Nuclear Weapon Prohibition Treaty: A Safeguards Debacle

Successive NPT review conferences have recognised nuclear disarmament will require safeguards that are both rigorous and universal. In concluding the nuclear weapon prohibition treaty, however, the negotiating states have failed to require a universal high safeguards standard. Rather, the treaty sets different standards depending on a party's circumstances. This approach not only damages the treaty itself, but also the prospects for disarmament and potentially the NPT. If the text cannot be corrected, what should have been an inspirational treaty will instead remain divisive and counterproductive.

Safeguards that are both rigorous and universal are absolutely essential for achieving and sustaining nuclear disarmament. This has been recognised by successive Nuclear Non-Proliferation Treaty (NPT) review conferences. In particular, Action 30, agreed in the Final Document of the 2000 Review Conference and reaffirmed at the 2010 Review Conference, stresses that when nuclear weapons have been eliminated the highest standard of safeguards applied by the International Atomic Energy Agency (IAEA)—currently comprehensive safeguards and additional protocols—should be applied universally to all states.

The Treaty on the Prohibition of Nuclear Weapons (TPNW; 'prohibition treaty') was adopted on 7 July 2017. A key issue in the negotiations was to determine what the treaty should require on safeguards. Considering that all the states participating in these negotiations were also party to the NPT review conference decisions, the prohibition treaty should have reflected these decisions and required the universal application of the highest safeguards standard. Instead, in direct contradiction of the review conferences, the prohibition treaty sets differential safeguards standards: the highest standard will apply to nuclear-armed states

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after they have disarmed, but the standard for other parties depends on the status of their safeguards arrangements when they adhere to the treaty.

It is difficult to understand how the treaty resulted in this anomaly. No doubt one factor was that a sizeable number of states with substantial safeguards experience boycotted the negotiations, thereby depriving the negotiations of much-needed expertise. The main problem was that the negotiations were side-tracked by NPT politics: Brazil, Egypt and some others pursued their political opposition to the IAEA Additional Protocol regardless of the detriment to disarmament. In so doing these states have damaged not only the prohibition treaty but disarmament prospects and potentially also the NPT.

The treaty outcome is all the more surprising because in the negotiations states with an Additional Protocol in force, or signed, outnumbered those without an Additional Protocol by 87 to 37. It reflects on the leadership and conduct of these negotiations that a minority was allowed to subvert the process, and that the majority were complicit in this undermining of NPT review conference decisions. Now the international community is faced with the challenge of finding a way to correct the treaty or work around it to repair the damage.

Safeguards differentiation in the prohibition treaty

The prohibition treaty sets out two different safeguards standards:

The highest standard—a safeguards agreement with the IAEA 'sufficient to provide credible assurance of the non-diversion of declared nuclear material from peaceful nuclear activities and of the absence of undeclared nuclear material or activities in that State Party as a whole'—applies to parties that had nuclear weapons after 7 July 2017 (the day the treaty was adopted) but eliminated them before joining the treaty (Article 4.1). This formulation corresponds to the combination of a Comprehensive Safeguards Agreement (CSA) and an Additional Protocol (AP), the most effective form of safeguards currently applied by the IAEA. Broadly speaking, a CSA facilitates verification relating to the non-diversion of declared nuclear material and activities for nuclear weapons activities, and an AP facilitates verification concerning the absence of undeclared nuclear material and activities.

This standard also applies to parties that have nuclear weapons upon joining the treaty, but only after they have eliminated their nuclear weapons and weapon programme (Article 4.3). Inexplicably, the treaty has no safeguards requirement for these parties while their nuclear weapons and weapon programme are being implemented. This is a major weakness: elimination of a state's nuclear weapons and programme could take years, during which time robust safeguards are required to ensure the state is not producing new weapons to replace those it is eliminating. At the very least, the treaty should have required such states to apply a CSA and AP to civil and non-sensitive nuclear materials and facilities immediately on adhering to the treaty, and ideally to apply appropriate monitoring and verification arrangements to the sensitive materials and facilities during the disarmament process until the required CSA and AP enter into force.

A lower minimum standard—a CSA without an AP—applies to a party that does not have a safeguards agreement when it joins the treaty (Article 3.2). Currently, there are 12 NPT parties without a safeguards agreement in place. It is not clear why the negotiating states considered that an AP, to facilitate the identification of any undeclared nuclear material and activities, is not needed for these states. Article 3.2 notes that such states may adopt 'additional relevant instruments', implying the AP, in the future but it does not specify this as a standard.

Critically, this lower standard also applies to parties that do not have an AP in place when the prohibition treaty enters into force. For parties that did not have nuclear weapons on 7 July 2017, the treaty requires only that they will maintain the IAEA safeguards obligations they have when the treaty enters into force (Article 3.1). Some parties will have a CSA and AP, thus meeting the highest safeguards standard. Others,

however, will have only a CSA.

This results in uncertainty on how the safeguards requirements will apply: we know which states currently have an AP in force, so will meet the treaty's higher safeguards standard, but we do not know whether any of the states presently without an AP will have one in place when the treaty enters into force. The treaty does not require these states to conclude an AP, they can remain under the lower safeguards standard. This differentiation is counterproductive to the ban treaty's objective of achieving disarmament. Also, as already noted, it contradicts NPT review conference decisions.

The need for rigorous and universal safeguards

The issue of safeguards standards relates to two situations: (a) the standard needed to support the non-proliferation regime while working towards nuclear disarmament; and (b) the standard needed to maintain a nuclear-weapon-free world when disarmament is achieved, at which time all states will be non-nuclear-weapon states (NNWS). For case (a) Brazil, Egypt and some others seem to believe the AP is not required, and have said they will not conclude APs until the nuclear-weapon states (NWS) meet their NPT disarmament obligations. As will be discussed, this position is an obstacle to achieving disarmament. For case (b) NPT Action 30, which was supported by Brazil and Egypt amongst others, declares that CSAs and APs should apply universally—but the prohibition treaty contradicts this.

Non-proliferation and disarmament are inextricably linked. Strong safeguards against clandestine nuclear weapon programmes are absolutely essential for disarmament to proceed: nuclear-armed states will not disarm when other states, seen as potential (or actual) proliferators have refused to accept the most effective form of safeguards, namely, the combination of a CSA and AP.

The IAEA emphasises (see for example the IAEA News Release entitled 'Nuclear Safeguards Conclusions Presented in 2016 Safeguards Implementation Report'), '[i]t is only in countries with both a comprehensive safeguards agreement and an additional protocol in force that the IAEA has sufficient information and access to provide credible assurances to the international community of both the non-diversion of nuclear material and the absence of undeclared nuclear material and activities.'

The AP was developed to redress the serious safeguards weaknesses revealed by the discovery of Iraq's clandestine nuclear weapon programme. It is now 20 years since the AP was adopted by the IAEA Board of Governors, in 1997. Today APs are in force in 129 states and have been signed by a further 17. Of the 61 NNWS with significant nuclear activities, 50 (that is 82 percent) have an AP in force. Five more—Belarus, Iran, Malaysia, Serbia and Thailand—have signed APs but have not yet ratified them. Iran is voluntarily implementing an AP, which it signed in 2003 but has not ratified, and is committed under the Joint Comprehensive Plan of Action to submit it for ratification by the Majlis (parliament). This makes a total of 90 percent of NNWS with significant nuclear activities that have concluded or at least signed an AP.

There are six NNWS with significant nuclear activities that have not signed an AP: Algeria had an AP approved by the IAEA Board on 2004 but has yet to sign it; and Argentina, Brazil, Egypt, Syria and Venezuela have not commenced negotiation of an AP.

There are 32 NNWS currently without (as far as known) significant nuclear activities that do not have an AP. Among these states, of particular note is Saudi Arabia which has expressed interest in uranium enrichment.

In saying they will not conclude APs until the NWS meet their NPT disarmament obligations, Brazil, Egypt and others are ignoring the fact that the NPT is not a binary agreement between NWS and NNWS but also establishes commitments amongst all the NNWS, that they will accept the Agency's safeguards system (NPT Article III.1) to assure each other that they are not seeking nuclear weapons. As I discussed in Trust & Verify No. 132 (January-March 2011), the Agency's safeguards system is not static but evolves over time. With 90

percent of NNWS with significant nuclear activities having ratified or at least signed an AP, the protocol is now clearly recognised as an essential part of the Agency's safeguards system.

Legalistic attitudes undermine confidence

It is misguided to see acceptance of the AP as primarily a legal issue, or even a diplomatic issue. The purpose of safeguards is to provide confidence in a state's commitment against acquiring nuclear weapons, and to ensure timely detection of diversion of nuclear material to nuclear weapons if it occurs. Where a state refuses to accept the most effective form of safeguards, this raises concerns about the extent of its commitment to non-proliferation. This is especially the case for states like Brazil, that once had a nuclear weapon programme, and Egypt, that was found to have undeclared nuclear material and activities. The NPT makes it clear that the achievement of nuclear disarmament requires the collaboration of all parties, NNWS as well as NWS. Where a state insists on lower safeguards standards for itself, this must call into question the seriousness of that state's support for disarmament. Disturbingly, such a position works against disarmament proceeding.

Brazil claims that NPT Action 30 requires NNWS to accept the AP only after the NWS have eliminated their nuclear weapons. This is a misrepresentation of Action 30. Action 30 does not say that NNWS need not accept the AP until the NWS do. Rather, Action 30 addresses the wider application of safeguards in NWS; nuclear-weapon states are the sole focus of this Action. CSAs and full APs cannot apply to NWS while they have nuclear weapons (unsafeguarded nuclear material). Action 30 says once these states disarm, CSAs and APs should be universal. The implication is that CSAs and APs should already apply in the NNWS, and CSAs and APs will become universal through the ability to apply these to NWS as they disarm.

If non-nuclear weapon states with nuclear programmes refuse to conclude APs this will adversely affect confidence in the non-proliferation regime, which will impact on the commitment to non-proliferation by other states, as well as the preparedness of nuclear-armed states to proceed with disarmament.

Potential damage to the NPT

The prohibition treaty provides opportunities for legalistically-minded states to frustrate the objectives of the treaty and the NPT by attempting to cherry-pick the NPT's safeguards requirements.

The NPT requires NNWS to accept the Agency's safeguards system. What constitutes the Agency's safeguards system is determined by the IAEA's decisions and practice. Despite the continued refusal of a small minority (10 percent) of NNWS with significant nuclear activities to accept an AP, the AP is now established as an essential part of the Agency's safeguards system. However, the prohibition treaty is inconsistent with the NPT in three respects:

1. For a non-nuclear weapon state without a safeguards agreement, Article 3.2 of the prohibition treaty says the state need conclude only a CSA (Article 3.2 goes further and specifies that the CSA is to be INFCIRC/153 (Corrected)). But the NPT does not use the term comprehensive safeguards agreement, nor does it refer to INFCIRC/153, which did not exist when the NPT was concluded. Article 3.2 rigidly applies a specific safeguards agreement that will likely become outdated and thereby prejudges what new safeguards standards the IAEA may decide upon.
2. Further, Article 3.2 gives the state 18 months from joining the treaty to bring the safeguards agreement into force—this conflicts with the timing requirement in Article III.4 of the NPT and could be interpreted as extending the period allowed under the NPT.

For a non-nuclear weapon state without an AP, Article 3.1 says the state need only maintain the IAEA safeguards obligations it has when the treaty enters into force. This prejudges how the Agency's safeguards system is constituted both now and into the future. It also contradicts the expectation of NPT parties, expressed in Action 30 and elsewhere, that the AP

will be universal.

Critically, and controversially, NNWS states parties to the prohibition treaty without an AP could attempt to use Article 3.1 to claim they do not have to conclude an AP to meet their NPT commitments. In fact, a circular argument has been set up: AP opponents used their misinterpretation of Action 30 to insist on drafting Article 3.1 the way it is, and now they could try to use Article 3.1 to substantiate their interpretation of Action 30. While Article 3.1 is expressed to be 'without prejudice to any additional relevant instruments that (a party) may adopt in the future', it is far from clear how this might be interpreted in practice.

Article 18 of the prohibition treaty says 'implementation of this treaty shall not prejudice obligations with regard to existing international agreements … where those obligations are consistent with the treaty', but again it is not clear how 'consistent with' might be interpreted, and who would make this interpretation. As with any question of treaty interpretation, there is the practical issue of how an interpretation most supportive of the treaty's objectives (to promote disarmament) can be arrived at and how it can prevail.

What can be done?

A nuclear weapon prohibition treaty that does not require a rigorous and universal safeguards standard will fail to provide the confidence needed for disarmament to proceed and to be sustained.

The best approach would have been for the UN General Assembly to require further negotiations on the treaty in order to fix the problems in the text. However, the states that concluded this text are a majority in the General Assembly, and are unlikely to admit they have made a mistake (though it is possible some capitals might consider their delegations failed to secure a treaty that represents their national interest). In any case, this opportunity has passed, with the treaty being opened for signature on 20 September. So now, states that want to show support for the elimination of nuclear weapons are confronted with the decision whether or not to join a defective treaty. The challenge will be how to limit the treaty's damage on the NPT, the safeguards system, and the prospects for disarmament. If remediation is not somehow achieved, it will make it more difficult to negotiate and implement a universal and effectively verifiable prohibition on nuclear weapons in the future.

Now that the treaty is open for signature and redrafting is not possible (except through an amendment process, likely to be politically-charged, which is permitted under Article 10 of the treaty, but which would lead to differentiated obligations between original and amended treaty states parties), the only sure way to address the damage is by ensuring that all NNWS currently without an AP ratify an AP by the time the treaty enters into force. The treaty's entry into force requires the adherence of only 50 states, so could occur relatively quickly. At the very least, an effort should be made to ensure that all NNWS with significant nuclear activities or planning such activities have an AP by that time. NPT parties that have APs—the great majority—should do all they can to assist, persuade or pressure the holdouts to conclude APs. Providers of safeguards training, including regional Centres of Excellence, should support these states to build the capacity needed to implement the AP as a matter of priority. Where necessary, high level representations should be made to bypass entrenched bureaucratic resistance to the AP.

Nuclear suppliers should help by requiring an AP as a condition for supply for any NNWS—it is inexcusable that a number of suppliers have not yet done this. It is time for the AP holdouts to put aside political games and recognise that their national interest—including the achievement of nuclear disarmament—is best served by a strong non-proliferation regime, of which the AP is a key element.

The states expected to join the prohibition treaty also happen to be parties to the NPT. They should make statements clarifying their intention that on safeguards matters the NPT will prevail over the prohibition treaty.

Of course it is not game over when the treaty does enter into

force. Efforts must continue to ensure that any remaining AP holdouts do conclude APs. This is a second-best outcome however, as the treaty does not oblige a party to maintain an AP concluded after the treaty's entry into force (so as far as this treaty is concerned the party could later renounce its AP—though no doubt this would be taken up in the Security Council).

More broadly, the nuclear-armed states need to address the underlying reason for the prohibition treaty, namely, global concern about the lack of action on disarmament. While the NWS and their allies keep talking of the need for a step-wise approach to disarmament there are no signs of any such steps being taken. It would help the politics of the situation—as well as achieving much-needed progress—if the NWS and the other nuclear-armed states initiate a programme of practical steps to reduce nuclear risks and weapon numbers. De-alerting, extending New START, commencing discussions on START IV, stopping the South Asian arms race, and no first use/sole purpose (deterrence) declarations are just a few actions that come to mind.

The reality is that major risk reduction steps leading to the elimination of nuclear weapons will have to be negotiated by the NWS and other nuclear-armed states and cannot be imposed upon them. This needs to be facilitated by a negotiating process on arms reductions and disarmament encompassing all the nuclear-armed states. There is an urgent need to establish such a process. In addition to agreements on specific steps, this process could enable negotiations on broader nuclear weapon prohibitions, which, unlike the prohibition treaty, could be supported by all states. For example, a treaty on no first use may well be achievable. In time this could lead to a treaty prohibiting any use of nuclear weapons (in effect, saying that nuclear weapons exist only until they can be eliminated without endangering the security of any state).

However arms reductions and eventual elimination proceed, strong and universal safeguards, together with other verification, transparency and confidence-building measures, will be absolutely essential. In this regard it is regrettable that the nuclear weapon prohibition treaty adds to, rather than mitigates, the challenges to be overcome.

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Carlson was a member of the Advisory Board of the International Commission on Nuclear Non-Proliferation and Disarmament and was founding chair of the Asia-Pacific Safeguards Network. He is a fellow of the Institute of Nuclear Materials Management and recipient of the Institute's Distinguished Service Award. Carlson has written numerous papers and presentations on nuclear nonproliferation, disarmament and verification issues. In June 2012 Carlson was awarded the national honour of Member of the Order of Australia (AM).

The Need for Another Look at Tritium

In the 1990's, the debate surrounding the use and regulation of tritium, a radioactive isotope of hydrogen, had reached its peak. It was partly fuelled by the looming tritium stock crisis in the US, which required the Department of Energy to take a decision on how and where tritium used for US nuclear weapons would be produced. International proliferation crises involving Iraq and the Democratic People's Republic of Korea (DPRK) also bolstered the discussion around nuclear dual-use items and the need to significantly strengthen export controls. Tritium, when combined with deuterium, is used as fuel in the fusion reaction part of a hydrogen bomb and it is also used to significantly increase, or 'boost', the yield of a nuclear weapon. Although not an essential component of a nuclear bomb, tritium is nonetheless strategically important given how it impacts a nuclear weapon's yield-to-weight ratio and is therefore considered to be a crucial component of any nuclear weapon possessor state's arsenal.

Discussing tritium from an arms control perspective on both international and national levels has not been on anyone's agenda for the last decade despite the fact that various developments have taken place regarding the use, demand and supply of tritium. This article attempts to explain why this might be the case by examining these developments as well as the possible reasons behind a lack of debate and by questioning whether there still exists a need today for increased controls on the production, use and sale of tritium.

Tritium as a strategically important element in nuclear weapon arsenals

In order to understand the strategic importance of tritium, a few aspects regarding its nature should be clarified. As opposed to uranium and plutonium which both have extremely long half-lives, 703.8 million years for uranium-235 and 24,110 years for plutonium-239, tritium only has a half-life of 12.3 years, meaning it has to be periodically replaced for it to be used effectively as fuel in fusion weapons. Seeing as tritium cannot be found in nature, it has to be produced to regularly replenish rapidly decaying stocks. Tritium can be produced in heavy-water reactors or through the irradiation of Lithium-6 targets for instance. Whereas information on how nuclear possessor states use tritium in their nuclear weapon designs is often classified, how they produce tritium has generally been determined or at least been speculated on with various degrees of supporting evidence.

In the case of the United States, this has even been the subject of tremendous debate in the 1990's, which was best illustrated in Kenneth D. Bergeron's 'Tritium on Ice'. In 1998 Department of Energy Secretary Bill Richardson gave the green light to the commercial Tennessee Valley Authority (TVA) Watts Bar nuclear reactor to begin irradiation of lithium rods for the production of tritium to replenish stocks used for nuclear weapons. This decision seriously undermined the US' prohibition on the use of commercial nuclear facilities for the production of nuclear weapon materials. The US Department of Energy released a report to Congress in 2015 detailing its tritium management plan through to 2060. As it stands, production needs to be increased to meet tritium requirements by adding a second reactor to the production cycle, the fuel for which has to be Low Enriched Uranium free from nuclear non-proliferation policy restrictions. This might be a problem in the future, as the US is low on domestic supplies for LEU, and given that it has already blurred the lines between civil and military on one occasion, it might not be wise to take further action to weaken even more the separation between military and commercial nuclear activities.

In France, tritium destined for the French nuclear arsenal was produced in two Celestin reactors at Marcoule between 1967-68 and 2009. Plans for the construction of a new naval test reactor at Cadarache which would partly be dedicated to tritium production were decided in the 1990's but have been delayed, with the reactor not yet completed according to the French Atomic Energy Commission (CEA)'s website.

In China, tritium is produced by the Baotou nuclear fuel component plant, which is under the authority of the China National Nuclear Corporation (CNNC). In Russia, Rosatom's Mayak Production Association in Ozersk (also known as Chelyabinsk-65) produces tritium through the Ruslan and Lyudmila nuclear reactors, and should be able to continue to support any tritium needs for Russian arsenals in the future according to Oleg Bukharin. In the United Kingdom, the Chapelcross reactors were decommissioned in 2004 and defueled by 2013, and the Calder Hall nuclear power station was closed down in 2003. Both provided the UK with supplies of tritium. Since their closure, one can only speculate that tritium might have been supplied by the US as was previously done between 1960 and 1979 in exchange for plutonium under the Mutual Defence Agreement. See, for instance, 'The UK Naval Propulsion Programme and Highly Enriched Uranium' by Dr Nick Ritchie and The Guardian article 'MoD admits flying nuclear materials between UK and US' of 1 March 2016.

A thin line between commercial and military uses

Although tritium is well-known for its use in nuclear weapons, the radioactive isotope of hydrogen also has smaller scale civilian applications such as self-powered lights (exit signs and runway landing lights) and bio-medical tracers. The need for tritium as fuel in nuclear fusion research has increased in the last decade, and the implications of this rise in demand will be examined further in a later section of this article. What is essential to take into consideration at this stage is the fact that the relationship between the commercial and military applications of tritium is inherently linked, as Martin B. Kalinowski demonstrated in his 2004 book 'International Control of Tritium for Nuclear Nonproliferation and Disarmament'. As he describes it, industrial applications of tritium were enabled by the release of several quantities of tritium from military production in the early 1960's while the proliferative risks associated with tritium only became publicly apparent in the early 1990's. Given that the quantity of tritium needed for a nuclear weapon is relatively small, just a few grams, and that there is no difference between tritium used for military or for commercial purposes, any quantity of tritium that could be diverted for military use would be a significant issue.

The rise of dual-use export controls as a possible answer

The International Atomic Energy Agency's (IAEA) Comprehensive Safeguards Agreement (INFCIRC/153) does not include tritium as a 'nuclear material', and so it is not included in its annexes. Tritium was not even discussed during the agreement's negotiations in the 1960's, due to its dual-use potential only being widely appreciated decades later. However, when the IAEA's Model Additional Protocol (INFCIRC/540) was negotiated during 1996-97, the debate on whether to include dual-use items such as tritium, as well as the facilities for the extraction and recovery of tritium, clearly reflected countries' economic stakes on the matter. Canada, the most significant civilian producer of tritium, France and Japan, principal importers, insisted on omitting these items from the final list. An argument, put forward by Japan and which has often been used since for the case against stronger controls of tritium, is that tritium would only become a threat should a non-nuclear weapon state have the capability to manufacture an atomic bomb, which is what the safeguards system is intended to prevent. Considering this scenario has already unfolded several times since then, albeit not in the case of NPT states parties, this argument does not seem watertight.

However, as a result, under the Additional Protocol, states do not have to report on the production or handling of dual-use items such as tritium although the IAEA Secretariat did encourage greater transparency in this regard. To address the issue of imposing greater controls over an extensive list of dual-use nuclear items including tritium, tritium compounds and tritium facilities at an international level, the Nuclear Suppliers Group (NSG) adopted a list of export control guidelines in 1992. Among NSG members, Canada, France and Japan have all implemented these guidelines in their national legislation. Nevertheless, NSG members only rep-

resent 48 states, and neither India, Pakistan, Israel nor any Middle Eastern state is a member.

In a questionable move, the Canadian Nuclear Safety Commission approved a shipment to Iran in 2005 of self-powered lights containing tritium. Although the quantity was not anywhere near sufficient to boost a nuclear weapon, the sale occurred at a sensitive time for nuclear proliferation in Iran, especially as Iran had sought to obtain and manufacture tritium at the time (at least according to the Iran Watch website). As Kalinowski pointed out in the case of NSG guidelines implemented by national legislation, 'there are no provisions to verify the stated end-use or to detect removal or re-export to sensitive countries'.

The problem of verifiability of export controls is not new. Identifying the end-user and use is perhaps the most crucial step, but not an easy one as it requires significant expertise and resources at the facility/company level as well as at the national level. Both need an overarching international legal framework that can catch oversights and an international system that allows for cooperation and strives to raise awareness. Although significant efforts have been made in the field of dual-use export controls through initiatives such as the United Nations Security Council Resolution (UNSCR) 1540 Committee and the European Union's Chemical, Biological, Radiological and Nuclear Risk Mitigation Centres of Excellence Initiative (EU CBRN COE), much still remains to be done in terms of implementation, enforcement and verification of compliance.

The role of tritium in nuclear fusion power

An anticipated increase in the civilian use of tritium will likely have implications for tritium stockpile security. In recent years, tritium has gained prominence in the field of nuclear fusion research, with both the Tokamak Fusion Test Reactor (TFTR) and the Joint European Torus (JET) project using tritium. However, the International Thermonuclear Experimental Reactor (ITER) will have to buy the tritium required from the global inventories for its 20-year cycle, exponentially increasing the civilian amount of tritium needed in one location to several kilos. Bearing in mind that the amount used for commercial applications is about 100 grams per year, this represents a significant increase. According to the ITER website, 'for DEMO, the next step on the way to commercial fusion power, about 300 grams of tritium will be required per day'. Such large quantities are simply not available on the market which means that successful 'tritium breeding' will be an essential part of this project. ITER should provide the opportunities to test tritium breeding techniques.

These upcoming developments and their potential for proliferation were examined by Franceschini, Englert and Liebert in a 2013 paper (see works cited, below) which looks at different proliferation scenarios in the context of nuclear fusion. They mention the potential for nuclear weapon states to start using tritium produced by fusion reactors (should tritium breeding be successful) to replenish military stocks instead of relying on dedicated facilities. Although the lines between the civilian and military production of tritium have already been blurred in the US, this would represent a step in that direction elsewhere, especially as India and China are ITER members.

The quantities of tritium which will be used and produced in the context of nuclear fusion are significantly more significant than the tritium needs of a small or medium-sized nuclear arsenal. In this context, diverting small amounts for weapons purposes could go unnoticed, therefore creating increased proliferation risks. The authors of the 2013 paper explore various theoretical approaches to the proliferation risks posed by nuclear fusion in sometimes quite distant futures. Nevertheless, some scenarios resonate with the current security environment more than we would like. For instance, one realist scenario assumes that in the future, nuclear fusion might be the only technology used in countries like Japan and South Korea where, 'under the impression of a weakening US nuclear umbrella', access to fissile material and tritium could be diverted to military use quite easily without adequate controls. As it stands though, deuterium-tritium operations at ITER, which will require significant purchases of tritium in anticipation, are scheduled to commence in 2035, less than

20 years from now. This is not as far off as we might think, especially given the lead time needed to establish the necessary legal frameworks and associated controls to avoid most-likely proliferative scenarios.

A key element for vertical proliferation

On Sunday, 3 September 2017, the DPRK conducted its sixth nuclear test, the explosive yield of which is estimated to have been at 140 kilotons (according to US intelligence assessments). It is the DPRK's most significant nuclear test to date and, based on its size, was either a boosted fission device or, as the regime claims, a hydrogen bomb. Despite the fact independent experts have not yet confirmed or repudiated the DPRK's claim, it confirms that the DPRK has managed to secure some tritium. Whether it is a steady supply of tritium is uncertain but based on 2016 estimates by Hecker, Braun and Lawrence (see works cited, below), the DPRK can indigenously produce tritium at the Yongbyon nuclear facility through irradiation of lithium targets in either the IRT-2000 reactor of the 5MWe reactor. Satellite imagery analysis has also speculated at the building of a new facility which could be a modern tritium production facility. Based on the DPRK's last two nuclear tests and the increasing frequency with which Kim Jong-Un has proceeded to test ballistic missiles, one can speculate that a regular supply of tritium has indeed been secured.

These developments clearly indicate the role tritium and tritium processing technologies play in vertical proliferation. In Trust & Verify No. 152, Hugh Chalmers looked at the various ways the DPRK might be producing tritium, and he excluded the possibility of importing it. Although the direct import of tritium itself is indeed highly unlikely, the import of the technology needed to irradiate lithium targets is not, which still brings into question the efficiency of dual-use export controls today. Pakistan is also a good example when looking at the lack of control over the sale of tritium and its role in vertical proliferation, as Pakistan managed to buy components of a tritium purification plant from German companies in the late 1980's and is known to 'spike' its nuclear weapons with tritium.

Limits to the debate and future possibilities

The public discussion around the proliferation risks of tritium in the arena of international organisations has been limited, as there has been no mention of tritium in any NPT Review Conference or Preparatory Committee paper since 1995. In the context of the Conference on Disarmament, there have been passing mentions of tritium by the Member States in working papers on the potential for a Fissile Material Cut-off Treaty (FMCT). In 2003, Japan asked to exclude tritium from the FMCT as it is 'neither a fissile material nor a nuclear material' and in 2006 asked for it to be studied in detail by IAEA experts before considering any inclusion. In a 2007 summary of the reports by Conference coordinators, it is mentioned that some states identified tritium as a material that could, to some extent, be regulated by the FMCT. These have not amounted to much. Unfortunately, the FMCT itself has been deadlocked following years of stalling and more recently outright blocking by Pakistan. Should the FMCT's programme of work be permitted to go forth, it is timely for a reinvigorated debate on the subject of tritium controls.

Although tritium cannot be considered a fissile material, its strategic role in a nuclear weapon possessor state's arsenal, current or future, has been sufficiently highlighted to merit some debate and avoid the same fate it suffered under the Model Additional Protocol negotiations. Given Japan's remarks in 2003 and 2006, it seems likely that negotiations will take a similar turn if states which have stayed silent so far continue to do so. For China and Russia, this could be an opportunity to have a moral high ground vis-à-vis the US.

Encouraging debate at other levels of the United Nations, notably the First Committee, could provide further scientific research on the potential proliferation impacts of nuclear fusion research and how to prevent them. A similar focus on tritium requirements and associated risks in nuclear fusion could be developed at the level of the EU CBRN COE. Given the absence of an overarching international framework for the control of nuclear dual-use items, both domestically and for export purposes, and the current lack

of political will to establish one, a realistic interim solution could be to at least bring the issue back to prominence in a variety of multilateral arms control and non-proliferation arenas, perhaps in the context of further scientific and technical investigations into nuclear disarmament verification.

NEVINE SCHEPERS

Névine is a former VERTIC intern and interim administrator who is currently finishing an internship at the International Institute for Strategic Studies' (IISS) Nuclear Policy and Non-Proliferation Programme. Before joining first VERTIC and then the IISS, she worked as an analyst at IB Consultancy in the Netherlands on CBRN-related market analyses and events. She holds a Dual Masters Degree in European and Asian Affairs from the universities of Sciences Po in Paris and Fudan in Shanghai, where she wrote her Masters thesis on the EU and China's involvement in the Iran nuclear deal. She also completed a BA in Asian studies at the University of Sydney.

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Verification Watch

India-Pakistan: A Proposal to Beef Up Information Exchanges

Angela Woodward, Deputy Executive Director

At the beginning of this year, India and Pakistan exchanged official lists of their respective nuclear facilities; marking the 26th time that such an exchange had taken place. This is by a bilateral agreement – the Agreement on the Prohibition of Attack against Nuclear Installations between India and Pakistan - which was implemented in January 1992. The agreement stipulates that on the first day of each year, the two parties must exchange a list of their nuclear facilities, with both countries pledging not to attack those identified in the list. According to Toby Dalton, the co-director of the Nuclear Policy Program at the Carnegie Endowment, this is the most enduring nuclear confidence-building measure (CBM) on record in South Asia, due to the continuity of compliance with the agreement, even through times of hostile relations between the two states. Since the first exchange, there have been allegations by both India and Pakistan as to incompleteness of the facilities on their respective lists. Yet, due to the lack of verification measures in place for the agreement, the States are required to depend entirely on each other's voluntary declarations.

Since the partition of British India in 1947, India and Pakistan have endured a complicated relationship, characterised by several hostile events. Reflecting a commonly held view, the Stockholm International Peace Research Institute recently reported that both India and Pakistan are expanding their nuclear stockpiles as well as developing their missile delivery capabilities. The non-attack agreement is just one of the CBMs that exist between the two countries; measures which have been put in place as an instrument of peacebuilding and facilitating communication between the two states. Amongst other things, the two countries also exchange lists of nationals of each country lodged in their respective jails, have an agreement whereby they give prior notification to each other of significant military activities and agree to undertake to adopt adequate measures to ensure that they do not violate each other's airspace.

Recently, there have been arguments that this CBM concerning non-attack of nuclear facilities ought to be modernised to better suit today's regional realities. Nuclear powered states are part of those realities. Thus the measures in place need to be able to ensure that the use of such weapons is avoided. Amongst those who hold such a view is Toby Dalton, expressed in his article 'Modernize the South Asia Nuclear Facility "Non-Attack" Agreement' (Stimson, 28 June 2017). This article argues that the agreement should be changed in two ways. Firstly, that the wording of the agreement should be broadened so it goes beyond just nuclear facilities, to also include infrastructure which if targeted would similarly result in 'environmental or humanitarian catastrophe', suggesting large dams as something beneficial to include. Furthermore, the proposition of the inclusion of a means of exchanging information about threats posed by non-state actors, namely terrorists, in relation to facilities encompassed by the agreement. Dalton argues that the need for these changes to the agreement come from the fact that over time, the agreement has become 'merely symbolic' and no longer has the stabilising influence that it held when the agreement was first decided.

Mr Dalton goes on to acknowledge some of the possible difficulties that would arise in the event of modernisation of the non-attack agreement. It refers explicitly to the transparency of their respective nuclear facilities and the issues surrounding intelligence sharing and 'sources and methods' of gathering the information on threats posed by non-state actors. However, it is possible that these challenges are outweighed by the possible benefits that a modernisation of this agreement would bring. Both India and Pakistan have a vested interest in ensuring that attacks on one another's nuclear facilities are avoided at all costs. Perhaps the modernisation of this non-attack agreement could act as a means of continuing to build confidence and peace between these two countries, which would be a benefit to the region, and beyond.

Public-Private Partnerships in Human Rights Monitoring

Angela Woodward, Deputy Executive Director

On 16 May 2017, the Office of the United Nations High Commissioner for Human Rights (OHCHR) announced an agreement with Microsoft Corporation, displaying an unparalleled degree of support from a private corporation. Beyond a US$5m grant, the partnership includes pro-bono technical assistance over a period of five years. This will ensure that the OHCHR is able to utilise the latest technological advancements in advancing their mandate, to promote and protect human rights for all. Technological developments are having a significant impact on how human rights violations can be identified, monitored and verified. For instance, cell phones with the ability to take photos have meant that human rights abuses can be captured instantaneously, leading to an overwhelming amount of evidence to be verified and used. Brad Smith, president of Microsoft, believes there is 'a great untapped opportunity in front of us, to use technology as a tool in new ways to protect human rights around the world.' Microsoft will be able to work with the OHCHR to ensure that the abundance of information from different sources is dealt with promptly.

One of the initiatives of this partnership is an information dashboard known as 'Rights View.' The main purpose of this project is 'to connect different data sources' from, amongst other things, governmental, NGO and activist sources. This will act as a platform for the staff of the United Nations to consolidate information on human rights abuses on one comprehensive platform. Moreover, the accessibility to such data will work to ensure a 'swifter response in crisis situations.' In practice, it is expected that the programme will contain a page for each country with applicable data and themes documented.

As well as Microsoft's commitment to ensuring that technology is advantageously employed by the OHCHR, they also recognise the need to encourage further engagement on human rights with the private sector. Earlier this year, the OHCHR launched its most ambitious appeal yet, for US$253m in extra-budgetary funding for work to be carried out in 2017, considerably more than the US$129m received last year. In urging support from both member states and private donors, United Nations High Commissioner for Human Rights, Zeid Ra'ad Al Hussein, described his office as being 'dramatically and chronically underfunded.' Only forty percent of the OHCHR budget is covered by the United Nations, with the work carried out in relation human rights receiving a paltry 3.5 percent of the total UN budget. Before the deal with Microsoft, Laurent Saveur, head of external relations at the UN Human Rights Office, maintained that the OHCHR received 'close to zero from the private sector.' Ideally, this partnership will encourage the engagement with other private organisations in the technology sector.

Funding by a corporation (such as Microsoft) comes with potential risks. There is the chance that it could create a conflict of interest in the instance that the office felt compelled to speak out on human rights issues such as labour rights and data privacy, which could affect the donor's bottom line. However, Penny Hicks, the director of thematic engagement at the United Nations agency, states that significant due diligence had been carried out before accepting Microsoft's donation and that the organisation would never remain silent on issues to preserve the financial relationship. Microsoft's commitment to both respecting human rights and promoting human rights through the power of technology has existed well before this agreement. Microsoft aligns itself to a 'Global Human Rights Statement' which carries a commitment to promote human rights throughout the world. In practice, this is carried out through programs which give various NGOs throughout the world access to Microsoft products to carry out their work; equip communities with access to technology and information during times of natural disasters and humanitarian crises and operating programs focused on education in technology in underrepresented communities.

It may take some time for Rights View and other technological developments from this partnership to become operational. In the meanwhile, there are hopes that this ensures that the OHCHR can use the most up-to-date technology to their advantage, as well as encourage more support form the private sector.

S&T Scan

Nuclear explosion monitoring

Névine Schepers, Research Intern
Verification and Monitoring Programme

The Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organisation (CTBTO) held the sixth CTBTO Science and Technology Conference during 26-30 June 2017 in Vienna. The five-day conference brought together scientists from all over the world who work on test ban monitoring and verification in a display of strength and unity against a backdrop of lagging ratification efforts that have thwarted entry into force of the treaty for the last decade. Among the 44 states whose ratification of the CTBT is essential for its entry into force, only two, Colombia and Indonesia, have done so since 2007.

Coinciding with the CTBTO conference, a report published in early June, sponsored by the US Department of Energy, titled 'Trends in Nuclear Explosion Monitoring Research & Development: a Physics Perspective' highlighted the technical progress made by the scientific community to improve detection systems used in the CTBT's International Monitoring System (IMS). Previous editions of Trust & Verify have taken a more detailed look at the IMS as well as the system of On-Site Inspections (OSI). See notably 'The CTBT International Monitoring System: A tale of two tests' in Trust & Verify No. 154 and 'On-site inspection training in the CTBTO's formative years' in Trust & Verify No. 141.

The efficiency of the IMS relies on its globally deployed network of 321 seismic, infrasound, hydroacoustic and radionuclide detection stations. The first three elements refer to the waves produced by an explosion that can be recorded and analysed using waveform sensors, whereas radionuclide detection involves measuring quantities of radioactive noble gases that can confirm whether a detonation is indeed nuclear.

In the last 20 years, many contextual factors have had an impact on nuclear explosion monitoring research. Radionuclide monitoring techniques, for instance, have had to be refined to detect less evident radionuclide signatures produced during underground nuclear explosive tests. Moreover, background noise has required detectors to become more sensitive and at the same time more efficient in singling out signals related to nuclear explosions, especially if those are 'small.' Finally, the continuous changes brought by the digital revolution in respect to data processing have had an influence on monitoring capabilities, providing tools to quickly compare new data against archived sets, as well as enabling advances in seismic tomography.

Taking into account these factors, nuclear explosion monitoring methods have known several breakthroughs in the areas of source physics, signal propagation, sensor development and signal analysis. These advances range from the detection of various relevant radionuclides and increasingly accurate magnitude and yield estimates to the development of different simulation models that can illustrate the impact of nuclear detonations on the surrounding environment. These include explosion source models, infrasound source models as well as crustal models and seismic velocity models.

Developing these models using data from past nuclear tests while adjusting to technological changes is no easy endeavour, but they provide monitoring teams with analysis tools to discriminate between nuclear and conventional explosions and earthquakes, and more accurately measure elements such as yield or magnitude. These tools have proven useful when monitoring the Democratic People's Republic of Korea's (DPRK) series of nuclear tests.

The CTBTO encourages further technical developments and the use of IMS data for purposes other than nuclear explosion monitoring (such as environmental monitoring or the study of climate change).

The IMS itself, which will eventually comprise 321 monitoring facilities and 16 laboratories worldwide, achieved a milestone in June 2017, with the certification of its remaining hydroacoustic station. Scientific collaboration and progress have proved essential in the establishment of the CTBT's verification regime and remain, as the Science and Technol-

ogy Conference has demonstrated, at the forefront of the organisation's efforts to push for the treaty's entry into force.

As far as arms control treaties go, the CTBT has a robust verification system to support it, reinforced by a large community of scientists working to improve it, but will continue to fall short of its full potential until it enters into force. On 20 September 2017, just as some states readied themselves to sign the Treaty on the Prohibition of Nuclear Weapons, CTBT state parties attended the Article XIV Conference, chaired by Belgium and Iraq, with the aim to promote and facilitate the treaty's entry into force. Hopefully this time, the all-too-recent DPRK nuclear test will serve as a wake-up call and provide an opportunity for invigorated action on the treaty's entry into force.

Centre News

Director's reflections

Andreas Persbo, Executive Director

The last edition of Trust & Verify came out on 4 July 2017. One significant development since then is worthy of some further reflection. On 7 July 2017, the Treaty on the Prohibition of Nuclear Weapons (TPNW) (in all six authentic texts) was registered in the United Nations Treaty Series. The treaty is the subject of the lead article of this issue.

As of Friday, 22 September 2017, 53 states had signed the treaty, and three countries (Guyana, the Holy See and Thailand) had also deposited instruments of ratification.

High signature rates are present in the Latin American and Caribbean Group (GRULAC) and the African Group, with 48 and 30 percent respectively of the group membership signing up to the new agreement. It is less impressive elsewhere: about 25 percent of the Asia-Pacific Group has signed, and 20 per cent of the Western European and Others Group (WEOG). No country from the Eastern European Group, most of which are in NATO, has signed the treaty to date.

Going forward, it is likely that ratifications will overlap with treaty membership to the African and Latin American Nuclear Weapon Free Zones. The number of WEOG states signing on may, perhaps, go up with one or two in the coming year, but is likely to remain low for as long as NATO remains united against nuclear prohibition.

Only nine signatory states are represented on the 35-country Board of Governors of the International Atomic Energy Agency (IAEA), meaning that it may become difficult to get the Agency's full and undivided cooperation in the implementation of certain aspects of the TPNW, and this should be a cause of concern to ban-treaty advocates.

Governmental and non-governmental communities alike are now abuzz with speculation over what this treaty may mean for the 2020 Review Conference for the 1968 Nuclear Non-Proliferation Treaty. It is likely to complicate its conduct, but

will not be the principal reason for a potential failure to adopt a Final Document. Indeed, how to address and manage deteriorating relations between the United States and the Russian Federation will be a more pressing matter for the conference's President.

According to Article 15 of the TPNW, the agreement enters into force 90 days after the deposit of the 50th instrument of ratification, acceptance, approval or accession. While this may happen in 2018, it will almost certainly be achieved by late 2019. VERTIC will continue to report on the implementation, monitoring and verification implications of the treaty into the future.

National Implementation Measures

Scott Spence, Programme Director

During this quarter, National Implementation Measures (NIM) programme staff worked on legislation surveys for the implementation of the Biological Weapons Convention (BWC) for five states and on legislation surveys for the implementation of the Chemical Weapons Convention (CWC) for two states.

On 17-18 July NIM Programme Director Scott Spence and Senior Legal Officer Sonia Drobysz attended the 40th Codex Alimentarius Commission in Geneva. Their participation took place in the context of EU CBRN CoE Project 53 which includes as one activity assisting Central Asian countries to realise their international obligations to harmonise national bio-safety and bio-security legal frameworks with Codex Alimentarius food safety laws, including by developing a legislative analytical tool for the Codex. On 24 July, Sonia Drobysz participated in a national roundtable on strengthening the implementation of UN Security Council Resolution 1540 (UNSCR 1540) organised by the government of Antigua and Barbuda and the United Nations Regional Centre for Peace, Disarmament and Development in Latin America and the Caribbean (UNLIREC). Dr Drobysz presented on the adoption of additional measures to implement UNSCR 1540.

On 4 August, Deputy Executive Director Angela Woodward joined a regional workshop for the Pacific Region on the universalisation of the Biological Weapons Convention convened by the BWC Implementation Support Unit. Ms Woodward's presentations focused on the BWC in the broader context of international legal instruments, the BWC in the regional context and the national implementation of the Convention. From 7-11 August, Sonia Drobysz participated in a veterinary legislation identification and biological threat reduction mission in Panama City, Panama. She joined the World Organisation for Animal Health (OIE) Veterinary Legislative Identification Mission (VLIM) as a biothreat legal expert, to analyse, assess and make recommendations on Panama's veterinary legislation to prevent, detect and respond to biological threats. On 16 to 18 August, NIM Legal Officer Cédric Apercé attended the 3rd African Conference on Emerging Infectious Diseases and Biosecurity in Accra, Ghana, organised by African civil society and concerned professionals from the Global Emerging Pathogens Treatment Consortium (GET). He presented on the international legal framework for biosecurity and dangerous pathogen management.

Mr Apercé attended the Summer Programme on Disarmament and Non-Proliferation of Weapons of Mass Destruction in a Changing World co-organised by the T.M.C Asser Institute and the Organisation for the Prohibition of Chemical Weapons (OPCW) in The Hague, Netherlands from 4-8 September. Sonia Drobysz and Cédric Apercé then conducted a workshop on national legislation for the implementation of the BWC organised in collaboration with the Government of Sierra Leone and the United Nations Office for Disarmament Affairs (UNODA) Geneva, under the EU Council Decision 2016/51 in support of the BWC. Taking place from 13-15 September in Freetown, Sierra Leone, the workshop gathered ministries and national agencies' representatives to discuss the current status of Sierra Leone's implementation of the BWC and the way forward.

Verification and Monitoring

Larry MacFaul, Programme Director

The VM programme has had a busy few months and is set for a similar level of activities until the end of the year. Fortunately, our capacity to deliver has also increased during this period. In July, the team carried out preparatory logistical work and research for several of our current projects. We were also involved in several administrative activities for the organisation as a whole.

In late August, the programme completed two workshops aimed at gathering views on a prospective multilateral Group of Scientific Experts on Nuclear Disarmament Verification (GSE-NDV). These follow similar meetings, for European and African stakeholders, in April 2017 under a project run under a grant from the Norwegian Ministry of Foreign Affairs. A workshop for stakeholders in Asia was held in Tokyo, Japan from 26–27 August 2017, in collaboration with the Tokyo Institute of Technology. The VM programme was represented by Andreas Persbo, Executive Director, Angela Woodward, Deputy Executive Director and Névine Schepers, then serving as Acting Administrator. A workshop for stakeholders in Latin America took place in Rio de Janeiro, Brazil from 31 August-1 September 2017 with support from the Nonproliferation for Global Security Foundation. The VM programme was represented by Larry MacFaul, Programme Director for Verification and Monitoring, Andreas Persbo and Noel Stott, Senior Researcher. The workshops involved researchers, diplomats and policy makers drawn from Australia, China, Japan and the Republic of Korea, and from Argentina, Brazil, Chile and Mexico respectively. All of the participants took part in their personal capacity.

Since our return, we have been drafting a report providing an outline of the feasibility and desirability of a GSE-NDV based on the views expressed in all the consultative workshops. We intend to launch the publication at a side-event during the UN First Committee in late October 2017.

Later in September, Alberto Muti re-joined the VM team as a Senior Researcher after a year of working on nuclear security with a range of countries for King's College, London. Alberto was a highly valued colleague at VERTIC and instrumental in delivering a number of our projects, so we are very excited to have him back. Shortly after his return, on 20 September, he travelled to the International Atomic Energy Agency's General Conference to meet with officials from several countries and with assistance providers to discuss nuclear issues and VERTIC's work in the area.

On 21 September, we ran a seminar in London on the Open Skies Treaty. The meeting brought together government officials from the US and UK, representatives from the Royal Air Force Regiment and remote sensing companies and arms control experts from academia and research institutes. The meeting focused on the treaty itself, current and future airborne and satellite sensors, as well as advanced technologies such as quantum applications. The project is supported by the US Department of State. The full VM programme attended and the meeting was facilitated by Larry MacFaul, Andreas Persbo and Hartwig Spitzer of Hamburg University, our project partner.

The team is very grateful for the helpful, enthusiastic and well-informed participation of colleagues from different countries, organisations and companies in all of the meetings outlined above.

During this period, we have also spent considerable time exploring opportunities to contribute further to our organisational mission to strengthen international peace and security in the coming months and years.

During this quarter, the VM programme bid farewell to Matt Korda, intern, and Névine Schepers who was an intern then Acting Administrator this quarter. Both Matt and Névine were terrific interns and highly productive in their short time here both in terms of research and writing as well as idea generation. They were also a pleasure to work with. We wish them both well for the future.

Grants and administration

Helen Cummins, Administrator

VERTIC is delighted to welcome back Alberto Muti after a year working on nuclear security at King's College. Alberto will be leading on our nuclear safeguards and security work as a Senior Researcher.

Three new interns took up their posts over the summer. The Verification and Monitoring programme welcomed Matt Korda, who has an MA in International Peace and Security from King's College and Névine Schepers, who holds a dual Masters from Sciences Po, Paris and Fudan University, Shanghai. The Office of the Executive Director welcomed Tilly Hampton, who holds Bachelor of Laws and Bachelor of Arts degrees from the University of Canterbury in Christchurch, New Zealand. Tilly is currently studying for a Masters in International Relations and Diplomacy at the University of Canterbury, for which she received a Masters scholarship from the New Zealand Peace and Disarmament Education Trust (PADET). She is providing research assistance to VERTIC's Deputy Executive Director, Angela Woodward.

We said good-bye to Mariama Gerard who is moving abroad with her family. We thank Mariama for her service and wish her well in her new venture. VERTIC gave a warm welcome to Helen Cummins, who has taken over the administration of the charity.

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