REVISITING BWC VERIFICATION

# Changes in Science and Technology since VEREX

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## VEREX

In 1991, the Third BWC Review Conference established an Ad Hoc Group of Governmental Experts "to identify and examine potential verification measures from a scientific and technical standpoint".[1] The measures were to determine:

> "whether a State Party was developing, producing, stockpiling, acquiring or retaining microbial or other biological agents or toxins, of types and in quantities that have no justification for prophylactic, protective or peaceful purposes; and
>
> whether a State Party was developing, producing, stockpiling, acquiring or retaining weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict."[2]

Over the course of 1992 and 1993, the Verification Experts Group, which became known as 'VEREX', held four sessions in which it examined and evaluated 21 potential verification measures. The measures were assessed on the basis of, amongst other things, "the amount and quality of information they provided" and "technological, material, manpower and equipment requirements".[3] In its report, VEREX recognised that "reliance could not be placed on any single measure"; however, it was argued that:

> "Some measure in combination could provide enhanced capabilities by increasing, for example, the focus and improving the quality of information, thereby improving the possibility of differentiating between prohibited and permitted activities and of resolving ambiguities about compliance."[4]

The report was considered at a Special Conference held in 1994, which agreed to establish the Ad Hoc Group (AHG). As such, the scientific and technical assessment undertaken by VEREX provided the foundation for political negotiations over the course of the mid-to-late 1990. As Tibor Tóth remarked, "the preliminary work of the AHG built upon the VEREX negotiations".[5]

*"A contemporary analysis of potential verification measures would generate different results to those reached in the early 1990s"*

## A contemporary analysis of potential verification measures

The central conclusions of the VEREX process, that "some measures in combination" can assist in "resolving ambiguities about compliance", likely remain valid. However, a contemporary analysis of potential verification measures would generate different results to those reached in the early 1990s. Indeed, the VEREX report explicitly acknowledged that "certain current scientific and technical shortcomings of some measures were appreciated" and that "some technologies associated with particular measures are limited by the commercial availability of equipment, materials and stages of development."[6]

This brief provides illustrative examples of salient developments that have occurred over the 25 years since VEREX,[7] in some of the 21 off-site and on-site verification methods the group examined. These have been grouped using categories developed in the work of VEREX, with the analysis informed by the work of the OPCW's Scientific Advisory Board and the Panel of Government Experts on Verification in all its Aspects.

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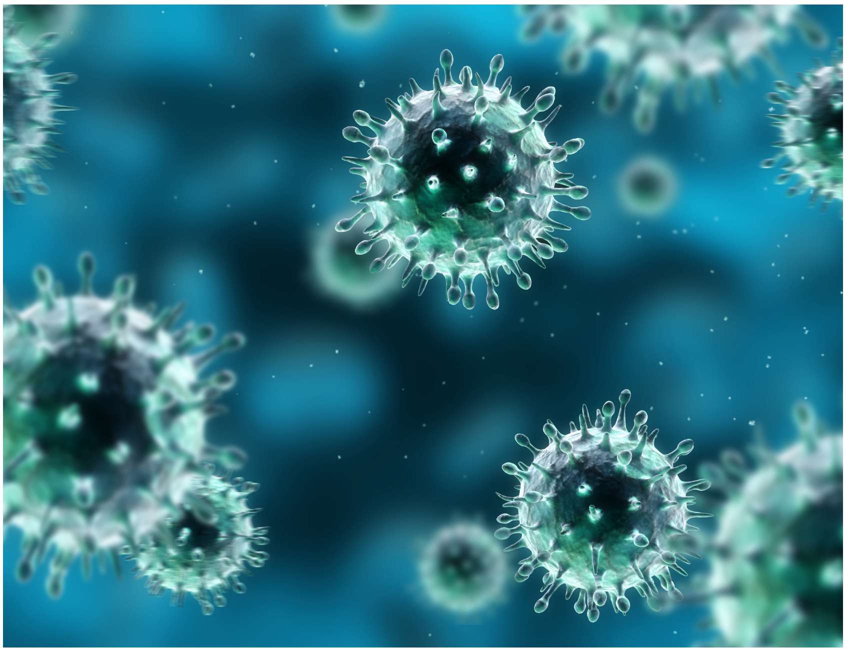
### *Information monitoring (off-site)*

The rise of the internet since VEREX has significantly enhanced the amount and quality of information available, as well as both the cost and speed of off-site information monitoring. The "surveillance of publications",[8] has become easier and quicker with online publication databases (e.g. SCOPUS) and bibliometric methods. Similarly, the "surveillance of legislation" has been advanced through online sharing of legal instruments and "innovative ways to monitor compliance…including national reporting" developed through UNSC Resolution 1540.[9] Since 1994, there have also been developments that can aid in monitoring some transfers. This includes "advances in tracking and tracing shipments and transfers of dual use items, including the use of authenticated end-use/user and delivery certificates"[10] and the emergence of electronic trade databases, such as the UN Comtrade Database.



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## *Remote sensing (off-site)*

Since 1994, the "remote monitoring of sensitive facilities" has become "common practice" in other treaty areas.[11] There have also been significant steps in remote sensing-related technologies. Certainly, the use of satellite technology has benefitted from lowering costs, greater availability (and access), increased frequency of imaging and enhanced resolution.[12] In terms of surveillance by aircraft, a series of technological innovations have converged to generate "monumental" improvements in surveillance drone technology.[13]

## *Inspections (off-site)*

Off-site sampling and identification technologies have also improved, with "networks of electronic nose (eNose) devices"[14] used in other contexts that could potentially be adapted. The analysis of information from such systems is routinely augmented with artificial intelligence methods (especially machine learning). Drone technology also has the potential to aid with off-site (and on-site) sampling and identification, which has been discussed in the context of the CWC.[15]

## *Inspections (on-site)*

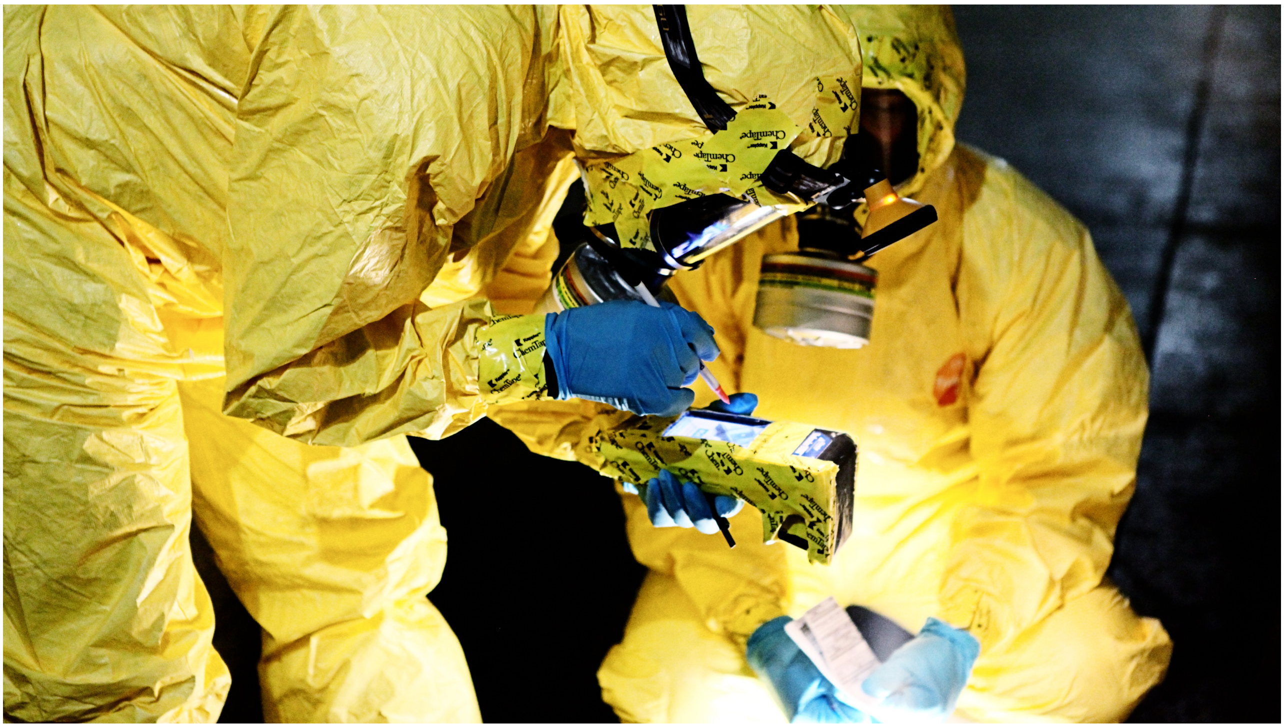
There have been developments in several methods under the category of on-site inspections. Since 1995, useful procedures and methodologies have been developed (and applied) for enhancing personnel interviews.[16] Visual inspection and the identification of key equipment (on-site) have been augmented by advances in ICT and machine learning that can potentially speed up the process of identifying equipment and instruments.[17] In terms of auditing, in 1994, the state of the art did not include common international standards of record-keeping.[18] The subsequent development and promulgation of guidance on good laboratory practice (GLP)[19] may have potentially increased the value of auditing as a verification tool in some contexts. Instrumentation for sampling and identification has become smaller, more portable,[20] faster and easier to use.[21] In addition, the utility of on-site sequencing technology, such as nanopore devices, has been demonstrated in the real-time identification of Ebola in West Africa.[22]

## Continuous monitoring

As the OPCW Verification Report of the Scientific Advisory Board's Temporary Working Group has noted, equipment for continuous remote monitoring has been explored by the IAEA. Such equipment notably includes "special seals with remote data transmission capability".[23] It is also of note that the use of hyperspectral methods exploiting satellite and aerial imagery could theoretically aid in identifying wider environmental biochemical changes over time.

## New technologies, sources and experiences

Since the mid-1990s, there have been advances in the fields of data mining, bioforensics and artificial intelligence that could be applied to augment verification activities. In addition, there are new



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sources of online information, including through social media, new tools for managing information, and greater experience in assessing materials submitted by states to international organisation looking at other unconventional weapons.

## Reflections

There have been significant changes in the underlying science and technology of relevance to verification over the last 25 years. These would benefit from a more systematic review. Such a review should consider:

- Whether the theoretical potential of some of these technologies can realistically be applied in the BWC context.
- The resources, skills and training requirements for such technologies to be operationalised.
- How to manage and validate large quantities of online data of "variable quality".[24]
- The economic, legal, logistical, political, and technical implications of using these technologies and/or methods.
- The development of guidance materials to ensure the robust application of certain methods.
- The changing nature of biological threats. Biological weapons development now may generate very different footprints to those envisaged in the early 1990s.

### Endnotes

1. BWC/CONF.III/VEREX/9, p. 1.
2. BWC/CONF.III/VEREX/9, p. 1.
3. BWC/CONF.III/VEREX/9, p. 1.
4. BWC/CONF.III/VEREX/8, p. 8.
5. Tóth, T "Time to Wrap Up", The CBW Conventions Bulletin, Issue 46, December 1999.
6. BWC/CONF.III/VEREX/8, p. 8.
7. BWC/CONF.III/VEREX/8, p. 3.
8. VEREX/9, Annex II, p.54
9. See A/61/1028. For the reports themselves, see the 1540 Committee "National Reports".
10. See for example Part I of A/61/1028, p. 15.
11. A/61/1028
12. SAB/REP/1/15 see also RC-4/DG.1 Annex 1, p. 51.
13. Ehrhard TP, 'Air Force UAVs The Secret History' (2010) www.dtic.mil/get-tr-doc/pdf?AD=ADA525674
14. RC-4/DG.1 Annex 1 p. 48.
15. OPCW SAB-26/WP.1 p. 26.
16. See for example A/61/1028. This claim is further supported from various workshop discussions.
17. RC-4/DG.1 Annex 1, p. 28.
18. BWC/CONF.III/VEREX/WP.84/Rev.1
19. WHO Handbook: good laboratory practice (GLP)
20. RC-4/DG.1 Annex 1, p. 47.
21. IAP. "The Biological and Toxin Weapons Convention - Implications of Advances in Science and Technology: Conference Report" (2015).
22. RC-4/DG.1 Annex 1, p. 24.
23. OPCW SAB/REP/1/15
24. A/61/1028

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