

From the Panel of Experts to the Multilateral Sanctions Monitoring Team: *plus ça change* in North Korean sanctions monitoring?

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Introduction

On 28 March 2024, Russia vetoed a United Nations Security Council (UNSC) resolution to extend the mandate of the UNSC 1718 Committee Panel of Experts. This veto marked the demise of the Panel, which was the primary body responsible for monitoring and reporting on the implementation of, and any incidents of non-compliance with, the UNSC sanctions measures adopted pursuant to UNSC Resolution 1718 (2006) and subsequent resolutions addressing the Democratic People's Republic of Korea's (DPRK) – hereafter North Korea – weapons of mass destruction (WMD) and ballistic missile programmes. Although the sanctions

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measures themselves remained in place, Russia's veto ensured that no authoritative and independent body would exist to gather, examine and analyse information relating to their implementation, violation and evasion.

In a bid to fill the void created by the lapse of the Panel's mandate, on 16 October 2024, the governments of Australia, Canada, France, Germany, Italy, Japan, the Netherlands, New Zealand, South Korea, the United Kingdom and the United States announced the establishment of a new Multilateral Sanctions Monitoring Team (MSMT). The stated objective of the MSMT is to "assist the full implementation of UN sanctions on the DPRK by publishing information based on rigorous inquiry into sanctions violations and evasion attempts." Beyond this initial announcement, which was made just as evidence started to emerge that North Korea was preparing to deploy troops to train and fight in support of Russia in the Kursk region and in Ukraine, little else is known about the new body.

As the eleven states which established the MSMT set out to operationalise the mechanism, they have an opportunity to take stock of the successes and the drawbacks of the original Panel of Experts system. They will also need to consider a key distinction between the two bodies: although both were established to monitor the UNSC's North Korean sanctions established in Resolution 1718 (2006) and subsequent resolutions, the Panel of Experts operated within the UN system, whereas the MSMT will operate outside of it. Hence, one of the immediate challenges for the MSMT mechanism is how to gain wider authority and legitimacy within the international community.

A history of North Korean sanctions monitoring: the Panel of Experts

On 14 October 2006, the UNSC adopted Resolution 1718 (2006) in response to the test of a nuclear weapon by North Korea on 9 October 2006. This Resolution imposed numerous sanctions measures on North Korea, including an arms embargo, asset freezes and travel bans for persons involved in its nuclear weapons programme, as well as prohibitions on the import and export of certain goods and materials. When North Korea conducted another nuclear test on 25 May 2009, the UNSC responded in June 2009 by adopting Resolution 1874 (2009), which expanded the existing sanctions regime and established the Panel of Experts. As North Korea continued to conduct nuclear weapons tests—four more in 2013, 2016 (twice) and 2017—and, eventually, ballistic missile tests, the sanctions regime continued to expand until it developed into what is now one of the most comprehensive ever adopted by the UNSC.

The Panel of Experts, at the same time, became increasingly involved in monitoring compliance with the sanctions.

Initially composed of seven members (an eighth member was added pursuant to Resolution 2094 (2013)), the Panel had expertise in customs and export controls; finance and economics; air and maritime transport; missile issues and other technologies; non-proliferation, procurement and trade; non-proliferation and regional security; nuclear issues; and other WMD and conventional arms. Its members, the experts themselves, were selected by the UN Secretary-General on the basis of expertise and an equitable geographic distribution.

The Panel was instructed to assist the UNSC Sanctions Committee on North Korea (formally named Security Council Committee Established Pursuant to Resolution 1718 or the '1718 Committee') in carrying out the Committee's mandate as defined by Resolutions 1718 (2006) and 1874 (2009); to gather, examine and analyse information from states, UN bodies and other parties regarding implementation of the sanctions measures, in particular on incidents of non-compliance; and to make recommendations on actions that the UNSC, the 1718 Committee or UN member states may consider adopting to improve implementation of the sanctions measures. The Panel published their analysis and recommendations in annual and, starting in 2017, biannual reports. The Panel of Experts was also tasked with assisting UN member states in preparing national implementation reports on measures they had taken to implement the provisions of the UNSC Resolutions, as well as supporting the 1718 Committee's efforts to develop Implementation Assistance Notices.

Between 2009 and 2024, the Panel of Experts published more than 20 reports on the implementation of the North Korean sanctions regime and provided valuable information detailing the sanctions evasion activities undertaken by the country and its network of facilitators. During this time, the Panel identified many individuals, companies, entities and vessels which failed to comply with the sanctions obligations and made frequent recommendations to the 1718 Committee for their designation. The Panel's reports also issued regular guidance to states and their respective authorities to help detect and prevent non-compliance with, or evasion of, the UNSC obligations. Similar guidance was issued by the Panel to private sector stakeholders in a wide range of industries to help mitigate their unwitting participation in prohibited activities or engagements with designated individuals, companies or entities.

From 2018 onwards, however, the Panel started to find itself caught within the crosshairs of international geopolitical tensions. It became increasingly difficult for the members of

the 1718 Committee, which can only make decisions by consensus, to agree on implementing the recommendations issued by the Panel of Experts. In August 2018, for instance, Russia used the Committee's consensus procedure to [block](#) a US proposal to designate a Russian bank for alleged violations of the North Korean sanctions measures. The UNSC itself, where the veto power of any of the permanent five members could be used to stifle resolutions seeking to implement the Panel's recommendations, similarly adopted its most recent resolution designating individuals and entities pursuant to Resolution 1718 (2006) over seven years ago on 22 December 2017.

The UNSC and the 1718 Committee's gradual inability to act on the recommendations issued by the Panel effectively reduced the latter's mandate to gathering, analysing and publishing information on sanctions implementation for UN member states and private sector stakeholders, and on incidents of non-compliance. Between 2018 and 2024, this task, too, became progressively more difficult to achieve as the Panel of Experts, which was bound by the same consensus-based decision-making procedure as the 1718 Committee, increasingly failed to agree on the publication of certain issues in their reports. In many cases, disagreement among the experts led to specific instances of non-compliance with the sanctions measures being omitted from the reports altogether.

In 2024, the challenges troubling the work of the Panel of Experts became insurmountable. The earlier outbreak of full-scale war between Russia and Ukraine in 2022, and the subsequent diplomatic and military [rapprochement](#) between Russia and North Korea pushed the Panel to its limits, as it was now tasked with gathering and examining [evidence](#) of blatant violations of the sanctions regime by a permanent member of the UNSC. In its final [report](#) of 7 March 2024, the Panel observed "clear evidence of the transfer of goods and materials" between North Korea and Russia, stopping short of explicitly calling the transfer a violation of the sanctions measures. The damage was done, and on 28 March 2024, Russia vetoed—and China abstained from voting on—a draft resolution intended to extend the Panel's mandate, which ended on 30 April 2024.

The Multilateral Sanctions Monitoring Team: learning from past experiences

The response by the countries which voted in favour of extending the Panel of Expert's mandate was swift. In April 2024, the USA, Japan and South Korea signalled their [intention](#) to pursue alternative means of monitoring the implementation of the UNSC's North Korean sanctions regime, either within

the UN system or outside of it. The subsequent discussions reportedly considered multiple fora for the monitoring of North Korean sanctions, eventually culminating in the decision to establish the MSMT on 16 October 2024.

In their joint [announcement](#), the countries which established the MSMT recalled the veto which disbanded the Panel of Experts and described their new initiative as "a multilateral mechanism to monitor and report violations and evasions of the sanction measures stipulated in the relevant UNSCRs."

This initial announcement and description reveals that at least one aspect of the intended direction and purpose of the MSMT will be to continue the former Panel of Expert's work in gathering, examining, analysing, and subsequently publishing information on the implementation of the sanctions measures, with a particular focus on instances of non-compliance and evasion of those measures. It is also expected that the MSMT outputs – the first of which is expected in early 2025 – will be prepared using a similar methodology as that previously adopted by the Panel of Experts. The content of the MSMT outputs is also anticipated to be comparable to that previously prepared by the Panel.

Beyond the preliminary information provided at the time of the MSMT's announcement, further details regarding the specificities of the mechanism remain unclear. Significant questions regarding the membership and composition of the MSMT, its procedures and working methods, the specific subjects of the inquiries it will pursue and the work it will undertake, the frequency and form of its intended outputs, and what (if any) role it will play in enforcement of the sanctions, are yet to be confirmed. As the eleven countries which have established the MSMT set about operationalising the mechanism, they have an opportunity to address these questions and learn from the strengths and weaknesses of the previous Panel of Experts system.

Membership of and participation in the MSMT: the impact on authority and legitimacy

UNSC sanctions regimes bind all UN member states to adhere to them. The now defunct Panel, by virtue of its status as a UNSC body, automatically ensured a certain degree of UN-wide representation and authority. The MSMT, on the other hand, has been established by a group of eleven Global North countries which have, historically speaking, been particularly active in implementing the UNSC's sanctions decisions. North Korea and Russia have already seized the opportunity to challenge the MSMT's authority and legitimacy, and have attempted to invoke the sentiment that the

new mechanism was established by a small club of countries acting out of self-interest to circumvent the UNSC. North Korea, for instance, described the new mechanism as “unlawful and illegitimate” and a “denial of the UN Charter”. Russia similarly described the MSMT’s establishment as an act “in circumvention of the UN Security Council” and an apparently “illegal” usurpation of the UNSC’s powers.

The MSMT’s establishment outside of the UN system clearly presents the new body with the challenge to establish the authority and legitimacy it will need in order to, firstly, effectively carry out its tasks and functions, and secondly, be seen as a body whose outputs can be relied upon by the international community as a whole, and not just by its eleven founding countries and others in the Global North.

One step the founding countries have already taken in a bid to strengthen the MSMT’s authority and legitimacy is to offer an open invitation to “other states from across the world” to join it. As of January 2025, however, no announcements have yet been made as to the participation of any new countries in the MSMT. The founding countries should continue to actively engage with other (currently) non-participating countries regarding participation in the MSMT – if not by encouraging them to become full members of the new mechanism, then perhaps by encouraging them to share with the MSMT information on issues related to the implementation of the UNSC’s North Korean sanctions measures. The wider and more diverse the geographic participation in the MSMT’s work, the more relevant its monitoring activities and outputs will be to the international community.

The composition and organisation of the MSMT: a team of . . . ?

Another important detail which remains to be confirmed is who will carry out the new mechanism’s monitoring work and produce its outputs, and how those carrying out this work will be organised.

The Panel of Experts, as noted above, was an impartial and independent body established by the UNSC under the 1718 Committee, composed of eight members selected on the basis of their expertise in issues relevant to the North Korean sanctions measures. Broadly speaking, the Panel made decisions, including on which details to publish in their reports, based on consensus.

It is unclear whether a similar approach will be taken in the appointment of members to, and the organisation of, the MSMT. It appears that numerous methods of organising the MSMT are currently being considered, including an approach whereby the new mechanism will function as a type

of intergovernmental communication channel, as opposed to a distinct, independent group. Another question which remains to be confirmed is on what basis individuals will be selected (i.e., subject matter experts, government officials, diplomats, etc.) to the new mechanism and how they will be organised (i.e., working out of ministries of foreign affairs, as an independent body, etc.). Similarly, if the MSMT is to be made up of individuals, there has been no confirmation whether they will need to possess the nationality of a participating country. The possibility for participation by individuals of non-participating countries seems most likely in the case of an independent body. It is more difficult to envision a situation in which individuals from non-participating countries could be involved in an intergovernmental, communication channel-type mechanism.

The organisation and composition of the new mechanism will clearly have an impact on its legitimacy and authority in the eyes of the wider international community, especially among those countries not directly involved in the MSMT’s activities. The activities and outputs of an impartial and independent body may be more successful in engaging and influencing non-participating countries, especially those that are, on the basis of their geographic proximity to North Korea or other factors, more frequently and more directly exposed to sanctions evading activities. Similarly, direct participation of individuals from non-participating countries in the MSMT’s work may help to build confidence in its work and outputs.

The professional composition of the new MSMT will also have an inevitable impact on the work and outputs of the mechanism. It would be difficult to expect any body to conduct monitoring activity and analysis on highly technical and complex issues in which its members have no expertise. In this context, the countries which have established the MSMT will also need to decide whether they wish to focus their efforts and resources on specific aspects of the UNSC’s North Korean sanctions measures, or whether they intend to monitor the regime as a whole.

The outputs of the MSMT: old habits die hard?

Initial discussions concerning the MSMT’s outputs indicate that the founding countries intend these to follow a similar methodology, and potentially be similar in content, to the reports previously prepared by the Panel of Experts.

The Panel’s reports followed the typical approach adopted by UN expert bodies in the preparation of publications. They usually comprised roughly 80 pages of analysis and several hundreds of pages of accompanying annexes, which documented evidence relied upon in their assessment. The

Panel's approach, while extremely comprehensive, often resulted in reports which were tedious to read and navigate.

Before the MSMT sets about preparing its first output, it may be worth considering whether there is scope to move away from the somewhat dated approach adopted by the Panel, and to take advantage of modern formats of displaying information to produce equally comprehensive but potentially more readable and navigable analysis. Other analysts, including newspapers and organisations specialised in open-source intelligence investigations, have taken advantage of modern multimedia formats to present complex North Korean sanctions evasion activities in a more accessible manner. In one [example](#), interactive maps and beneficial ownership diagrams were developed to detail routes used by vessels which conducted illicit ship-to-ship transfers of oil, and the network of entities facilitating these transfers.

Another consideration regarding the MSMT's upcoming outputs is whether these should consist of comprehensive reports covering all the issues the MSMT will be tasked with monitoring on an annual or bi-annual basis, or whether shorter, more targeted outputs could be released on specific topics on a more regular or ad hoc basis. While the Panel's reports were comprehensive, the bi-annual publishing schedule sometimes rendered any developments in sanctions evasion at the start of the reporting period less relevant by the time the report was published months later. Shorter, more focussed outputs published as the need arises would enable relevant stakeholders—government and private sector actors that use these reports—to take earlier and potentially more effective action to implement the sanctions measures or to address instances of non-compliance.

The MSMT: what role, if any, in enforcement?

A point on which the MSMT's announcement was silent is whether the new mechanism will be involved in any activities related to the enforcement of the UNSC's North Korean sanctions regime. As we have seen above, a crucial part of the mandate of the Panel of Experts involved making recommendations on actions and designations that the UNSC, the 1718 Committee or UN member states could have adopted to improve the implementation of the sanctions measures. The Panel's reports also contained recommendations to government agencies and private sector stakeholders to improve implementation of the sanctions regime and prevent non-compliance.

Given that the MSMT will operate outside the UN system, it is highly unlikely that its reports will make formal recommendations to the UNSC and its 1718 Committee which,

in any event, since 2018 have been unable to act on the recommendations of the now defunct Panel. What seems more likely is that the new mechanism may play a more general role in the enforcement of sanctions on the part of the countries which make up the MSMT. The outputs of the MSMT could continue the work undertaken by the Panel to produce recommendations for both participating and non-participating countries, their government agencies, and the private sector.

The countries which make up the MSMT could also go further, and agree between themselves to designate, through their own national and regional sanctions measures, the entities, individuals and vessels identified by the MSMT as being in non-compliance with the sanctions measures.

While any enforcement function undertaken by the MSMT will not be as far-reaching as that undertaken within the UNSC, it would nevertheless reinforce the notion that, although the mandate of the Panel of Experts has come to an end, the sanctions themselves remain in force, and non-compliance therewith will not be met with silence.

Conclusion

One of the most significant issues the founding countries of the MSMT will need to address is how the new mechanism will gain wider authority and legitimacy within the international community. A reputation of legitimacy and authority can be built from the outset by continuing to encourage other countries to join the MSMT to further expand and diversify geographic participation. At the same time, the founding countries should continue to be transparent and open about the issues which remain to be clarified pertaining to the new mechanism's operation, including whether the MSMT will function as an intergovernmental communication channel or a distinct independent group of individual experts, whether there is room for participation in the MSMT by individuals of non-participating countries, and whether the MSMT will have any role in the enforcement of the UNSC's North Korean sanctions regime. By addressing these issues, and by building on the lessons learned from the Panel of Experts' nearly fifteen years of operation, the MSMT has the potential to fill the significant void in North Korean sanctions monitoring created by the demise of the Panel in 2024.

Endnote

- 1 The author participated in a workshop, organised in November 2024 under the Chatham House Rule, which discussed North Korean sanctions monitoring challenges and included presentations by participants specialising in the issues discussed in this article. The content of this article draws partially on discussions held during this workshop.

Verification Watch

The future of the CTBT and ratification post-US election

Hailey Wingo

The [Comprehensive Nuclear Test Ban Treaty \(CTBT\)](#) opened for signature in 1996 and has established an expansive global network for verification under its Preparatory Commission, yet continues to await entry into force as a result of Article XIV of the treaty, which requires all 44 listed [Annex 2 states](#) to ratify the treaty before it can enter into force. Nine of those states have still to do so: China, India, Pakistan, North Korea, Israel, Iran, Egypt, Russia and the United States. All signatory states have abided by a nuclear test moratorium – and only North Korea has tested since 1998, but there are fears about the strength of this moratorium without the CTBT in force and in the context of rising competition between geopolitical powers. The United States is one of the nine Annex 2 holdouts, and following the November 2024 general election a new Congress and President will formally take office this month. This article outlines possible implications of this change in US political leadership for the CTBT in the coming years.

Senate ratification blocked

The [US Constitution](#) grants the power to negotiate treaties to the Executive Branch (the President), but requires the Senate to ratify treaties by a two-thirds majority. In some cases, the Senate uses this power to prevent a treaty from becoming legally binding on the United States. When former President Bill Clinton, whose administration had negotiated and signed the CTBT, submitted the treaty to the Senate for ratification in 1997, it passed into the Foreign Relations Committee. This committee was led at the time by Senator Jesse Helms, a leading figure in the conservative movement who was known for his [partisanship](#); Helms held the CTBT in the Foreign Relations Committee for over two years with no progress towards bringing it to the Senate floor.

In 1999, Democratic Senators tried to push the matter forward by submitting a letter to Helms and promising to create logjams on other matters if the CTBT was not brought to the floor of the Senate. Under this pressure, the Republicans agreed, but they allotted [only 18 hours](#) for debate in contrast to most treaties brought before the Senate, which often get

weeks of debate on the floor. President Clinton, who was a strong proponent of the treaty, became more heavily involved as the end of debate approached and it became clear the vote would be split along partisan lines.

Ratification was unsuccessful, despite a [concerted White House campaign](#) in the week preceding the vote and a failed political manoeuvre by Democratic senators to delay the vote once they realized they did not have the required majority. This failed ratification was a public embarrassment for the Clinton administration, not just on the domestic stage but also internationally. The United Kingdom and France had both ratified the CTBT having been urged to do so by the United States, and the failure of the US to ratify further complicated the ratification of the other remaining Annex 2 states.

On the twentieth anniversary of the treaty's opening for signature, the Obama administration tabled a UN Security Council (UNSC) resolution in favour of the CTBT's entry into force, reaffirming the nuclear test ban moratorium. While [resolution 2310 \(2016\)](#) was received positively on the international stage as a clear confidence building measure by the administration to demonstrate US support for the CTBT, it caused controversy domestically. Republican senators viewed the move as an attempt to circumvent Congressional powers of treaty ratification by binding the US to a moratorium via a UNSC resolution rather than through adoption of the CTBT. A group of senators led by Marco Rubio penned a [letter](#) to President Obama condemning this action as an unconstitutional overreach of the executive branch's power and threatened to cut off US contributions to the Preparatory Commission for the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) in retribution. The CTBTO was set up in 1996 and tasked with building up the verification regime of the CTBT in preparation for the treaty's entry into force, as well as promoting the treaty's universality.

The limits on Presidential authority on CTBT matters

While the Senate's actions made it clear in 1999 that the executive branch is not the only arbiter of whether the US ever ratifies the CTBT, the executive branch can impact the broader nuclear testing issue through [Department of Energy readiness posture reviews](#) and presidential directives (e.g. [National Security Memorandum 7](#) under the Biden administration and

[National Security Presidential Memorandum 31](#) under the Trump administration), and budget allocation proposals. The President also has the sole authority to order the use of nuclear weapons. Interpretation of whether this extends to authorization of a nuclear test is contested and depends on whether the Presidency considers itself constrained by customary international law to [‘refrain from acts which would defeat the object and purpose’](#) of a treaty to which the US is a signatory. Although the Bush administration [argued](#) that the US was not bound by this obligation, presidential authority to resume nuclear testing would still face numerous constraints, including domestic legal ([US legal code §2530](#)) and political hurdles, potential diplomatic fallout and strategic considerations.

The Biden presidency provided an unrealised opportunity to revisit CTBT ratification. The CTBT had experienced [‘waning political salience’](#) in the Republican Party and the first Trump administration was far less vocal in opposition to the CTBT than the Bush administration, pledging continued support to the CTBTO, International Monitoring System (IMS) and International Data Centre in its Nuclear Posture Review. However, the first Trump administration also [declared](#) that it would not pursue CTBT ratification and shortened the time required to resume nuclear testing from 24–36 months to 6–10 months. Even as the Trump administration [made first steps](#) towards test site transparency and confidence building measures, such as voluntary visits to former testing sites, the then-head of the Defense Intelligence Agency [accused](#) Russia of low-yield testing, echoing one of the central senatorial objections to the CTBT. Some senior national security officials under the previous Trump administration even [reportedly](#) floated the idea of a nuclear test to intimidate China and Russia.

The new Trump administration and Senate

The new Trump administration’s position on the treaty over the next four years could be influenced by Cabinet members. Mike Waltz, Trump’s pick for national security advisor, [does not appear to have](#) a clear position on the CTBT, nor does he appear to be particularly hawkish when it comes to nuclear arsenals. Former national security adviser Robert O’Brien, one of the most vocal advocates for resuming nuclear testing within the former Trump administration, [has not yet been given a role in the upcoming administration](#). On the other hand, Marco Rubio is now President-elect Trump’s pick for Secretary of State. In addition to rallying 32 of his fellow Republican senators against Obama’s UNSC resolution, he was also one of only four senators to [sign](#) the 2019 Cotton

Letter which called for the US to formally withdraw its signature of the CTBT. With Marco Rubio shaping foreign policy, the next Trump administration might take a more anti-CTBT stance in the next iteration of the Nuclear Posture Review.

In the Senate elections, the Republicans won a slight majority ([53 out of 100 seats](#)) which they will hold until at least 2026. In addition to Senate ratification, Congressional impact on the CTBT includes budget oversight. Through this power, Congress could refuse funding for activities in readiness for nuclear testing, as well as ensure that the Stockpile Stewardship and Management Plan (set up to ensure the readiness and safety of the US nuclear arsenal in the absence of nuclear testing) receives sufficient funding. Congress also has the power to amend [US legal code §2530](#), which currently prohibits any underground testing of nuclear weapons by the US until such time as a foreign state conducts a nuclear test.

None of the original group of senators from 1999 who blocked the Democrats’ attempt to delay the vote on ratification are still serving in Congress. However, certain influential Republican voices remain who are staunchly against CTBT ratification, notably Tom Cotton and possibly Marco Rubio (if he chooses not to accept his nomination for Secretary of State or fails to be confirmed). Of the senators projected to hold seats in the 119th Congress (2025–2026), four voted against the CTBT in 1999; eight signed the 2007 [Kyl Letter Opposing CTBT Ratification](#); 19 signed the 2016 [Rubio Letter Opposing Obama’s UN Resolution](#); and four signed the 2019 [Cotton Letter Calling for Unsigning the CTBT](#).

Longstanding concerns in the Senate

Most of these senators’ arguments against the CTBT have remained consistent. The 1999 hearings in the Senate on the CTBT [focused on two main strands of debate](#): first, how the US could effectively verify if countries were adhering to the CTBT, and second, whether the US could maintain a reliable and safe nuclear arsenal by relying on the Stockpile Stewardship Program. Despite three decades of development of the IMS – from no stations in 1999 to [292 certified by the end of 2023](#) – and its [proven ability](#) to identify nuclear tests under a kiloton and [distinguish between natural events and suspected tests](#), these concerns over verification persist. VERTIC has published analyses which detail the [effectiveness of CTBT verification](#) and how doubts about verification [“\[have\] grown steadily more difficult to sustain”](#) in light of the development of the IMS and preparation of the treaty’s On-Site Inspection (OSI) mechanism. The US National Academy of Sciences has

twice concluded that the CTBT is verifiable and that the safety, security and reliability of the US stockpile can be maintained without testing.

The Rubio letter argued that the US does not need the IMS given its own national capabilities for detection, which include non-IMS seismic and radionuclide stations, Bhangmeters and electromagnetic pulse detectors, and interferometric synthetic aperture radar. This disregards very important aspects of treaty verification, including the ability to share evidence of noncompliance (evidence collected by the intelligence community to support allegations of low-yield testing have not been declassified) and to have it collected by a sufficiently impartial body. Of course, any unclassified evidence of underground testing by US national technical means could supplement data collected through the IMS; the CTBT provides a basis for sharing such data and for multilateral determination of compliance.

Low-yield testing by Russia and China appears to be a primary concern. The Kyl letter argues that if covert testing can take place, the CTBT does not uniformly freeze weapons development and thus presents a national security risk to US deterrence. The Rubio and Cotton letters are pessimistic about whether unilaterally detected low-yield tests would be adequately addressed under the CTBT. The utility of low-yield testing for developing new weapons designs has been contested and the US National Academy of Sciences suggested that low-yield testing would be most useful for addressing arsenal safety through one-point safety tests. Kyl published an opinion piece in 2009 which latched onto the lack of a definition of a nuclear explosion within the text of the treaty – an additional anti-CTBT argument thread that was picked up by the subsequent letters in 2016 and 2019. These arguments do not mention that despite the lack of explicit definition within the treaty text itself, the P5 have all separately made public statements as well as a joint statement that the CTBT is a zero-yield treaty.

Future prospects

The prospects for CTBT ratification under the next US government are unpromising. There is no indication that Republican arguments against the treaty have shifted despite the development and demonstrated capability of the IMS, preparation of the OSI mechanism and the success of the Stockpile Stewardship Program. Moreover, one of the most vocally opposed senators to the treaty is poised to become Secretary of State.

However, while CTBT ratification is unlikely it does not make a return to nuclear testing a foregone conclusion. The communities near the Nevada Test Site who received compensation for long-term health impacts from nuclear testing (dubbed the ‘downwinders’ by the Radiation Exposure Compensation Act, RECA) are an overwhelmingly Republican constituency. The RECA (which expired in July 2024 after it was blocked by Republican House Speaker Mike Johnson) was introduced by a Republican senator, and 86 per cent of the counties where the downwinders live voted red in both the presidential and congressional election. This is a small but potentially potent group of stakeholders that could play an outsize factor in nonpartisan grassroots advocacy against resumed nuclear testing. In addition to diminished political visibility in Washington, the CTBT issue has also become less prominent amongst the American public. Opinion polls on the issue are out of date, but suggest that the CTBT is not a partisan issue for most voters and could have latent widespread support.

Despite what the Cotton letter implies—that the President could easily remove the US signature to the CTBT—the treaty remains on the Senate Executive Calendar. A two-thirds Senate vote is required to give consent for ratification but also to send the treaty back to the President for disposal. Rubio has publicly criticised the treaty; but the primary grievance in his letter addressed to Obama was what he perceived as an abuse of the executive branch’s power. If he were to recommend to Trump that the US to remove its signature from the treaty without the Senate releasing the issue from its calendar (which is unlikely given the slight Republican majority), it would contradict the basis for his 2016 rebuke of the Obama administration.

Unfortunately, concerted advocacy for CTBT ratification is unlikely to find many sympathetic stakeholders in the upcoming government and may even risk pushing the treaty’s opponents to put significant barriers to ratification in place. In the meantime, the most feasible opportunity for progress may be private engagement with prominent sceptics to understand the extent to which further technically-backed assessments of the verifiability of the CTBT could address their longstanding objections. Further, it will remain essential to preserve guardrails independent from the CTBT, but which also preserve the nuclear test moratorium. The next administration must recognize that if the US removes its signature from the CTBT and resumes nuclear testing, Russia and China are likely to do the same, unencumbered by any restriction on yield.

The attribution of cyber security attacks on nuclear facilities: in the UK and through the international legal framework

Hugh Chalmers

The operator of the UK's largest and most complex nuclear site recently pleaded guilty to criminal charges relating to years of cyber security failings and was fined £332,500 as a result. The charges were brought by the UK Office for Nuclear Regulation (ONR) to Westminster Magistrates Court and related to Sellafield Ltd.'s failure to comply with relevant provisions of the Nuclear Industries Security Regulations (NISR) 2003. Sellafield Ltd. pleaded guilty to failing to ensure there was "adequate protection of Sensitive Nuclear Information on its information technology network", including by failing to carry out annual health checks on its operational and information technology systems, as required by their own approved site security plan. According to ONR's Senior Director of Regulation, these failings "were known about for a considerable length of time but despite [ONR's] interventions and guidance, Sellafield failed to respond effectively, which left it vulnerable to security breaches and its systems being compromised".

The Sellafield site contains the world's largest civilian stockpile of separated plutonium, and some of the most complicated decommissioning challenges. A successful attack on its information technology and operation technology systems could compromise sensitive information (such as material inventories, security arrangements and incident response plans), delay important decommissioning activities, or hold vital operations or information to ransom.

It is not clear to what extent these vulnerabilities were exploited, and if so, by whom. The Guardian newspaper claimed that Sellafield had indeed been "hacked into by cyber groups closely linked to Russia and China". ONR stated that "there is no evidence that any vulnerabilities at Sellafield Ltd have been exploited as a result of the identified failing". However, it also told the court that tests at Sellafield demonstrated that it was possible to download and execute malicious files onto Sellafield's IT networks "without raising any alarms" and that "it was impossible for Sellafield to prove that the nuclear site had not been 'effectively attacked'".

If Sellafield Ltd.'s cyber security arrangements had indeed been breached, it may be very challenging to attribute the breach to any particular individuals or any particular state. Attribution has been described as "one of the most intractable problems of an emerging field, created by the underlying

technical architecture and geography of the Internet". Forensic analysis of any footprints left by an attacker may help identify routers or computers that were involved in the breach. However, these footprints may evaporate quickly or be covered by the attacker. If they can be followed to provide technical attribution, they may not lead to any useful human attribution. An organisation or individual hosting a particular server of interest can plausibly argue that the server had been hijacked to carry out an attack. Similarly, if that server is overseas, an investigation may not have the jurisdictional right to pursue any more information.

The international legal framework for nuclear security

This highlights the value of international cooperation in identifying, attributing and responding to cyberattacks on nuclear facilities. States have recognised that both the perpetrators and consequences of non-state attacks on nuclear facilities may be transnational, and they have established an international legal framework for nuclear security to address this problem. For example, the amended Convention on the Physical Protection of Nuclear Material (aCPPNM) requires State Parties to establish physical protection regimes for nuclear material and facilities (such as that established by NISR 2003) and criminalise certain acts against such targets. It also requires its Parties to cooperate with and assist each other with criminal proceedings related to those acts. The International Convention for the Suppression of Acts of Nuclear Terrorism (ICSANT) similarly requires its States Parties to criminalise certain acts involving radioactive material or nuclear facilities and established a framework for international cooperation and information exchange to detect, prevent, suppress and investigate these offences.

Cyber security of nuclear information and systems fits only partially and indirectly within this international legal framework for nuclear security. The criminalisation and cooperation provisions of both ICSANT and the aCPPNM extend to acts of intentional or knowing sabotage against nuclear facilities—including those carried out through cyberattacks—that release or risks the release of radioactive material or substances. But such releases are only one of many possible consequences of a successful cyberattack. The aCPPNM and ICSANT criminalisation provisions do not address the theft, destruction or compromise of sensitive nuclear information, nor do they address the compromise of nuclear operational systems in circumstances when nuclear or radiological safety is not compromised.

Thankfully the absence of cyber-specific provisions in the international legal framework for nuclear security does not leave this area entirely ungoverned at the international level. Existing principles of international law apply to the cyber realm just as they apply in the physical realm. This body of international law includes the UN Charter and its principles of state sovereignty, non-intervention in internal affairs, due diligence at home and the peaceful settlement of disputes. States are increasingly confident in invoking these principles of international law to call out malicious state-based cyber activities. However, they are often vague in precisely which principles are at issue. Some experts have [pointed out](#) that states might do this on purpose to maintain their own leeway when acting through cyberspace. It is also difficult to demonstrate conclusively when a particular principle has been violated. For example, commentators [have argued that](#) the mass replacement of uranium enrichment centrifuges in the wake of the STUXNET attack demonstrates that STUXNET was an illegal use of force. However, other commentators [have pointed out](#) that the centrifuges were already unreliable so their replacement cannot be conclusively blamed on the actions of STUXNET.

The only international treaty covering cyber security is the Council of Europe's Budapest Convention. This Convention, like the nuclear security instruments above, requires its parties to criminalise a defined set of cyber activities and establishes a common baseline for investigative powers. It also establishes a framework of international cooperation and assistance in responding to and prosecuting criminal acts in cyberspace. The UK is a party to this Convention and its provisions may have been relevant if Sellafield Ltd.'s information and operational technology systems had been attacked as The Guardian claims. However, neither China or Russia are parties to the Convention, which is anyway traditionally oriented towards infringements of copyright, computer fraud, child pornography and hate crimes, rather than cybercrimes committed against nuclear facilities.

If Sellafield Ltd.'s information and technology systems were attacked by state or non-state actors associated with China or Russia, the UK would have an international legal framework to call on. However, that framework is patchy and seems so far to be untested in dealing with attacks on nuclear facilities. States have so far struggled to agree on a more universal international legal framework for cyber security beyond the Budapest Convention, so a nuclear-specific addition to that framework seems very unlikely at the moment. Until that changes states will have to learn from Sellafield Ltd.'s failings and strictly enforce national protective measures.

Update on North Korea's enrichment programme

Hailey Wingo and Grant Christopher

Earlier this year, VERTIC's Verification and Monitoring Programme concluded a multi-year project to construct [a model of North Korea's nuclear fuel cycle](#). There are many unknowns about this nuclear programme, and thus the model was built with many assumptions and various scenarios. This was done in the hope that these estimates will be refined as new information emerges, particularly in terms of the scope of the enrichment programme.

In September 2024 some new information emerged when North Korean Supreme Leader Kim Jong Un was pictured on state media visiting a centrifuge enrichment plant—the first time that pictures of the inside of a North Korean enrichment plant have been released.¹ Both [the International Atomic Energy Agency \(IAEA\)](#) and open-source community believe that these photos show the enrichment cascades at Kangson, North Korea's second suspected enrichment site (the first being Yongbyon).

The open-source community was fairly confident in having correctly identified Kangson on the basis of [expansion in early 2024](#), as previously reported by the IAEA. [Analysis](#) of the photos released in September helped to confirm this. It remains possible, but unlikely, that the photos are of an unidentified enrichment programme at another location in North Korea, potentially underground. However, North Korea has been very secretive about its enrichment programme and it is unlikely to release photos that could help identify additional sites.

Siegfried Hecker, who led the Stanford University team that visited Yongbyon in 2010, has been [consulted](#) about the differences between the centrifuge hall he was shown then and the one in these photos. He noted that the hall's layout was "almost a carbon copy of what I saw", but with upgrades to the amount of piping connecting the centrifuges – [considered likely to be cooling coils](#) that enable the rotors to spin more quickly without overheating. The centrifuges themselves also [appear to be a more advanced design than the P2-type](#) seen in 2010, although they remain a similar height (and thus assumed rotor length).

Centrifuge scenarios

VERTIC's model of North Korea's nuclear fuel cycle has built in two centrifuge scenarios. The first assumed a P2-type with

a separative work units (SWU) range of 2-5 per unit/year (based on Hecker's visit data); the second assumed an IR6-type as a placeholder for an improved model with 7.5-8.5 SWU. The latter scenario draws on the progress observed from the Iranian IR-2 to the IR-6 centrifuges within a similar timeframe between Hecker's visit and the construction of VERTIC's fuel cycle model. Within that time, Iran progressed from steel rotors to carbon fibre rotors in its centrifuges. While the photos at Kangson do not offer definitive proof of similar progress in the North Korean programme, [some analysts](#) have pointed to the presence of what are likely cooling coils as a potential indicator that they have switched to composite material rotors.

Iran's IR-6 centrifuge is a 110 cm tall, 20 cm wide unit with two carbon fibre rotor tubes connected by a bellows (which may be either carbon fibre or metal); its average SWU is estimated at [5.25 per unit/year](#). While a more detailed mensuration analysis of the photos has not yet been published (see for example [this report](#) estimating the size of North Korean nuclear devices), the centrifuges shown in the photos have been estimated at [about 150 cm tall](#).

The close arrangement of the centrifuges shown [has been interpreted as an indicator](#) that the visible cascades are involved in enrichment to Low Enriched Uranium (LEU), but not to Highly Enriched Uranium (HEU). This is because the risk of reaching criticality rises as the material within approaches weapons-grade levels; the HEU cascades are spread out to lower the density. This theory would imply that LEU is produced at both Kangson and Yongbyon. It may be that there are undocumented parts of Kangson that have more HEU-suitable cascades, or that North Korea employs other methods to prevent its cascades from reaching criticality. It is also possible that Kangson produces only LEU, which is then shipped to another unidentified enrichment site for further enrichment to HEU. Of course, such an arrangement would require the LEU to be transported between the two facilities in such a way that prevented it from being detected by remote sensors.

More information would be useful, but based on the images shown—and assuming a consistent cascade layout throughout, as well as estimates of the available floor space based on overhead imagery captured during the construction and extension of both facilities—it is possible to make a rough estimate of the total number of centrifuges within Kangson and Yongbyon. The Stimson Center's [38 North programme](#)

[has estimated](#) that the two rooms pictured at Kangson hold over 2,000 centrifuges, and [past analyses have estimated](#) that there could be up to 5,000 centrifuges at Yongbyon.

Updating VERTIC's model

Many questions and ambiguities remain about North Korea's fissile material production capacity. These include establishing: the timeline between 2010 and 2024 when North Korea updated its centrifuge design; whether P2-type centrifuges remain in operation at Yongbyon; the rotor construction material and the operational parameters of the cascades; and even whether all the pictured centrifuges are operational. However, the release of these photographs has allowed the open-source community to add another layer of detail to our understanding of the assumed function of Kangson.

Within VERTIC's model, this new information can be used to update certain scenarios and discount others. For example, the model had considered the possibility of enrichment at Yongbyon only. Since September, this seems increasingly unlikely. The model had also presented two divergent scenarios: one in which North Korea seeks to improve upon its initial centrifuges and one in which it doesn't. While details of the improvements may need modification, the information available indicates that it is likely improvements have taken place, even if the alternative cannot be discounted yet.

Overall, the release of the centrifuge photographs has shifted the balance of likelihood away from the lower limits of the HEU estimate within our model. But it is worth keeping in mind that this judgement, and especially a widespread perception of an increased (possibly overexaggerated) nuclear capability, may be beneficial to North Korea's strategic goals of developing a nuclear arsenal and using it as leverage. It is important, therefore, to continue to ask the question: why, after over a decade of secrecy regarding its enrichment facilities, has North Korea chosen to release these photographs? Nonetheless, the implications of the signalling from Pyongyang aside, the release of such information is an incredibly useful addition to our knowledge of such an opaque enrichment programme.

Endnote

- 1 [Researchers from CISAC at Stanford University visited and were shown the enrichment hall at Yongbyon in 2010](#), but were not allowed to take photos. Until this point, most of what was known in open sources about North Korean centrifuges has been based on these researchers' recollections.

Another step taken to establish a multilateral Group of Scientific and Technical Experts on Nuclear Disarmament Verification

Noel Stott

On 1 November 2024 the UN General Assembly First Committee that considers disarmament and international security matters, including the principles governing disarmament, passed [resolution A/C.1/79/L.67](#) requesting the UN Secretary-General to elicit the views of Member States on the possible establishment of a Group of Scientific and Technical Experts on Nuclear Disarmament Verification (GSTE-NDV) within the UN system. Proposed by Brazil and Norway, the resolution was adopted by the full General Assembly in late December 2024.

This is an important development and VERTIC encourages all UN member states to contribute their views on the issue. VERTIC in a [website post](#) welcomed the development and announced that it is ready to assist UN member states, on request, in compiling their views for submission to the Secretary-General.

As stated in the July 2024 edition of [Trust and Verify](#), the need for such a process was set out in the 2023 First Committee statement by 39 UN member states, and during the in-depth discussions undertaken by the two Group of Governmental Experts (GGE) established under UN General Assembly [Resolution 71/67](#) of 5 December 2016 and [Resolution 74/50](#) of December 2019, as well as further consultations in 2024 in both Geneva and Vienna with relevant stakeholders.

Outcome of the vote

At the First Committee, 173 member states voted in favour of the November resolution, with one member (Russia) voting against and two (Iran and Syria) abstaining. Egypt, India, Iran, France and Pakistan, provided explanations of their votes.

Interestingly, [according](#) to Reaching Critical Will, the disarmament programme of the Women's International League for Peace and Freedom, Pakistan in its explanation of its vote expressed support for the resolution, with the caveat that nuclear disarmament verification is best addressed in the context of a specific treaty regime and the proposal for a group of scientific and technical experts should be examined in a representative forum that includes all relevant stakeholders, namely the Conference on Disarmament (CD).

[Egypt](#), while acknowledging “the good faith and good intentions behind this initiative as a potential contribution to discussions on nuclear disarmament obligations and com-

mitments” . . . cautioned “against the abuse of the discussion on enhancing capabilities of nuclear disarmament as one more way to distract the focus on the essential matters related to nuclear disarmament or as an additional pretext to delay implementation of existing obligations and commitments by nuclear weapon states”.

[France](#), on the other hand, although recognising that the “resolution seems [to us] to respond to the challenges of verifying nuclear disarmament, without prejudging the objectives and mandate of the group of scientific and technical experts, which will ultimately need to be clarified” . . . expressed its regret that the wording in the preambular “seems to preempt the format of nuclear verification mechanisms, conceived exclusively as ‘multilateral’ when they can also be of another nature”.

These are all important views that should be taken note of. It is also worth noting that preambular paragraph 12 in the resolution, which recognises that the decisive factor for achieving real measures of disarmament is the political will of states, especially nuclear-armed states, was retained by a separate vote of 153-1-5, with Russia also voting against this paragraph.

In the UN General Assembly vote on the resolution in late December, 164 UN member states voted in favour and only Russia expressed a no vote, and Iran was the only state to abstain. Several UN member states were not present for the vote, including Syria that had abstained during the First Committee vote.

Key features of the resolution

The resolution further calls on the Secretary-General to also consider the views of relevant intergovernmental organisations (IGOs) entrusted with the verification of other disarmament and non-proliferation treaties. This presumably refers to IGOs such as the International Atomic Energy Agency (IAEA), the Organisation for the Prohibition of Chemical Weapons (OPCW) and the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO), and possibly others not related to the non-proliferation and disarmament of weapons of mass destruction. As such the resolution recognises the “considerable amount of knowledge and positive contributions on nuclear disarmament verification [that] has already been assembled by past and ongoing initiatives and partnerships among Member States”.

Some states, including Australia, Bulgaria, Germany, Switzerland and the Nordic countries, referenced their support for the resolution in their general and other statements to the

First Committee. Denmark, Finland, Iceland, Norway and Sweden, jointly argued, for example, that “such a GSTE-NDV would provide unique practical benefits in support of the long-term goal of nuclear disarmament and enable States to work collaboratively on NDV in a multilateral setting”.

The resolution also recognises that credible multilateral nuclear disarmament verification capabilities will be instrumental to providing assurance of compliance with nuclear disarmament agreements for the achievement and maintenance of a world without nuclear weapons.

In addition to gathering written views of states, provision is made in the resolution for three informal in-person meetings to discuss and debate the potential scope and modus operandi of a Group of Scientific and Technical Experts. One of these will be held in Geneva, the seat of the CD, which is the world’s only permanent multilateral disarmament treaty negotiating body (although no programme of activity has moved forward since 1996), and two at the UN headquarters in New York where most states have representatives.

Next steps

Based on the views gathered in this process, the Secretary-General will submit his report to the General Assembly at its eightieth session in September 2025 for further discussion by member states. It is envisaged that his report will contain various options for the establishment of a GSTE-NDV without making any explicit recommendations.

The resolution also notes the contribution of civil society and academic and research communities to nuclear disarmament verification. The resolution thus also provides a vehicle by which NGOs and academics, working with UN member states, can propose how best to develop a more coherent approach to addressing the challenges posed by nuclear disarmament verification. UN member states, IGOs and civil society have a unique opportunity to consolidate their on-going efforts to develop potential measures that would provide ‘credible or sufficient assurance’ that a state or indeed that the world will remain free of nuclear weapons once disarmament has taken place.

The Final Report of the special session of the General Assembly devoted to disarmament (SSOD-I) recognised that all states have a responsibility to play a role in nuclear disarmament. Hence, attention should be given to ensuring that non-nuclear-armed states and particularly so-called smaller states and those in the Global South are able to express their opinions on the value of establishing a multilateral group with

VERTIC publication

The recent collapse of the Assad government in Syria has changed the future of the country’s political and security landscape. Central to this new reality will be how the new government addresses the issue of chemical weapons and their recent use. In the article *Future for Syria and the Chemical Weapons Convention: the legislative implications*, Eliza Walsh, Thomas Brown and Larry MacFaul discuss the main legal issues currently facing Syria and other CWC states parties, and argue that the most pressing issue for Syria and the international community is dealing with the weapons and facilities themselves.

a focus on NDV, the group’s modalities, and under whose mandate it should fall. As the resolution itself underlines “equal opportunities for equitable geographical representation and participation should be provided for in nuclear disarmament verification education, training and capacity-building, taking into account the special needs of interested developing countries, upon their request, to participate in the relevant efforts”.

Implementation Watch

Can traditional chemical security and bio-security measures keep pace with technological advances? The lessons from two UK cases

Eliza Walsh

Introduction

In recent years, numerous instances of individuals obtaining chemicals or biological agents to be used for malicious purposes have been reported across the world. This year two criminal cases in the United Kingdom involving the toxin ricin have made the news and raise questions about the efficacy of traditional chemical security and biosecurity measures.

The case of Thomas Kwan

In the first of the two cases, Thomas Kwan, a general practitioner disguised himself as a community nurse and injected his mother's partner with a toxic substance at their home on 22 January 2024 because of a dispute over his mother's inheritance. Mr Kwan sent fraudulent National Health Service letters to supposedly provide his mother's partner with a coronavirus booster jab. During their investigation, law enforcement officers found liquid mercury, thallium, sulphuric acid and arsenic in the home of Mr Kwan. Additionally, the police found in Mr Kwan's garage the ingredients and materials needed to produce ricin, a toxin found in the seeds of the castor bean plant and a controlled chemical under Schedule 1A of the Chemical Weapons Convention (CWC). It also falls within the scope of the Biological and Toxins Weapons Convention (BTWC). The Court also noted in the sentencing remarks that Mr Kwan's house contained "a library of material describing and giving instructions on the use of the various chemicals in killing human beings", including a book which outlined the amount of poison required to kill a person. Mr Kwan refused to disclose to authorities the substance which he administered to his mother's partner. Mr Kwan was charged with attempted murder as well as the production of a chemical weapon, under section 2(1)(B) of the Chemical Weapons Act and the use of a chemical weapon, ricin, under section 2(1)(A) of the Act. However, an expert later concluded during the trial that the toxic chemical was iodomethane, a fumigant pesticide, which the judge accepted.

After the first day of his trial, Mr Kwan pleaded guilty to the attempted murder charge which replaced the other charges. On 6 November 2024, Mr Kwan was sentenced to a term of imprisonment of 31 years and 5 months.

The case of Axel Rudakubana

The second case, which is currently ongoing, involves an individual by the name of Axel Rudakubana. The 18-year-old is accused of murdering three children and the attempted murder of 10 other individuals in Southport, UK on 29 July 2024. An extensive investigation by the Merseyside Police led to two further charges against Mr. Rudakubana in October 2024, including the production of a biological toxin, namely ricin, contrary to Section 1 of the Biological Weapons Act 1974. In a search of Mr Rudakubana's home, ricin was said to have been discovered. He has also been charged under Section 58 of the Terrorism Act 2000 for the possession of a document of a kind likely to be useful to a person committing or preparing an act of terrorism.

Chemical security and biosecurity implications

Both cases raise important questions relating to the effectiveness of national implementation of chemical and biological weapons legal instruments. In particular, how can individuals who wish to make and use chemical or biological weapons be prevented from obtaining them in the first instance?

An important aspect of national implementation of the CWC and BTWC is the need for criminal prohibitions in place to act as a deterrent against the use of chemical or biological weapons as well as providing a penalty in cases of violations of these laws. For example, in both cases outlined above, the Chemical Weapons Act of 1996 and Biological Weapons Act of 1974 enabled these individuals to be charged with relevant offences. However, it is also crucial to have strong and effective preventative measures in place at the national level against the use of chemicals or biological agents for malicious purposes. Unfortunately, chemical security and biosecurity measures are often not implemented in the same manner or frequency as criminal prohibitions. For example, in the case of the CWC, states have an obligation to enact 'initial measures' in their national legislation, but chemical security measures do not

form part of these ‘initial measures’ and are therefore often not included in the implementing legislation of a state. In both cases listed above, the individuals charged were able to obtain toxic chemicals such as liquid mercury and arsenic, ricin or the ingredients and materials required to make ricin, without it having been detected by law enforcement as a suspicious transaction. In the case of Mr Kwan, in order to obtain the chemicals, he set up a shell company under his GP practice in which he claimed to be a research officer within the research unit of the company.

This then begs the question as to what measures and controls can realistically be put in place to avoid these circumstances where individuals over-step the law without trace or attracting suspicion. In this regard, chemical security and biosecurity controls have a crucial role to play. Chemical security and biosecurity measures require personnel management measures to control who has access to these materials, physical protection measures to avoid theft or diversion of the materials, transfer security measures to control the trade and transfer of these materials, as well as a range of other protections, including cyber security measures to control not only the chemicals and biological agents themselves but also the information and cyber protections surrounding them. In both these cases, the individuals were able to obtain from publicly available sources information that would be useful for terrorist purposes and were able to obtain ricin and other toxic chemicals without it being detected by law enforcement as a suspicious transaction. With so much information readily and publicly available on the internet, coupled with the exponential growth in the capacities of artificial intelligence, it is becoming increasingly difficult to control the access to information and intelligence which is necessary to produce these weapons. Additionally, online black markets and third-party e-commerce sites reduce the barriers for individuals to obtain the necessary materials to make such weapons.

As technology advances, the ability of law enforcement agencies to detect such suspicious transactions is likely to become even more strained. This is something that BTWC and CWC states parties will have to continue to grapple with in the coming years. Traditional chemical security and biosecurity measures may no longer be sufficient to keep pace with these new threats. As a starting point, states which do not have chemical security and biosecurity measures in place should enact such measures in their national legislation. Additionally, new and innovative chemical security and biosecurity measures are needed to counter the growing ease with which individuals

are able to obtain these materials and information. This might involve new measures to regulate the use of artificial intelligence, regulations on third-party e-commerce sites or other innovative solutions.

Biological dual-use export violations lead to US Bureau of Industry and Security sanctions on Indiana University

Alix Renaudin

Background of the case

Between November 2017 and April 2021, the *Bloomington Drosophila Stock Centre* of Indiana University exported 42 shipments of different strains of genetically modified fruit flies that contained transgenes of ricin toxin (A-subunit) to 30 different institutions in 16 destinations worldwide without a licence.

Although the protein expressed by the ricin A-gene is not a toxin and does not therefore pose a danger by itself, ricin and all its subunits fall under export control measures, particularly those established in application of biological and chemical weapons non-proliferation instruments.

In mid-June 2024, the Bureau of Industry and Security (BIS) of the US Department of Commerce and Indiana University signed a [Settlement Agreement](#) where the latter admitted the illicit exports. As part of this agreement, the BIS issued an order imposing an administrative penalty of a one-year suspended denial of exports privileges for *Human and Animal Pathogens and Toxins, Genetic elements and genetically modified organisms*, and *Plant pathogens* classified under the US Commerce Control list. Additionally, Indiana University is required under the order to deliver export compliance training on the [Export Administrative Regulations](#) (EAR) to relevant research administrators and fiscal officers of the University and to deliver two presentations on the illicit exports at issue to a forum of stock centre directors and to the Association of University Export Control Officers conference.

Disarmament and non-proliferation frameworks

Although ricin has benign uses—it can be found in small quantities in ‘castor oil’ and can be used for medical purposes to kill cancer cells, for example—it is one of the most used toxins for hostile purposes. In 2020, for example, an envelope containing ricin was [addressed](#) to the White House and intercepted by US authorities.

An example of a ‘dual-use’ substance, ricin – a toxin (a biologically produced chemical) is covered by both the 1972 *Biological and Toxin Weapons Convention* (BWC) and the 1993 *Chemical Weapons Convention* (CWC), where it is specifically included in Schedule 1A. As such, it is also included in various international export control regimes.

In this case, the ricin toxin is included at the international level in the *Australia Group* common ‘List of Human and Animal Pathogens and Toxins for Export Control’ to which the United States participates.

At the domestic level in the United States, ricin is a controlled substance under the EAR, originally issued under the Export Administration Act of 1979, as lastly amended by the Export Control Reform Act of 2018. Ricin is covered under the ‘Commerce Control List’, specifically under the Export Control Classification Number (ECCN) 1C351 *Human and Animal Pathogens and Toxins*.

National implementation implications

The effective implementation at the domestic level of export control regimes is essential to ensure that dual-use materials, such as ricin are not used to develop biological, toxin or chemical weapons. Robust and efficient control systems should include comprehensive lists of materials the transfer of which is restricted and subject to controls. Such controls include licensing requirements, compliance and enforcement mechanisms, associated with relevant end-user precautions as well as the sufficient training of relevant stakeholders. These measures help to prevent the malicious transfer of controlled items and the occurrence of inadvertent breaches of export control measures.

In this case, the extended period during which Indiana University was able to export these controlled materials without a licence, seemingly without any intervention by the authorities, underscores the need for implementing robust control and enforcement mechanisms. This case recalls another very similar one, also involving an American university, [Princeton University](#), which had, for five years on 37 occasions between 2013 and 2018, exported various strains of an animal pathogen classified under the same ECCN as ricin without a licence. In both cases, the Universities voluntarily disclosed the violations and cooperated with the BIS investigation.

Scientific institutions must ensure robust internal oversight of their transfer activities to avoid violations of the export control frameworks while national authorities should maintain effective mechanisms to monitor compliance, detect violations and respond in a timely manner to unauthorized transfers.

Moreover, beyond export and transfer controls, the oversight of scientific research and related activities involving dual-use items and technologies should be sufficiently efficient to avoid any misuse of dual-use materials, through an illicit access and transfer of such materials.

This case highlights the critical importance of strong export control measures to prevent the unauthorized transfer of dual-use materials. Universities, involved in dual-use scientific activities must ensure strict compliance with export regulations while national authorities must ensure efficient oversight and enforcement mechanisms to contribute to global non-proliferation, safety and security objectives.

Science and Technology Scan

Innovations in the use of AI for tracking dark ships

Grant Christopher

Advances in the use of artificial intelligence (AI) for tracking ships may finally give sanctions enforcers an advantage over evaders at sea. One of the most longstanding problems of sanctions enforcement is the use of ships by North Korea to evade United Nations sanctions under Security Council Resolution (UNSCR) 1718. North Korean evasion strategies are [well documented](#). Despite measures to improve monitoring and enforcement, authorities have always lagged tactical innovations of North Korean smuggling networks.

How can ships that seek to evade UNSCR 1718 be tracked? This is a problem of [Maritime Situational Awareness \(MSA\)](#), that encompasses understanding where all ships are located and what they are doing at any given moment. More broadly, the European Defence Agency defines MSA as the effective understanding of activities, associated with and occurring in the maritime domain, that could impact on the security, safety and environment. This is closely linked to the concept of [Maritime Domain Awareness](#) which encompasses anything related to the maritime domain that could impact security, safety, economy or the environment.

Maritime traffic can be monitored by tracking a vessel's Automated Identification System (AIS), a public broadcast of the ship's identification and location. Ships that purposefully disable these are known as 'dark ships'. Vessels that turn off their AIS may be engaged in activities such as illegal, unreported and unregulated fishing, waste dumping, smuggling, piracy or sanctions evasion. The AIS can be tracked in real time, through portals such as [MarineTraffic.com](#).

Locating dark vessels requires alternative data sources that provide vessel location and that can then be checked against AIS data. There are a variety of sources that can be used to generate comparative geographic data sets for marine traffic. These are remote sensing capabilities such as satellite imagery, littoral and shipbound radar and underwater acoustic data can track and identify ships over a wide area.

A simple analysis to identify dark ships would compare satellite imagery against AIS data over a specified region, or region of interest (ROI). A map of AIS data can then be exported from MarineTraffic with geotagged ships and names

to identify all broadcasting marine vessels. A second data set can be generated of all ships in this ROI using satellite imagery. By comparing these two datasets the ships that are not broadcasting their AIS can be identified.

However, it is not always possible to concentrate searches over a small area. The seas are vast and there are many ships: at any given time, MarineTraffic is tracking over 250,000 vessels. The [Food and Agriculture Organisation of the United Nations](#) estimated in 2020 that there were 4.1 million active fishing vessels. A 2023 analysis by [Global Fishing Watch](#) using machine learning to analyse 2 petabytes of imagery—five years' worth of data—estimated that 75% of global fishing vessels are not publicly tracked. Data analysis at this scale cannot use a human at every stage, and requires extensive use of algorithms. As with any data available at scale, it is also a key area of development for leveraging machine learning.

There are significant efforts underway to enhance maritime situational awareness using AI. Computer vision, a type of AI that allows computers to analyse visual data, can be used to assist and [automate object detection of ships](#). Beyond computer vision, AI can be used to [improve the ability to predict trajectories](#) of ships and [directly identify ships that are likely to have a high risk of sanctions violations](#).

Efforts to improve monitoring with AI are not just restricted to software. In 2024, Mitsubishi announced its [AIRIS system](#), which uses satellite data with an onboard AI to identify and track dark ships. The innovation of onboard AI will prioritise transmission of 'signal' data with AI-identified dark ships and less 'noise' from normal maritime traffic. The onboard AI can be updated as the model improves further increasing efficiency. The AIRIS system is scheduled to be launched aboard the Japan Aerospace Exploration Agency RAISE-4 satellite in 2025.

Despite the promise of significant progress using AI, maritime sanctions evasion is only one component of North Korean sanctions evasion. Since North Korea shares a border with Russia and China, there are a small number of road and rail crossings. Even before the growing strategic partnership with Russia, a significant volume of North Korean trade could be expected to be facilitated by neighbouring countries. Challenging maritime sanctions evasion by North Korea can be aided by AI. Yet, evasion tactics will continue to evolve in the face of improved monitoring capabilities.

Centre News

National Implementation Measures

Angela Woodward, Yasemin Balci, Thomas Brown, Eliza Walsh and Alix Renaudin

Since the last edition of *Trust & Verify*, the National Implementation Measures (NIM) team has continued to work across a number of projects to support the national implementation of international instruments focusing on chemical, biological, nuclear and radiological (CBRN) weapons and the security of related materials.

BWC National Implementation Measures Database

Together with the United Nations Institute for Disarmament Research (UNIDIR), the team has continued working on the Biological Weapons Convention (BWC) National Implementation Measures Database launched on 15 August 2023 under a project funded by the US Department of State. Legal Officer Eliza Walsh participated in the SynBio Africa Conference 3.0 in Nairobi, Kenya from 17–19 July 2024 where she presented on national implementation of the BWC and gave an overview of the database. Work has continued to complete research for country profiles for all 187 States Parties to the BWC, with the publication of all country profiles in English expected in December 2024.

Pilot project on BWC legislative drafting training

Since February 2024, NIM and partner Civilian Research and Development Foundation (CRDF) Global have been implementing a pilot project for the development and conduct of a training workshop on legislative drafting for BWC implementation. The project is funded by the US Department of State through the Office of the Non-proliferation and Disarmament Fund (NDF). The training workshop was successfully conducted in Bangkok, Thailand, from 28 October–1 November 2024, gathering 15 participants representing 6 countries in Latin America and the Caribbean and Southeast Asia alongside regional experts and a representative from the United Nations Office of Disarmament Affairs.

EU CBRN Centres of Excellence (CoE) Project 81

The team has continued to implement EU CBRN CoE Project 81 on ‘Enhanced Biosecurity in South East Asia’. Work has also continued on reviewing partner countries’ biosecurity legislation and developing related guidance under Work Package 2 of the project. Co-Programme Director Fanny Tonos and Senior Legal Officer Thomas Brown also took part in a regional conference under the project in Bangkok, Thailand, from 2–5 July 2024, leading group training sessions on legal frameworks for biosecurity.

Other NIM news

Senior Legal Officer Thomas Brown and Associate Legal Officer Alix Renaudin represented VERTIC at the Fourth Session of the Working Group on the Strengthening of the BWC from 21–23 August 2024. Thomas also participated virtually in a hybrid event to discuss Malawi’s BWC implementing legislation organised under the auspices of EU CBRN Centres of Excellence Project 99 on 8 October 2024. Legal Officer Eliza Walsh participated in an Expert Meeting on Developing a Compendium of Best Practices for a National Legislative and Regulatory Framework on Chemical Security convened by the Organisation for the Prohibition of Chemical Weapons in the Hague from 21–22 October 2024. She also virtually presented on NIM’s work at a CBRN Criminalisation Workshop related to Strengthening the CBRN Investigation, Prosecution and Adjudication Capabilities of Moldova organised by the UN Interregional Crime and Justice Research Institute on 8 November 2024. From 25–26 November 2024 Eliza also joined the 29th Session of the Conference of States Parties to the Chemical Weapons Convention.

Co-Programme Director Fanny Tonos left her position at the end of July. The NIM programme expresses its appreciation for her valuable contributions during her time at VERTIC. Angela Woodward took over the responsibility of Co-Programme Director for National Implementation on 1 August 2024.

Verification and Monitoring

Alberto Muti, Grant Christopher, Hugh Chalmers, Noel Stott, Hailey Wingo and Caroline Higgins

Outreach in Africa

Since the last issue of *Trust and Verify*, in June, Co-Programme Director Alberto Muti and Senior Researcher Noel Stott attended and presented at a short course on nuclear disarmament which had been specifically designed for African students, diplomats, and practitioners by the African Nuclear Disarmament Verification Hub and the Radiation and Health Physics Unit of the University of the Witwatersrand. The course was both in-person and online and aimed to contribute to increasing the pool of knowledge in non-nuclear weapon states (NNWS) to allow active engagement in nuclear disarmament and non-proliferation debates and activities—nationally, regionally and internationally; enhance the knowledge base on the technical and political challenges associated with verifiable nuclear disarmament as a means to contribute to the operationalization of multilateral nuclear disarmament verification in the future; and, provide a unique learning and networking opportunity for African students and early career professionals and expert presenters, from diverse backgrounds with an interest in nuclear disarmament, non-proliferation and verification.

Webinars, conferences, seminars and other outreach activities

The VM Programme arranges webinars with expert presenters on various aspects of nuclear disarmament verification in support of the activities of the three regional hubs in Africa, Central Asia and Latin America. In June, the speakers included Professor Nick Richie, Senior Lecturer in International Security at the Department of Politics and International Relations, University of York, UK and Professor Joelen Pretorius, Head of Department and Professor: Economic and Management Faculty, Department of Political Studies, University of the Western Cape, South Africa. Nick spoke to ‘Irreversible nuclear disarmament and ‘unmaking’ nuclear weapons complexes’, while Joelen focussed on ‘Lessons from South Africa for irreversibility of nuclear disarmament’. In July, Dr Leonardo Bandarra at the Institute of Political Science at the University of Duisburg-Essen, Germany and Prof. Dr. Malte Götsche: TU Darmstadt and leader of ‘Science for Nuclear Diplomacy’ of the Cluster for Natural and Technical Science Arms Control Research (CNTR) at the Peace Research Institute Frankfurt, gave briefings on the research work currently being under-

taken by VeSPoTec (Nuclear Verification in a Complex and Unpredictable World – social, political, and technical processes) consortium. In August, the webinar focused on developments in technical verification of nuclear disarmament at the Alva Myrdal Centre for Nuclear Disarmament (AMC) at Uppsala University, Sweden, with Dr Peter Anderson, leader of the AMC’s Working Group 4 speaking.

As part of our webinar series for nuclear disarmament verification hubs, in October, Styrkaar Hustveit, a senior adviser in the Section for International Nuclear Safety and Security at the Norwegian Radiation and Nuclear Safety Authority, provided an update of, and lessons learned, from the Quad Nuclear Verification Partnership’s ‘TYPEWRITER’ project.

From 30 September to 1 October 2024, Executive Director Larry MacFaul, Co-Programme Director Grant Christopher and Senior Researcher Noel Stott, attended the VERTIC and NPSGlobal Foundation co-hosted conference bringing together representatives of the three emerging nuclear disarmament verification (NDV) research and innovation hubs in Africa, Central Asia and Latin America. The conference formed an important part of our Norway-funded project in support of enhancing global NDV capacity and in particular in non-nuclear-armed states. Held in Rio de Janeiro in Brazil, highlights included a keynote address by Gustavo Zlauvinen, Ambassador, Ministry of Foreign Affairs of Argentina, President of the Tenth NPT Review Conference and a visit to the Brazilian-Argentine Agency for Accounting and Control of Nuclear Materials (ABACC) Headquarters, where participants had the opportunity to receive an overview of the work of ABACC and visit their laboratory. We were hosted by ABACC’s Secretary-General, Dr Marco Marzo and Sonia Fernández Moreno, Director of Planning & Evaluation. The conference reviewed current international developments and their impact on efforts to build capacity for nuclear disarmament verification and aimed to foster a collaborative environment to share the three regional Hub’s activities, initiatives and future plans. An open discussion was also held on how we can better organise hub activities in the future.

Also in September, Alberto Muti, spoke on the margins of the 68th IAEA General Conference on the implementation of nuclear safeguards during crisis scenarios. The side event was organized by Germany in collaboration with the research consortium VeSPoTec. Researcher Hailey Wingo served as a rapporteur at the 6th Spiez Convergence Conference.

In November, VERTIC hosted a workshop on scenarios for overhead cooperative monitoring with support from the

US Department of State. Grant Christopher and Hailey Wingo participated in an Open Source Intelligence on nuclear programmes workshop, hosted by the Stanley Center for Peace and Security in Lisbon. Hailey Wingo attended the EU Non-proliferation and Disarmament Consortium Conference and spoke on a panel on the topic of ‘Chemical Disarmament and the Re-emergence of the Chemical Threat’.

In December, the V&M Programme partnered with the Open Nuclear Network to brief diplomats and international civil servants in Vienna on the outcomes of their recent research into the Comprehensive Nuclear-Test-Ban Treaty (CTBT). Senior Researcher Hugh Chalmers met with the Executive Secretary of the CTBT Organisation’s Provisional Technical Secretariat and his team to discuss the findings of his research and emerging issues in the prohibition of nuclear weapon tests. He also presented his findings to diplomats from CTBT State Signatories at a seminar, hosted by the Vienna Center for Disarmament and Nonproliferation and the Open Nuclear Network. Alberto Muti and Hailey Wingo also hosted a workshop on verification of the Biological Weapons Convention on the sidelines of the 2024 Meeting of State Parties.

Publications

In August, Grant Christopher published a chapter in the Research Handbook on Cyberwarfare, with Kings College London Senior Lecturer Joe Devanny, titled ‘Cyber arms control and counter proliferation: the limits of the possible’. As part of our biological weapons risks work, Hailey Wingo and Alberto Muti published a piece with project partners in the Bulletin of Atomic Scientists in September on AI and bioweapons, titled: ‘Apathy and hyperbole cloud the real risks of AI bioweapons’.

In October, Hailey Wingo published a report from a workshop held in January 2023 on IAEA Safeguards and the Irreversibility of Nuclear Disarmament in the Journal of Peace and Nuclear Disarmament. Also resulting from that workshop, in the same issue, Mark Hibbs, nonresident senior fellow in Carnegie’s Nuclear Policy Program, published an article titled ‘Irreversible Disarmament and Verification: Guidance from IAEA Safeguards’.

New projects

In September, VERTIC began a new project supporting the United Nations Secretary General Mechanism for investigations into the alleged use of chemical and biological weapons, funded by the United States Department of State, while in

October VERTIC began collaboration with the Royal United Services Institute on a project to assess the chemical weapons capability of North Korea, funded by the Government of Canada.

Compliance Mechanisms and Measures

Angela Woodward and Roel Walravens

North Korean maritime sanctions

The Compliance Mechanisms and Measures (CMM) Programme’s work on implementing UN Security Council sanctions on North Korea continued into the third and fourth quarters of 2024. The team is conducting training activities with states and other relevant maritime stakeholders involved in implementing the sanctions. Operating as part of a consortium together with the James Martin Center for Nonproliferation Studies the CMM team continued to develop training courses on sanctions implementation pertaining to due diligence in sanctions implementation, ship registry operations, and sanctions enforcement. CMM’s project mandate focuses primarily on research of UN Security Council maritime sanctions-related issues, particularly on matters related to their legal implementation, but also includes identifying new trends in sanctions evasion tactics, examining case studies of enforcement and compiling best practices of effective national implementation.

Outreach and external relations

In November 2024, Researcher Roel Walravens participated in the ‘Emerging Biotechnologies: Risks, Governance, and Regional Collaboration Symposium’ in Putrajaya, Malaysia. This workshop was organised by Health Security Partners in collaboration with the Science and Technology Research Institute of Defense, the Indonesian Biorisk Association and the BioRisk Association of the Philippines.



building trust through verification

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Mission statement

VERTIC is an independent, not-for-profit, nongovernmental organisation. Our mission is to support the development, implementation and effectiveness of international agreements and related regional and national initiatives, with particular attention to issues of monitoring, review, legislation and verification. We conduct research, analysis and provide expert advice and information to governments and other stakeholders. We also provide support for capacity building, training, legislative assistance and cooperation.

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