otherwise.¹¹² However, such an approach logically follows from the *Lotus* principle, and is likely to be in line with state practice. As such, the 'presumed illegality' interpretation of the precautionary principle is incorrect. A better view is that this provision creates a minimum standard of care when choosing weapons for an attack.¹¹³ As part of this standard of care, military leaders should take into account the possible (albeit contentious) environmental and health effects of DU munitions when considering the use of said munitions in an attack, and avoid using the munitions when appropriate.¹¹⁴ This is somewhat of a nominal restriction on the use of DU munitions, and indeed, states that use DU are presumably adhering to this principle as part of the practice of weaponizing. Nonetheless, it would seem that the precautionary principle, as well as the basic principles of IHL restricting how a weapon is used (e.g. proportionality, distinction, etc.) are the only restrictions on the use of DU munitions in an armed conflict.

F Conclusions

To conclude this section of the paper, it is evident from the above analysis that DU munitions are legal under IHL, though their use may be restricted by the precautionary principle. Despite this legality, it is clear that there are 'some' adverse environmental and health effects related to DU munitions, though the extent of these effects remains contentious. With this in mind, there is a growing disquiet across both the states system and civil society about these possible effects. In 2014, the United Nations General Assembly passed its fifth resolution concerning the issue of depleted uranium munitions.¹¹⁵ These resolutions have noted that there is a need for clarity on the health and environmental impacts of DU munitions, as well as a need to mitigate these impacts. Importantly, the most recent of these resolutions received a considerable number of votes in its favour (150 in favour, with 27 abstentions and 4 against the resolution). Additionally, civil society organisations are raising concerns about the use of DU munitions in armed conflicts and the possible health and environmental impacts of this usage. The most prominent of these, the International Coalition to Ban Uranium Weapons, advocates for a treaty ban of DU munitions. Through both state and civil society responses to DU munitions, it is clear that DU munitions states will need to resolve the issues concerning the health and environmental impacts of these munitions, as well as the

¹⁰⁷ Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I), opened for signature 8 June 1977, 1125 UNTS 3 (entered into force 7 December 1978) art 57(2)(a)(ii).

¹⁰⁸ Kleffner and Boutruche, above n 96, 151.

¹⁰⁹ Beckett, above n 3, 82.

¹¹⁰ Ibid 82-3.

¹¹¹ *SS 'Lotus' (France v Turkey) (Judgment)* [1927] PCIJ (ser A) No 10, 18.

¹¹² *Legality of the Threat or Use of Nuclear Weapons (Advisory Opinion)* [1995] ICJ Rep 226, 238-9.

¹¹³ Borrmann, above n 87, 274; Kleffner and Boutruche, above n 96, 152.

¹¹⁴ Borrmann, above n 87, 274.

¹¹⁵ See *Effects of the Use of Armaments and Ammunitions Containing Depleted Uranium*, GA Res 69/57, UN GAOR, 69th sess, 62nd plen mtg, Agenda Item 96, Supp No 49, UN Doc A/RES/69/57 (2 December 2014); *Effects of the Use of Armaments and Ammunitions Containing Depleted Uranium*, GA Res 67/36, UN GAOR, 67th sess, 48th plen mtg, Agenda Item 94, Supp No 49, UN Doc A/RES/67/36 (3 December 2012); *Effects of the Use of Armaments and Ammunitions Containing Depleted Uranium*, GA Res 65/55, UN GAOR, 65th sess, 60th plen mtg, Agenda Item 97, Supp No 49, UN Doc A/RES/65/55 (8 December 2010); *Effects of the Use of Armaments and Ammunitions Containing Depleted Uranium*, GA Res 63/54, UN GAOR, 63rd sess, 61st plen mtg, Agenda Item 89, Supp No 49, UN Doc A/RES/63/54 (2 December 2008); *Effects of the Use of Armaments and Ammunitions Containing Depleted Uranium*, GA Res 62/30, UN GAOR, 62nd sess, 61st plen mtg, Agenda Item 98, Supp No 49, UN Doc A/RES/62/30 (5 December 2007).

ongoing question of their legality. The next section of this paper will explore solutions to these issues, ultimately arguing that a regulatory treaty is required.

V THE NEED FOR A REGULATORY TREATY

A *Ineffectiveness of a Treaty Ban or Moratorium*

The major proposed solution to the issue of the environmental and health effects of DU munitions is a treaty ban. However, for the treaty to have any kind of international legitimacy or effect, it would require the majority of DU munitions user-states to agree to it.¹¹⁶ Such a situation is unlikely given the current legality of these munitions under IHL, as well as their military utility. Similarly, calls for a moratorium on the use of DU munitions, such as those of the Latin American Parliament¹¹⁷ and European Parliament,¹¹⁸ are unlikely to receive widespread acceptance from DU munitions-using states.

B *A Proposed Regulatory Framework*

It is proposed that a regulatory treaty for DU munitions be created. The regulatory framework created by this treaty would have three core components: 1) transparency measures; 2) mitigation measures; and 3) independent research. Firstly, transparency measures would include state-conducted legality reviews and the establishment of a system of monitoring for DU munitions stockpiles. Under art 36 of *Additional Protocol I*, states are required to determine whether a new weapon would, in some or all circumstances, be prohibited by IHL.¹¹⁹ Whilst this provision is unlikely to be customary IHL or apply to DU munitions (as they may not be 'new' anymore), its approach should nonetheless be emulated within a regulatory treaty in order to promote transparency in the use and acquisition of DU munitions. As part of this legality review requirement, states would publicly put forward their position on the legality of DU munitions in a formal document. This legality review requirement would be useful to DU munitions states, as it gives them the opportunity to clearly set out their arguments in favour of the legality of DU munitions in order to rebut criticism from states and civil society organisations opposing DU munitions. In addition to legality reviews, a monitoring system should also be created. This monitoring system would require states to disclose their DU stockpiles in order to improve international knowledge of the number of DU munitions worldwide.¹²⁰ Again, the accountability of this process would be useful to DU munitions states, as it removes some of the secrecy associated with the proliferation, use and effects of DU munitions.

Secondly, with regard to mitigation measures, a regulatory treaty would include measures to record and retain information, warn and protect affected parties, and clean up affected areas. These mitigation measures could be modelled from those contained within *Protocol V to the Convention on Certain Conventional Weapons* ('*Protocol V*').¹²¹ *Protocol V* is a treaty that seeks to minimise the impact of explosive remnants of war. It requires states to, over the course of an armed conflict, record and retain information pertaining to their use or abandonment of explosive ordnance which may become explosive remnants of war.¹²² It also requires states to ensure that their information on the use or abandonment of explosive ordnance is divulged to any affected party at the conclusion of the armed conflict (subject to legitimate security and practicality constraints).¹²³ Similarly, a regulatory treaty on DU munitions could require states to record and retain information on matters such as the location of areas targeted with DU munitions, amount of DU munitions used, and location of corroding or abandoned DU

¹¹⁶ Morton, above n 24, 24.

¹¹⁷ Latin American Parliament, *Resolution No. 18: Prohibition on the Use of Depleted Uranium Weapons* (3 December 2009) <<http://www.parlatino.org/comisiones-permanentes/derechos-humanos-justicia-y-politicas-carcelarias/declaraciones/resoluciones/resoluciones/1580.html>>.

¹¹⁸ European Parliament, *European Parliament Resolution of 22 May 2008 on Uranium Weapons (Depleted) and their Effects on Human Health and the Environment - Towards a Global Ban on the Use of Such Weapons* (22 May 2008) <<http://www.europarl.europa.eu/sides/getDoc.do?type=TA&reference=P6-TA-2008-0233&language=RO&ring=B6-2008-0220>>.

¹¹⁹ *Protocol Additional to the Geneva Conventions of 12 August 1949, and Relating to the Protection of Victims of International Armed Conflicts (Protocol I)*, opened for signature 8 June 1977, 1125 UNTS 3 (entered into force 7 December 1978) art 36.

¹²⁰ Morton, above n 24, 26.

¹²¹ *Protocol V to the Convention on Prohibitions or Restrictions on the Use of Certain Conventional Weapons Which May be Deemed to be Excessively Injurious or to have Indiscriminate Effects*, opened for signature 28 November 2003, 2399 UNTS 100 (entered into force 12 November 2006).

¹²² *Ibid* art 4(1).

¹²³ *Ibid* art 4(2).

munitions. Once the conflict has concluded, the state that has used DU munitions could provide this information to an affected state to ensure that health and environmental impacts are minimised. The state that has been affected by the DU munitions, or a relevant international organisation, could then assist in ensuring that civilians are warned of impacted areas, and that impacted areas are quarantined and monitored. *Protocol V* also requires the clearance, removal or destruction of explosive remnants of war at the end of an armed conflict by: a) the state that caused an area to be affected by explosive remnants or war; b) the affected state; and/or c) a mutually agreed third-party state or international organisation.¹²⁴ Under a regulatory treaty for DU munitions, a similar approach could be established whereby states, international organisations, or both, would be responsible for the clean-up of impacted territory in order to minimise any environmental or health effects.¹²⁵ Appropriate international organisations to integrate into such a framework could include UNEP, IAEA, and WHO.

Finally, the independent research component of a regulatory treaty for DU munitions would incorporate the creation of an independent research body. This body would be entrusted with conducting impartial studies on the short- and long-term health and environmental effects of DU munitions.¹²⁶ Previous studies concerning the health and environmental effects of DU munitions have been limited and inconclusive. Furthermore, many health studies are tainted by accusations of political bias. Through extensive research independent of the influence of international politics, it is hoped that the health and environmental effects of DU munitions can be clarified. As analysing the legality of DU munitions largely relies upon their known health and environmental effects, this clarification is crucial to resolving the status of DU munitions under IHL. Such clarification may ultimately limit the circumstances in which DU munitions may be used, or even lead to their illegality through the application of IHL or through a treaty ban.

VI CONCLUSION

Although DU munitions have the capacity to contaminate the environment and human beings with DU, the likely extent and possible effects of this contamination remain unclear. Nonetheless, despite the uncertainty concerning adverse health and environmental effects, DU munitions do not breach IHL principles and treaty provisions concerning unnecessary suffering, distinction, proportionality, and environmental damage. Furthermore, DU munitions cannot be considered nuclear, radiological, chemical, or incendiary weapons under IHL. With this legality in mind, it would seem that the only restrictions upon the use of DU munitions are the rules of IHL in a general sense and the precautionary principle.

A regulatory treaty should be developed to minimise the environmental and health risks of DU munitions and clarify their legal position. This treaty would incorporate: 1) transparency measures such as legality reviews of DU munitions and the monitoring of DU munitions stockpiles; 2) mitigation measures, including recording and retaining information concerning possible DU impact sites, warning and protecting affected parties, and cleaning up affected areas; and 3) the creation of an independent research body to conduct unbiased research on the environmental and health effects of DU munitions.

¹²⁴ Ibid art 3.

¹²⁵ Avril McDonald, 'Averting Foreseeable and Unexpected Damage: The Case for a Precautionary Approach *Vis-à-vis* Depleted Uranium Weapons' in McDonald, Kleffner and Toebes (eds), above n 6, 281, 314; Okafor-Yarwood, above n 10, 122; Nuclear Policy Research Institute, above n 1, 21.

¹²⁶ Morton, above n 24, 26.