

MATERIAL HARM

A review of IED components and measures to prevent their spread



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Cover image

Marines recover artillery shells turned into roadside bombs
(Date: 3 March 2005) Source: United States Marine Corps

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INTRODUCTION

Improvised Explosive Devices (IEDs) have a devastating impact on the lives of civilians around the world.

They kill thousands every year, inflict desperate physical injuries, and spread fear and disruption across affected communities. IEDs are used by armed actors globally, and have proved to be effective against even the most advanced of militaries. IED attacks block life-saving humanitarian aid, close down markets, schools and hospitals, and hinder the political, social and economic development of a country.

From 2011 to 2013 AOA V recorded that 53,008 civilians in 66 countries and territories were killed and injured by IEDs. They made up 81% of the total number of IED casualties. Where IEDs are used in populated areas, a staggering 91% of those killed and injured were civilians.

The threat of IED attack is a global problem. In recent years their impacts were most acutely felt in Iraq, Pakistan, Afghanistan, Syria and Nigeria.¹

Part of the reason that IEDs are so prevalent is the fact that they are cheap and relatively easy to make. They can be made from a whole range of materials, from everyday objects found in the home to commercial explosives used in construction and mining. Military weapons left in unsecured stock-piles, susceptible to looting during times of armed violence and regime changes, can equally be used to make these deadly weapons.

In *Material Harm*, AOA V will examine the sources of IED materials and what is being done to restrict the flow of IED materials globally.

Accessing bomb-making materials is just one step in carrying out an IED attack. Counter-IED



A raid on an improvised explosive device factory belonging to FARC in Colombia, 10 July 2011.

THE HUMAN TOLL OF IEDS

2011-2013

+70%

INCREASE IN CIVILIANS KILLED & INJURED BY IEDS SINCE 2011



2011 17,499 KILLED & INJURED BY IEDS



76% OF THESE CASUALTIES WERE CIVILIANS.

2012 20,917 KILLED & INJURED BY IEDS



81% OF THESE CASUALTIES WERE CIVILIANS.

2013 26,887 KILLED & INJURED BY IEDS



85% OF THESE CASUALTIES WERE CIVILIANS.

SUICIDE BOMBINGS

SINCE 2011, THE NUMBER OF CIVILIAN CASUALTIES FROM SUICIDE ATTACKS HAS INCREASED BY **ONE THIRD.**



5,544 CIVILIANS KILLED & INJURED IN SUICIDE ATTACKS



7,291 CIVILIANS KILLED & INJURED IN SUICIDE ATTACKS

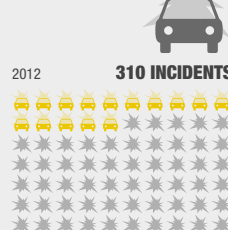
CAR BOMBINGS

SINCE 2011, THE NUMBER OF IED INCIDENTS INVOLVING CAR BOMBS HAS **TRIPLED.**



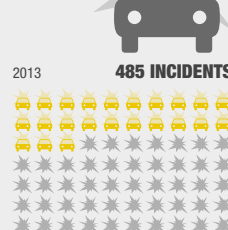
2011 156 INCIDENTS

CAR BOMBS ACCOUNTED FOR 11% OF IED ATTACKS IN 2011.



2012 310 INCIDENTS

CAR BOMBS ACCOUNTED FOR 21% OF IED ATTACKS IN 2012.



2013 485 INCIDENTS

CAR BOMBS ACCOUNTED FOR 33% OF IED ATTACKS IN 2013.

DATA: AOV, based on English-language media reports

measures must also target financial networks behind insurgents, seek to disrupt the passing on of bomb-making knowledge, and attempt to intervene in the planning and carrying out of IED attacks. While acknowledging, though, the multifactoral approach to combating IED harm, this report will only focus on efforts to disrupt the proliferation of IED-making materials.

IEDs have been used for hundreds of years.² However, their threat and use has grown exponentially in the 21st century, as methods and means of warfare have adapted to modern threats. Armed conflict rarely means the armies of two or more countries fighting according to the traditional laws of warfare. Rather it involves rebel forces, armed groups, and terrorists, with the majority of armed conflicts now being fought within countries' borders.

Even when one group dissolves and gives up its arms, another armed group often replaces it, and the knowledge of how to construct an IED is passed from group to group. It is collected in manuals or passed through word-of-mouth from

bomb-maker to apprentice as bomb-making technology becomes more sophisticated and the techniques more effective. Insurgents and armed actors can even find instructions detailing how to make IEDs on the Internet. Anders Behring Breivik, who killed 77 people in Norway, used Google Translate to understand terror manuals found online during his preparation for his IED attack on Oslo.³ It is hard to put that genie back in the bottle, so it is vital that bomb-making materials are controlled as tightly as possible to stop this deadly knowledge from being harnessed.

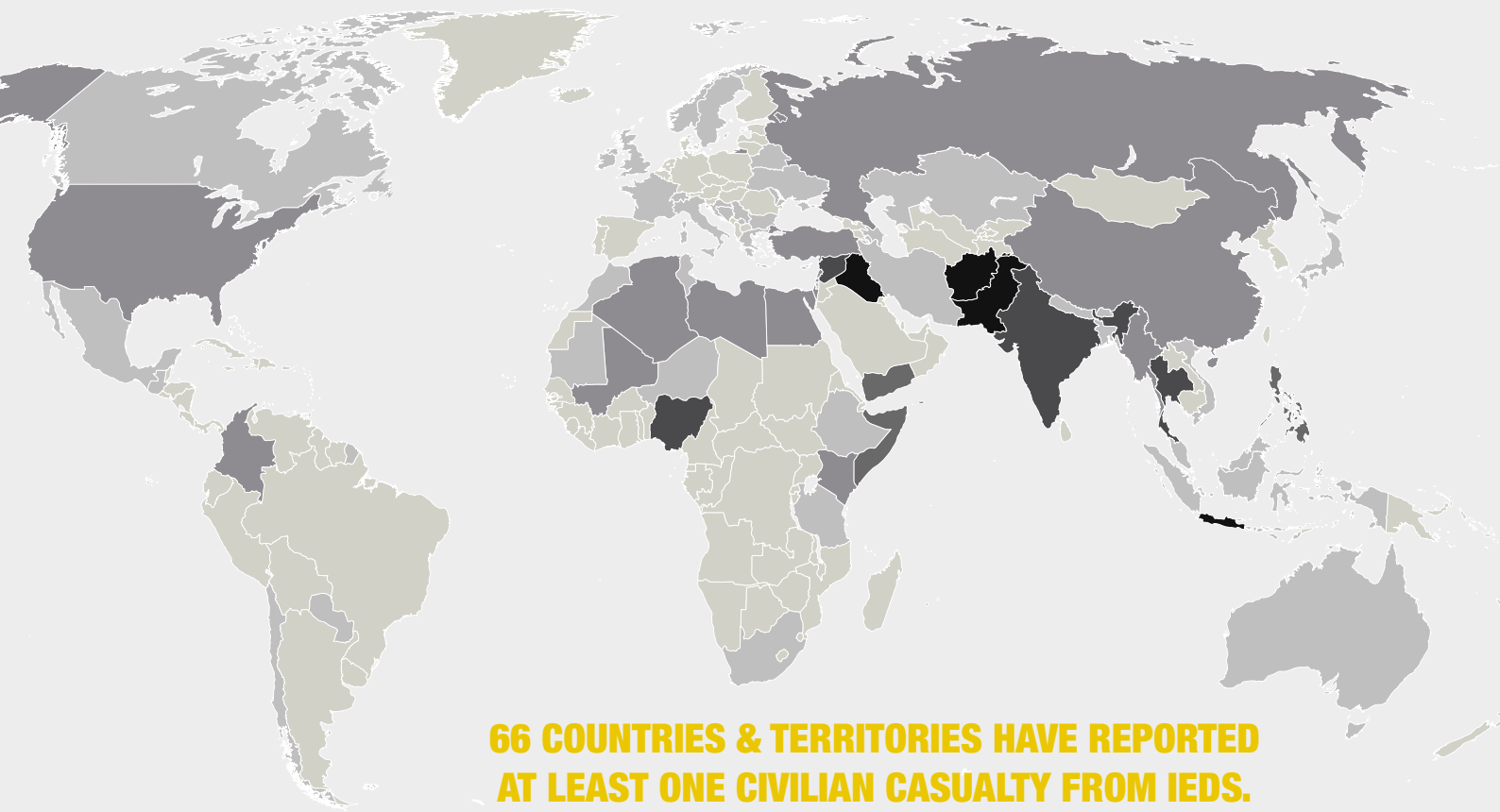
Extensive technological efforts, countermeasures and regulations are being adopted to prevent IED attacks and stem the global flow of IED materials. Yet the development of IEDs often evolves faster than counter-IED solutions, with insurgents finding ways around counter-IED measures.

This report will consider the materials commonly used to make IEDs, and what can be done to curtail these materials from falling into the hands of those who will use them to construct these deadly weapons.

IEDS: A GLOBAL PROBLEM

2011-2013

IMPROVISED EXPLOSIVE DEVICES HAVE A DEVASTATING IMPACT ON THE LIVES OF CIVILIANS AROUND THE WORLD.



MOST AFFECTED COUNTRIES BY IEDS



HOW IEDS WORK

IED definition

“A device placed or fabricated in an improvised manner, incorporating destructive, lethal, noxious, pyrotechnic or incendiary chemicals and designed to destroy, incapacitate, harass or distract. It may incorporate military stores, but is normally devised from non-military components.”

International Ammunition Technical Guideline, UN (2011)

In order to consider the materials used in the construction of IEDs, it is necessary to understand how they work.

IEDs generally consist of four components: a main charge, a smaller explosive initiator, an initiating mechanism (i.e. a switch or trigger) and a container.

Main charges form the bulk of the explosive content of an IED. It is the main charge that kicks out the devastating blast effects of an IED, but the charge itself is relatively inert, and so a far more sensitive primary explosive, the initiator, is required to detonate. For larger bombs more than one detonator, or a detonating cord, might be used to ensure that the entire main charge detonates simultaneously.⁴

As creating IEDs from their individual chemical components is extremely dangerous, IEDs are often sourced from commercially manufactured detonators. Sometimes an intermediate step is

needed between the detonator and main charge, known as a booster, which increases the explosive energy of the detonator.⁵

IEDs are a type of explosive weapon, and like artillery shells, rockets or missiles, they cause damage and death by projecting blast and fragmentation from around their point of detonation. They are often designed to project metallic components to increase its deadly impact, and often contain objects like ball bearings and nails. IEDs can cause wide area effects, and are especially destructive when used in populated areas, like markets.

Victim-activated IEDs are particularly indiscriminate, as they can be detonated by anything exerting enough pressure on them. Often the victims of such IEDs are civilians.⁶

It is possible for IEDs to be activated through a number of different methods, as this report will now outline.⁷

IED TYPES

IEDs can be categorised in a number of different ways, one of which is by their modes of detonation. Broadly, IEDs can be triggered in three ways:

TIMER-OPERATED IEDS

A timer-operated IED is simply detonated by a fuse, clock or a kitchen timer. A metal contact is attached to a clock hand or similar rotating mechanism, and when it reaches another metal contact, it completes the circuit and initiates the IED.⁷ Left in a crowded market or otherwise populated area, timer-operated IEDs are particularly dangerous to civilians; they detonate the moment the clock runs out, regardless of who is in their vicinity.

Countdown timers on electronic devices like mobile phones can also activate IEDs.

These IEDs have been used for decades. For example, in 1984 a bomb connected to a video-recorder timer targeted the then British Prime Minister Margaret Thatcher in a hotel in Brighton.⁸ They are still a common and deadly threat to unsuspecting civilians today. In Pakistan in January 2014, nine people were killed and a further 51 were injured when a timer-operated IED exploded in a mosque.⁹

VICTIM-OPERATED IEDS

A device is classified as 'victim-operated' when it is detonated by pressure pushing two metal contacts together, by a trip or pull-wire, or by the victim inadvertently pressing a button that allows an electrical current to flow to a detonator. Victim-operated IEDs are often detonated when a person or animal stands on them, or when they are driven over. These IEDs cannot distinguish between armed actors and civilians, and as such are inherently indiscriminate. To this end, victim-operated IEDs are considered de-facto anti-personnel landmines, and are prohibited under the 1997 Mine Ban Treaty.¹⁰



© Israel Defense Forces

The Israel Defense Forces exhibit a phone used as a remote detonator for explosive devices, 20 August 2002.

COMMAND-OPERATED IEDS

Command-operated IEDs are detonated generally by radio signals or command wire. Triggered only at the operator's behest, they theoretically provide the greatest level of discretion and control on the part of the perpetrator. They can cause civilian harm for a range of reasons including; as a result of deliberate targeting; through their sheer blast size (they often use of large amounts of explosives); or down to the deployment of these weapons to attack a target in populated areas.

Radio-controlled devices have been used since the 1970s, but are particularly adaptive to new technologies which makes them particularly difficult to detect and prevent.¹¹ Such a cat-and-mouse game between IED operators and detectors emerged in Iraq. In 2003, at the beginning of the Iraq war, simple household items like car alarm switches were used to set off IEDs. In response to this, US troops employed radio jammers. Insurgents reacted in turn by using remote controls with bandwidths beyond these jammers' range. Fairly rapidly, high-power devices such as extended-range cordless phones, and mobile phones on every network, using 1G to 3G, were brought into use, again outwitting currently available jammers.

Suicide bombings

Suicide bombings are a form of command-operated IEDs. They are ordinarily detonated at a time of the bomber's choosing, with a switch that completes an electrical circuit. Suicide bombs can result in especially high numbers of civilian casualties, since they are often detonated in populated areas like markets and outside places of worship. In one of many such examples (in January 2011), a suicide bomber killed at least 60 people in Tikrit, Iraq, wearing a heavy suicide vest containing ball bearings.¹²

Car bombs operated by suicide bombers also fall under the command-operated category.¹³ In Afghanistan in July 2014, a suicide attacker detonated a car bomb to devastating effect, killing at least 89 civilians, injuring a further 42, and destroying at least 20 shops.¹⁴

Just under a fifth of IED incidents in 2013 were reported to have involved suicide bombers, according to AOA data. Over 6,300 civilians

were killed and injured in 271 suicide attacks in 19 different countries. Suicide bombings have a particularly devastating impact, with an average of 31 people killed and injured in each attack. This number is far higher than for either victim-activated IEDs (6), remote detonation (11), or timer-operated (18).¹⁵

Another form of commonly command-detonated IEDs is the use of improvised explosive projectiles. These devices approximate the launch mode and behaviour of conventional ordnance like mortars and artillery rockets. They have been used in the Syrian civil war, where rebel groups have fashioned IED projectiles. One example of this is the "hell cannon", which launches homemade mortars made out of projectile gas canisters.¹⁶

TYPES OF IMPROVISED EXPLOSIVE DEVICES

An improvised explosive device (IED) is "a device placed or fabricated in an improvised manner, incorporating destructive, lethal, noxious, pyrotechnic or incendiary chemicals and designed to destroy, incapacitate, harass or distract."

IEDS CAN BE OPERATED IN THREE WAYS

TIMER-OPERATED IED

IED is activated by everyday household items such as:

FUSES
CLOCKS AND KITCHEN TIMERS
VIDEO RECORDER TIMERS
COUNTDOWN FUNCTIONS ON
MOBILE PHONES



VICTIM-OPERATED IED

A person, vehicle or animal activates an IED through:

TRIPWIRES
METAL PLATES
CLOTHES PEGS
TILT SWITCHES



COMMAND-OPERATED IED

An IED is activated by:

RADIO OR REMOTE CONTROL DEVICES
LIKE CAR ALARMS, RADIOS AND MOBILE
PHONES

SUICIDE BOMBERS, EITHER BY
CONCEALING EXPLOSIVES ON THEIR
BODY OR BY DRIVING A VEHICLE LADEN
WITH EXPLOSIVES



HOW IEDS ARE MADE

IEDs materials are generally sourced from three things: homemade chemicals, commercial materials, or military materials seized from unsecured stockpiles. This report takes each construction source in turn, and evaluates the efforts already underway to control and limit their availability.

One key response vital to the effectiveness of counter-IED efforts is robust data collection. Many countries, among a wide range of actors, are building IED-monitoring mechanisms to understand the threat in more detail. For example, countries in the European Union have access to tools and databases for exchanging information concerning explosives, including the EU Bomb Data System. These exchanges include specialised libraries where experts can share intelligence documents and access specialist forums.¹⁷ Non-EU countries have also been allowed access to the system; Norway, for instance, was granted access after the July 2011 attacks in Oslo.¹⁸

In America, the U.S. Bomb Data Center provides explosive tracing services, tracking explosives

from manufacturer to purchaser, to law enforcement agencies in and out of the country.¹⁹ The US Defense Department's Joint Improvised Device Defeat Organization (JIEDDO), established in 2006, is responsible for coordinating efforts to address IEDs globally.²⁰ It develops effective training techniques and ensures troops are properly equipped, as well as working to attack networks of bomb makers. However, although President Obama's Counter-IED policies are strong, JIEDDO's budget is to be slashed, something that should be criticised.²¹

AOAV has investigated the varied IED data collection efforts in its report, "Tracking IED Harm."²²

The strength of counter-IED safeguards varies from country to country, with their effectiveness reliant on how well officials implement them, the amount of resources dedicated to the threat, and the quality of the intelligence gathered.

This report details some of these safeguards and responses.



Abandoned 125mm HEAT tank shells awaiting disposal near Misrata, Libya in March 2012.

HOMEMADE EXPLOSIVE MATERIAL

Homemade explosive material can be made from everyday items. These include things like paint thinner, nail polish remover, fertiliser, bleach and hair dye.

For the purpose of this report, however, AOA has focused on two chemicals that are the most common homemade sources of IEDs: ammonium nitrate and potassium chlorate. Present in IEDs around the world, these chemicals are at the root of many of the IEDs driving terrible humanitarian harm in Pakistan and Afghanistan in particular.

As one IED material becomes better regulated and monitored, insurgents and armed actors often – perhaps self-evidently – shift their ambitions towards securing other materials. This report therefore also shines a spotlight on the emerging threat from hydrogen peroxide.

AMMONIUM NITRATE: THE GROWTH OF THE FERTILISER BOMBS

Ammonium nitrate-based fertilisers are used in the manufacturing of homemade IEDs, particularly in Afghanistan and Pakistan. They are considered the most common precursors used in IEDs.²³ Ammonium nitrate, however, is a complex material and is not effective as an explosive in small amounts.²⁴ Its effectiveness depends on several factors including the material's crystal size and density.

According to the World Customs Organization (WCO), the biggest producers of ammonium nitrate are Russia, the US and China.²⁵ However, it is an extremely popular and cheap material, made for legitimate agricultural reasons by factories worldwide. The primary concern faced by many security services is that ammonium nitrate can be legally purchased, not merely diverted or stolen during transfer.

Its central role in farming and mining makes it impossible to simply stop the transfer or

production of something so many legitimate businesses rely on. However, some historic measures have been implemented to regulate the availability of legally-available materials, and such measures might prove useful for other security services in their efforts in the future.

Developing regulations and monitoring: Ireland, the UK, and Norway

The IRA used ammonium nitrate-based fertilisers from the 1970s, prompting the government in 1972 to ban the chemical's use in Northern Ireland, except under very strict licence. The Dublin government followed suit, moving stocks held by farmers and wholesalers to army-guarded stockpiles.²⁶

There were also efforts to make ammonium nitrate harder to detonate, but *"bombers found ways to convert the modified AN (ammonium nitrate), called calcium ammonium nitrate (CAN) into bomb-making material"*, although *"such efforts may have discouraged some amateur bombers or reduced the extent of property damage."*²⁷

Ammonium nitrate-based fertilisers continued to be widely available throughout the rest of the UK, where there has never been a ban on the trade and transfer of the material. The UK's Department for the Environment, Food and Rural Affairs conducted research into alternative fertilisers to try and move farmers away from a reliance on this ammonium nitrate.²⁸ Yet it was found that other substances were less efficient and more damaging to the environment.²⁹ The UK continued to be *"the heaviest user of ammonium and ammonium nitrate-based fertilisers in the world,"* and this primary IED source continued to be readily-available.³⁰

In 2014, a "secure your fertiliser" initiative was rolled out by the National Counter Terrorism Security Office, where a 5-point plan encouraged

farmers to do the following: use a supplier approved by the Fertiliser Industry Assurance Scheme; keep fertiliser in a secure area; carry out regular stock checks and report any theft to the police; refrain from leaving fertiliser on fields overnight; and refuse to sell ammonium nitrate onwards without seeing documentation.³¹

Several laws have been passed in recent years to try and limit the transfer of particularly volatile ammonium nitrates.

In 2003, the UK government passed regulations on ammonium nitrate in England, Wales and Scotland. These required ammonium nitrate with a nitrogen content of greater than 28 per cent to pass a Detonation Resistance Test.³²

In 2009, the European Union imposed further restrictions, in the form of Regulation (EC) No. 552/2009, on the sale of ammonium nitrate. This regulation banned its sale where it contained over 28 per cent by weight of nitrogen that had not been subject to a detonation test.³³

The 2009 regulations also restricted the sale of ammonium nitrate with a nitrogen weight of 16 per cent or more, except for supply to farmers.³⁴ This was designed not only to lessen the risk of detonation when handling high ammonium nitrate content during agricultural activities, but also to make it harder to turn the fertiliser into explosives.

In 2013, EU regulations were passed designed to reduce the risk of highly concentrated chemicals being accessible to the public, as well as placing a duty on sellers to report any suspicious transactions of listed chemicals, including ammonium nitrate, to appropriate authorities.³⁵ The UK implemented these regulations in the form of the Control of Explosives Precursors Regulations 2014.³⁶

Such trans-national and regional regulation, however, must be combined with monitoring in order to be truly effective. The importance of monitoring is demonstrated in the case of Anders Behring Breivik, who detonated a car bomb in Oslo on 22 July 2011, killing eight people, before travelling to the island of Utoeya and killing 69 people with small arms.³⁷

Breivik carefully planned his attack, even registering as a farmer in order to purchase fertilisers. His name was linked to a Polish chemical company investigated by the Norwegian customs agency when they reviewed all recent imports of 14 high-risk precursors.³⁸ However, he was not personally investigated and so was permitted to purchase ammonium nitrate sensitisers from the Polish company, picking them up in Sweden and taking them back to Norway. Had the purchase of the aluminium powder been cross-checked with the fertiliser, suspicions to Breivik's intentions may well have been raised.³⁹

The ease with which Breivik accessed and transferred ammonium nitrate should serve as a stark warning for the future - that more needs to be done to regulate and monitor these chemicals.

Case Study: Afghanistan and Pakistan

IEDs have had a devastating impact in Afghanistan.

AOAV data shows that 5,347 civilians were reported as killed or injured by IEDs from 2011 to 2013.⁴⁰ They have also had a huge impact on military personnel, causing over half of US military deaths in Afghanistan from 2008 to 2011.⁴¹ The situation in Afghanistan demonstrates both the means through which materials to make IEDs are being transferred across borders, and the importance of regulating such materials and their transfer.

In Afghanistan itself, the use, production, storage and sale of ammonium nitrate fertiliser is prohibited, and has been since January 2010.⁴²

However, much of the nitrate which is used to produce IEDs is transferred to Afghanistan from neighbouring Pakistan, where it is made legally and in large quantities.

Much of the calcium ammonium nitrate used in IEDs in Afghanistan comes from two factories in Pakistan, owned by the Fatima Group.⁴³ The fertiliser legally made and traded by the company would be enough to make over 20 million IEDs.⁴⁴ While various initiatives have attempted to reduce the availability of these materials, production has never stopped, the group's Chairman blaming

THE WORST IED ATTACKS

VISUALISING THE FIVE WORST IED ATTACKS FROM 2011 TO DECEMBER 2013.

QUETTA, PAKISTAN

DATE: 16 FEBRUARY 2013

RESPONSIBILITY: LASHKAR-E-JHANGVI

THE ATTACK

A suicide attack using 1,000kg of explosives was detonated in a busy market. The explosion destroyed dozens of vehicles, and completely leveled a two-story building comprising over 40 shops.



TOTAL KILLED: 89



INJURED: 221

PESHAWAR, PAKISTAN

DATE: 22 SEPTEMBER 2013

RESPONSIBILITY: JUNDULLAH BRANCH OF THE TEHREEK-E-TALIBAN PAKISTAN (TTP)

THE ATTACK

Two suicide bombers struck a Christian congregation at All Saints' church in Peshawar. It was reported that six kilograms of explosives were used in the suicide vests of the bombers.



TOTAL KILLED: 85



INJURED: 100

KANO, NIGERIA

DATE: 20 JANUARY 2012

RESPONSIBILITY: BOKO HARAM

THE ATTACK

A series of coordinated bomb attacks and gunfire targeted police stations, military barracks, state security headquarters, a passport office and an immigration office. Subsequently, police found a further 10 unexploded car bombs and 300 devices made from aluminium cans and other explosives in the city.



TOTAL KILLED: 185
CIVILIANS KILLED: 150



INJURED: AT LEAST 50

DAMATURU, NIGERIA

DATE: 4 NOVEMBER 2011

RESPONSIBILITY: BOKO HARAM

THE ATTACK

Banks and churches were targeted in multiple IED attacks in the capital of Yobe state.



TOTAL KILLED: 148



INJURED: 131

MOGADISHU, SOMALIA

DATE: 4 OCTOBER 2011

RESPONSIBILITY: AL-SHABAAB

THE ATTACK

A suicide truck bomb exploded outside four government ministries, including the Ministry of Education. Many of the dead were students. It was reported that the suicide bomber had driven the truck, laden with drums of fuel, into a checkpoint.



TOTAL KILLED: 82



INJURED: 150

other countries that produce the material in greater quantities and intensity.⁴⁵

Security efforts have increasingly focused on ways to prevent the fertiliser from ending up being used as a weapon, such as exploring ways to track it once it has left the factory.⁴⁶

Efforts at working with manufacturers have had mixed results. The Fatima Group had improved its packaging and distribution in an attempt to prevent its fertiliser from falling into the wrong hands, taking simple steps like dyeing the crystals to make diversion more detectable. Yet still ammonium nitrate continues to find its way into the hands of bomb makers in Afghanistan through its porous borders with Pakistan, Iran and China.⁴⁷

*“Twice a week, a caravan of trucks lumbers out of volatile northwest Pakistan city in the dead of night and makes its way toward Afghanistan, loaded with one of the most coveted substances in a Taliban bombmaker’s arsenal: ammonium nitrate fertilizer... The amounts ferried are staggering. Each truck carries 130 bags, each of which contains 110 pounds of ammonium nitrate. A caravan typically has least 12 trucks, which means a single night’s shipment can move 85 tons of the fertilizer.”*⁴⁸

Through intelligence work, forensic police investigations, and custom controls, states have placed a priority on disrupting supply chains and networks behind the transfer of materials and technical knowledge, which enables IED manufacture.

Programme Global Shield (PGS), established by the World Customs Organization, INTERPOL and the United Nations Office on Drugs and Crime (UNODC) in 2011 is one of the only international control mechanisms for the transfer of homemade explosive materials. PGS was set up to monitor and thwart the trafficking of precursor chemicals. In its industry experts list 14 chemicals, including ammonium nitrate, which pose the “*greatest threat for use as explosive*.”⁴⁹

Customs administrations from 85 countries share information on these precursor chemicals, and 51 aggregate seizures equating to 140.67 metric tons of chemicals reportedly occurred in 2012-13.⁵⁰

The programme does suffer from pitfalls, the most serious being that China, perhaps the world’s largest exporter of explosive precursor chemicals, does not participate in Shield.⁵¹

In Pakistan and Afghanistan the program has also had limited success. In 2011 Shield claimed to have seized 33 tons of precursor chemicals, including ammonium nitrate.⁵² Yet NATO’s International Security Force (ISAF) in Afghanistan, alongside Afghan forces, was reported in 2012 as having seized almost fourteen times that - with 480 tons of ammonium nitrate fertiliser taken.⁵³

Global Shield is a fine initiative that has unified efforts to tackle the most prominent and destructive source materials of IEDs. While the successes of ISAF and Shield should be applauded, it has also been recognised that they only address a small percentage of the scale of the problem: “*We are sweeping ammonium nitrate fertilizer off the battlefield at historic rates. But the IEDs are going up at historic rate, too...*” said one senior US official in 2012.⁵⁴

Far stronger domestic law enforcement is needed to back up the measures to make tracking easier. In an anonymous interview given in 2010 one businessman claimed to pay \$830 in bribes to local police and officials for a single truckload of ammonium nitrate. At that time no Pakistani court had ever convicted anyone of smuggling ammonium nitrate into Afghanistan.⁵⁵

Domestic failures and weaknesses inevitably undermine international attempts to stem the flow of materials across borders. It is only through a completely joined-up effort backed by strong political will that regulation at source will see its full effect realised.

POTASSIUM CHLORATE: MAKING THE SWITCH

Potassium chlorate has been used in the production of IEDs for decades.⁵⁶ It is a powerful source material, and was used to devastating effect alongside sulphur and aluminium powder to construct the IEDs used in the 2002 Bali bombings.⁵⁷

However, it has only recently been significantly used in countries like Afghanistan. With so many

resources being put into attempting to stem the flow and effect of ammonium nitrate-based fertilisers in Afghanistan, insurgents are increasingly turning to potassium chlorate. In June 2013 it was reported that 60% of the IEDs in Afghanistan contained potassium chlorate.⁵⁸

Brigadier General Robert Walters, Deputy Director for Operation and Intelligence at JIEDDO has said that this type of precursor, banned for sale within Afghanistan itself, is still legally imported from neighbouring countries, such as Pakistan for use by the textile and matchstick industries. In the same manner as ammonium-nitrate, the chemical is then diverted to insurgents for use in IEDs: *“We believe insurgents perceive potassium chlorate as being easier to use and a more effective explosive.”*⁵⁹

Not only is it easy to use, it is also cheap. Whereas a 110-pound bag of ammonium nitrate is reported to cost \$160 in Afghanistan, the equivalent weight of potassium chlorate costs only \$48.⁶⁰ Imports from India, China and Iran, to Pakistan have *“spiked significantly”* in recent years. In August 2013 100 tonnes of bomb-making equipment, including potassium chlorate, was seized in Quetta, Pakistan, near the Afghan border.⁶¹

This emergence of potassium chlorate as a primary ingredient in IEDs in Afghanistan is of deep concern. It shows the ease and speed with which IED-makers can switch ingredients and sources for their deadly devices.

For security, customs and trade officials, this poses a considerable challenge. It is extremely difficult for them to understand and measure the threats passing right in front of their eyes, masquerading as common household or business supplies.

The hard truth is that the production of fertilisers is unlikely to be dramatically curtailed any time soon. Their legal trade is too valuable to many countries around the world. In order to limit the misuse of these fertilisers as much as possible, a host of bodies would have to be involved, governments and private industries alike. Cross-border sales and subsequent transport of fertilisers must be further regulated, and domestic laws should be

adopted to regulate their use. Concerted efforts should be made to follow up reports that fertilisers are being used to manufacture IEDs. All of this requires considerable cost, political commitment and tighter cross-border controls.

HYDROGEN PEROXIDE: THE LONDON 7/7 BOMBINGS

What happened?

On 7 July 2005, 52 people were killed and over 700 injured when four suicide bombers detonated explosives on three London underground trains and one London bus.

The bombs

Each IED consisted of several kilograms of high explosive containing a mixture of pepper and hydrogen peroxide. Each was detonated by an improvised electric detonator consisting of a primary high explosive compound made using hydrogen peroxide.⁶²

The inquiry into the bombings highlighted that *“the bombers were able to purchase and store their equipment without questions being asked.”*⁶³ Failed bombings in London a couple of weeks later also used hydrogen peroxide, the cost of which was reported to be only £550.⁶⁴

Response

In 2013 EU regulations were passed, reducing public access to chemicals such as hydrogen peroxide above a defined concentration.⁶⁵ Retailers and manufacturers are now responsible for restricting sales and correctly labelling their products.⁶⁶ The UK implemented these regulations in the form of the Control of Explosives Precursors Regulations 2014, which requires, amongst other measures, a licence to be obtained before regulated substances can be supplied.⁶⁷

COMMERCIAL EXPLOSIVE MATERIAL

If not based on homemade fertiliser sources, IEDs are often based wholesale on commercially manufactured explosive materials and detonators. Detonators, one of the four main parts of an IED and the hardest to simply make from scratch, are often taken from commercial stockpiles. As Roger Davies, a counter-IED specialist and AOA board member puts it: *“If you gave a terrorist a choice, he’d always use a commercial detonator, and it’s only when the supply of commercial detonators gets tricky that they’d produce their own...it’s dangerous. They end up losing their fingers. Or worse.”*⁶⁸

When such stockpiles are not secured, there is a lack of regulation in place, or officials simply turn a blind eye to the illicit trade in commercial explosives and detonators, then these materials can be used with tragic consequences for civilians.

Regulations have been implemented domestically to prevent illicit diversion. For example, Michael Cardash of the Israeli police and a former senior bomb disposal officer, told AOA that in Israel *“everything is regulated very strictly. There’s great difficulty to get commercial explosives...you need special permits, and there’s only one company that makes them.”*⁶⁹

The first challenge facing regulators is understanding the scale of the problem of diversion. The European Commission 2012 review mentions proposals to establish the EU Database on Explosives, which would aim to collect and provide a centralised access point to technical data about commercial explosives available on the EU market.⁷⁰

The establishment of a database containing detonator manufacturers and the characteristics of their detonators, such as serial numbers or other distinguishing markings, would be beneficial to the international community. Such a database would allow detonators to be traced back to their

point of origin. It would however also require a significant level of engagement with the private sector and as such would probably need to be supported by enforced regulation to this end.

Regarding plastic explosives, some restrictions have been adopted in an attempt to combat their use by non-state actors. In the aftermath of the Lockerbie bombing in 1989, the Security Council passed Resolution 635, calling on states to devise and implement measures to prevent acts of terrorism, including those involving explosives.⁷¹

By 1 March 1991, the Convention on the Marking of Plastic Explosives for the Purpose of Detection was adopted.⁷² It requires State Parties to mark plastic explosives with a chemical agent that can be detected by commercially available vapour or particle trace detector, and/or dogs.⁷³

When the Syrian military requested 500 tons of explosive nitroamine RDX from two Indian firms in 2009, the US demanded that the Indian Government terminate the transfer of the material, as *“the sheer volume of RDX that Syria’s military is contemplating purchasing is of particular concern.”*⁷⁴

It was indicated that the US Ministry of External Affairs Technology Unit would investigate the proposed sale.⁷⁵

Three case studies, from three continents, show good and bad current practice in developing regulatory responses to limit the availability of commercial explosives and detonators.

SPAIN

Incidents

- September 1999, Euzkadi Ta Askatasuna (ETA) stole eight tonnes of dynamite from a factory in Brittany
- March 2001 ETA stole 1.6 tonnes of dynamite and 20,000 detonators from a warehouse in Grenoble⁷⁶
- The bombs used in the 2004 Madrid bombings, in which 191 people were killed and more than 1500 wounded by an Al Qaeda-affiliated terrorist group, used material stolen from a mine in the Asturias region of Spain⁷⁷

Response

In December 2005 France passed three laws requiring security to be strengthened at premises manufacturing and storing explosives.⁷⁸ Spanish legislation in this area is now “*widely considered to be the strictest in the EU.*”⁷⁹

In 2010, 500 kilos of a nitroglycerin-based substance was stolen from a quarry in Portugal. The Spanish Guardia Civil was notified as “*a matter of routine procedure*” since “*international cooperation standards*” imply notifying neighbouring countries whenever large amounts of explosives are stolen.⁸⁰

NIGERIA

Incidents

- Commercial explosives are often used in IEDs used to kill and injure civilians in Nigeria. In 2013 Boko Haram raided a construction site in Yobe, stealing 150 kilos of explosives and hundreds of detonators⁸¹
- Explosives used in suicide attacks in August 2014 were reportedly stolen by Boko Haram from a quarry run by a Chinese road construction company in May that year.⁸²
- In November 2014, Boko Haram militants raided a cement factory and seized dynamite from a quarry, where they reportedly had “*unhindered access to the quarry site.*”⁸³

Response

No legal regulations have been adopted in response to any of these incidents. Clearly, Nigerian authorities should ensure that commercial premises and any explosives they contain are kept as securely as possible to ensure that Boko Haram and other extremist groups does not have ready access to explosive materials.

AFGHANISTAN

In 2010, Pentagon officials estimated that Afghanistan had around \$1 trillion in untapped deposits of precious minerals including gold, silver and iron ore.⁸⁴ These seams clearly present economic opportunities for the country, but they also present the potential for corruption and unsustainable development.⁸⁵ Illegal mines exist: *“often makeshift structures created by blasting mountainsides indiscriminately.”*⁸⁶

In 2013, it was recognised by the Security Council’s Monitoring Team that: *“Explosive materials, detonating cords and detonators are being produced and sourced in an increasingly professional manner”* and that control of their supply *“is central to undermining the capacity of the Afghan insurgency to use [IEDs].”*⁸⁷

A number of measures were proposed by the Monitoring Team, such as:

Requiring mining companies to keep detailed records of explosive material and detonator imports;

Different colours being used to represent different manufacturers, so that a clear chain of supply could be established.

Monitoring sales, collecting data on commercial detonators, and imposing strict regulations both on commercial detonators and commercial explosives might make immediate and substantial inroads in preventing the manufacture of IEDs.



© Simon Conway/AOAV

UXO outside Misrate from explosive violence in Libya, 2011.

MILITARY EXPLOSIVE MATERIAL

The scattered detritus of explosive remnants of war (ERW) litter many countries that have experienced explosive violence. Combined with abandoned or unsecured military stockpiles, unexploded ordnance creates a fertile hotbed of IED materials.

Military-grade explosives, such as plastic explosives like Semtex and conventional military ordnance like artillery shells and landmines, can be used to construct IEDs. These weapons, which contaminate wide areas long after hostilities have ceased, can pose a grave threat to civilians in and of themselves, and are often recycled by non-state armed actors to make new bombs.

Unexploded ordnance has provided the militant group Al-Shabaab with the raw material for IEDs.⁸⁸ Syrian rebel fighters make regular use of explosive materials from government shells that have failed to explode.⁸⁹

UNSECURED STOCKPILES

An especially troubling aspect of military explosive materials being used in the production of IEDs is that of unsecured military stockpiles. Particularly when a country is already unstable, unsecured stockpiles can result in explosives falling into the hands of militants.

There are a number of existing international instruments that seek to address issues to do with stockpile management. These include the 1997 Mine Ban Treaty, and Protocol V to the Convention on Conventional Weapons (CCW).⁹⁰ Collectively this regulatory framework should reduce the availability of manufactured explosive weapons to be made into IEDs.

Yet over and over again, despite warnings from activists and monitors on the ground, the international community has failed to act to prevent weapons from a past conflict becoming the new weapons of the next.

IRAQ

IED attacks in Iraq have had a devastating impact on civilians for many years. Thousands have lost their lives and been injured. Iraq saw more civilian casualties from IEDs between 2011 and 2013 than any other country. In 1,596 IED attacks AOAV recorded 24,413 civilian deaths and injuries.⁹¹

The widespread availability of conventional ordnance, abandoned and left unsecured after the 2003 conflict began, has contributed to these terrible statistics.

In January 2003, the Al Qaqaa storage facility south of Baghdad was sealed by the Atomic Energy Agency. The facility contained 377 tons of explosives.⁹² By April 2003, the explosives had vanished.⁹³



© Sgt. Robert A. Sturkie, U.S. Marine Corps

US marines prepare to destroy artillery shells found in an old ammunition supply in Iraq, January 2006.

In the autumn of 2003, US military commanders estimated that 130 known weapon and ammunition storage sites in Iraq contained between 650,000 and 1,000,000 tons of munitions.⁹⁴ This did not include unknown arms caches.

“There were just not enough boots on the ground, and the military didn’t give it a high enough priority to stop the looting. Tens of thousands of tons of ammunition were being looted, and that is what is fuelling the insurgency.”

David Kay, the former chief US weapons inspector.⁹⁵

A US Defense Intelligence Agency report as early as November 2003 stated that the vast majority of explosives and ordnance used in IEDs against coalition forces came from stockpiles and caches.⁹⁶

IEDs quickly became the “greatest casualty producer among our troops in the field,” as described by General Abizaid, the top American commander in the Middle East during the first years of the Iraq war.⁹⁷

Between July 2003 and October 2007, IED attacks killed over 1,600 coalition personnel.⁹⁸ The

number of IED attacks in Iraq increased dramatically, from 100 IED attacks per month in 2003 to 100 attacks per week in 2004 to 100 attacks per day in 2007.⁹⁹

In October 2004, Human Rights Watch stated that it had given coalition forces detailed information about massive stockpiles of unsecured Iraqi explosives and munitions, even providing GPS coordinates: “But when we informed coalition forces, they told us they just didn’t have enough troops to secure these sites,” said executive director Kenneth Roth.¹⁰⁰

Once stockpiles were located, the way that they were secured was simply not dealt with in an adequate manner by coalition forces. As one Colonel recalled: “Some engineer units thought that blowing bunkers full of ammunition by pouring diesel on the floor and setting it on fire, would cause ammo inside to detonate and fully destroy it... All they had done was scatter munitions everywhere.”¹⁰¹

Every effort should be made to identify and secure major weapons stockpiles to prevent such explosives being used to make IEDs. Concerted efforts to clear land contaminated by unexploded ordnance and destroy abandoned or unsecured stockpiles continue globally, largely due to the impetus of the 1997 Mine Ban Treaty and 2008 Convention on Cluster Munitions. States must sign up to these treaties and dedicate resources to their application.

Without such action, unsecured stockpiles will continue to be exploited, and their impacts will continue to devastate civilian communities.

LIBYA

When NATO began their no-fly zone in Libya in 2011, after Gaddafi was condemned by the UN for “gross and systematic violation of human rights,” significant weapon stockpiles were identified throughout the country.¹⁰² NATO’s air strikes destroyed or damaged 6,000 military targets, including ammunition bunkers.¹⁰³ But rather than the explosive materials being destroyed, ordnance was spread across open fields. On the ground, journalists and NGOs reported unsecured



The UN headquarters in Baghdad after the attack in August 2003.

stockpiles and munitions scattered around, creating a dangerous and difficult situation for citizens, particularly children.¹⁰⁴

After coming across a field full of munitions, Richard Spencer writing for The Telegraph described how: “we picked our way nervously through the field, into an orchard. Here there were boxes containing rubbery and plasticky blocks... They were clearly marked: Semtex and TNT.”¹⁰⁵

“...[we saw]... pile upon pile of landmines, neatly stored in their boxes. I made an initial, conservative calculation that there were 60,000 of them. I now learn that it was two and a half times that: 150,000.”

Richard Spencer, describing stumbling across a field in Libya in September 2011.

Such raw explosive material can easily be transformed into IEDs. “Two artillery shells can make a car bomb, and there are hundreds of thousands of them missing in Libya,” Peter Bouckaert of Human Rights Watch reported.¹⁰⁶

Despite efforts to secure stockpiles by NGOs, the challenges posed have included a lack of assistance from the national government, including “resource limitations, such as those related to funding, staff with technical expertise, and explosives for controlled demolitions; difficulties in gaining access to abandoned ordnance sites; and the need to increase national capacity for clearance.”¹⁰⁷

In December 2013, the Security Council expressed concern about Libya’s unsecured weapons, calling upon the government to take more ‘concrete’ measures such as ensuring proper management and the safe storage of weapons.¹⁰⁸

The failure to secure stockpiles of weapons in the aftermath of the airstrikes in Libya has had lasting

effects on the region. Violence has escalated in countries around Libya, as arms have fallen into the hands of insurgents, rebels, and non-state armed actors.

IEDs have grown as a threat to civilians in Libya since the invasion. In December 2013 Libya saw its first ever suicide bombing when seven people were killed by a blast at a checkpoint near Benghazi.¹⁰⁹

Unsecured stockpiles have not only pose a danger to civilians within Libya, but there are reports of weapons flowing out of the country and fuelling conflicts elsewhere. In 2013 the UN Security Council’s Group of Experts reported that the “the proliferation of weapons from Libya continues at an alarming rate,” spreading by land and sea to a suspected 12 countries.¹¹⁰

Cross-border transfers of weapons from Libya to Egypt significantly increased after 2011: “Egyptian authorities say the weapons are shipped from Libya, which is awash with arms, and smuggled into Gaza by gangs operating in Sinai.”¹¹¹ As well as Egypt and beyond, Syria was a “prominent destination for some Libyan fighters and Libyan military material.”¹¹²

Tunisia, Algeria and the Niger have also been affected by weapons originating in Libya.¹¹³ In 2012 a Security Council report stated that 645 kilos of Semtex and 445 detonators were seized during a convoy interception in the Niger. The explosives were reportedly destined for Al Qaeda militants in Mali, and their seizure indicated that “terrorist groups have been acquiring arms, weapons and explosives from Libyan military stockpiles.”¹¹⁴

CONCLUSION

From Iraq to Ireland, Afghanistan to Nigeria, Thailand to Russia, IEDs have claimed thousands of lives and torn apart communities. States and international organisations have been slow to respond collectively to this international security problem, but in the past decade there have been numerous counter-IED programmes and innovative technological responses, as well as strict national and regional regulations put in place.

Globally there is clearly a growing awareness on the storage and security of materials that could potentially be used in IEDs.

Yet as AOA V has shown, an increasing number of civilians have been killed and injured by IEDs around the world. As such, more clearly needs to be done.

Homemade explosives can be easily smuggled through porous borders, and it is all too easy for commercial explosives and detonators to be diverted onto the black market. Unsecured stockpiles of fertiliser and commercial explosives used in the mining and construction industry can also be raided. While military stockpiles, as we have recently seen, can be looted by armed groups and used against the most advanced militaries, causing a significant loss of life.

This report has shown that there is a vast amount of practical measures being taken that can be modelled and adopted by other counter-IED actors.

There needs to be a greater awareness of the number of civilians killed and injured each year by IEDs, and a greater condemnation of their use, from both political and religious figures.

Information sharing between countries should not be overlooked if there is to be a joined-up and concerted effort to reduce global IED harm. According to Professor Oxley, co-director of the Center of Excellence in Explosives Detection, Mitigation and Response at the University of Rhode

Island, *“There is an amazing amount of stuff going on right now, there really is. There’s more communication between countries than there ever has been. There’s also a fair amount of funding, so I think we’re doing pretty good.”*¹¹⁵

There are strong networks of information sharing around the world, but the difficulty lies with engaging countries that have a reputation of keeping information on materials that could be used for the construction of IEDs to themselves. As former senior bomb disposal officer Michael Cardash of the Israeli police states: *“I would say the biggest problem, and an easy one to solve, is sharing knowledge. People don’t like to share knowledge.”*

He continues: *“Countries don’t like to share knowledge, but it saves a lot of money because you will find that some countries are working on the same projects all over the world, trying to work on the same problems all over the world. And instead of sharing the knowledge, they’re wasting a lot of money trying to find solutions.”*¹¹⁶

Data collection on IED use, and sharing this data, would help bodies including law enforcement, scientists, academics and NGOs.

Engaging with private industries, for example, to establish a database on the characteristics of their detonators would aid authorities in establishing the chain of supply, and identify where detonators used in IEDs are originating.

Measures can then be implemented to attempt to prevent such material being used to create IEDs.

In short counter-IED efforts have come a long way in the past decades. However, as the threat from a wide range of insurgents and armed actors continues to shift elusively these efforts must also expand and change to meet them. New technologies may improve detection and control mechanisms but can equally be harnessed by IED users to develop new deadly dangers to civilians.



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A pile of rusting UXO lies outside an abandoned stockpile outside Misrata, Libya, in March 2012.

Ultimately one of our greatest weapons against IEDs lies in strong, well-enforced regulation. At the moment however, it is one of our greatest weaknesses.

Regulations governing restrictions on precursor materials fail to stop the spread of IEDs if they are not implemented properly. At the same time, greater restrictions are not always the best

solution, as they may place a high burden on private industries and damage the economy, particularly in developing nations.

Governments and the private sector should work together to establish cost-effective ways to curtail the flow of IED materials, both within and across borders.

RECOMMENDATIONS

- States and international organisations should work collaboratively to generate greater awareness of the number of civilians killed and injured each year by IEDs, and encourage a greater stigma from political, religious and social leaders on the use of IEDs.
- Deaths and injuries caused by IEDs, and all forms of armed violence, should be promptly and accurately recorded. Such recording is not only a basic right of every victim, but can help provide evidence to prevent and reduce the impact of armed violence.
- Victims of IED attacks should receive a full range of support including treatment for both physical and psychological harm. States should work to recognise and support the rights of victims.
- More research is needed to explore the long-term and indirect harm of IED attacks in populated areas. In particular studies on victims of less high profile attacks would be important contributions as would research on the mental health effects of living with IED threats.

HOMEMADE EXPLOSIVE MATERIAL

- All states should increase efforts to control access to the components of IEDs, including addressing the transfer and trade of illicit materials.
- States should sign up and support the work of Programme Global Shield, and should provide resources to ensure its continuing survival.
- As a matter of urgent priority states should share purchase information of large or suspicious transactions of precursor materials between countries and its law enforcements, as well as the industries that produce and sell precursor materials.

COMMERCIAL EXPLOSIVE MATERIAL

- States and the private sector should both give and ask for support to secure stockpiles of explosives and detonators in the mining and construction industry need greater security.
- States and the private sector should work together to create a database containing detonator manufacturers and the characteristics of their detonators, such as serial numbers or other distinguishing markings, would be beneficial to the international community. Such a database would allow detonators to be traced back to their point of origin.

MILITARY EXPLOSIVE MATERIAL

- States, the private sector and international organisations should create a greater awareness that unsecured stockpiles, whether fertiliser stockpiles, stockpiles of commercial or military explosives and detonators, is a source for those who manufacture IEDs.
- Securing stockpiles must be a high priority for invading forces and states involved in armed conflict. Stockpiles must be guarded to prevent those who wish to make IEDs from accessing the material.

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ACTION ON ARMED VIOLENCE

Action on Armed Violence (AOAV) is a London, based charity that has a central mission: to reduce harm and to rebuild lives affected by armed violence.

We do this by carrying out field work, research and advocacy to reduce the incidence and impact of global armed violence.

The number of fatalities from armed violence is estimated to be over half a million people killed every year. Around two thirds of these violent deaths are estimated to occur outside conflict situations. Poorer countries are particularly badly affected.

We seek to remove the threat of weapons, monitor the impact of explosive weapons around the world and investigate what causes armed violence – from guns to suicide bombings. We aim to clear land of explosive weapons and work with governments to regulate guns.

We work with victims of armed violence, offering psychosocial assistance, providing opportunities to help them earn a living and to try to reduce conflict at local levels.

We work to build communities affected by armed violence, working with governments and measuring and monitoring the incidences and impacts of armed violence around the world.

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