Scientific Advisory Board of the OPCW

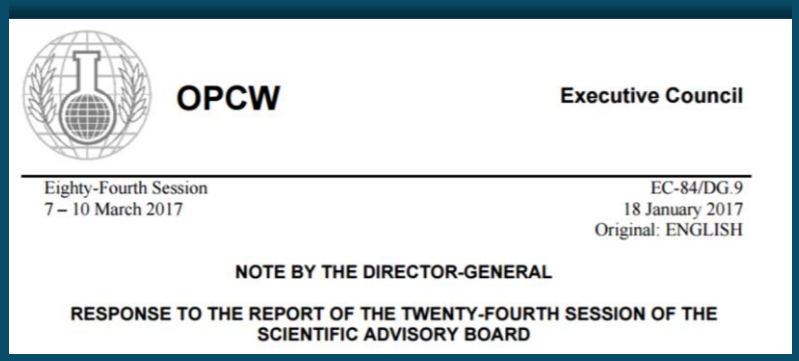
Temporary Working Group on Investigative Science and Technology

Presented by Dr Veronica Borrett

Chairperson, TWG on Investigative Science

TWG ON INVESTIGATIVE SCIENCE AND TECHNOLOGY

SAB REPORTS REVIEWED PRIOR TO FIRST TWG MEETING INCLUDE:



OPCW

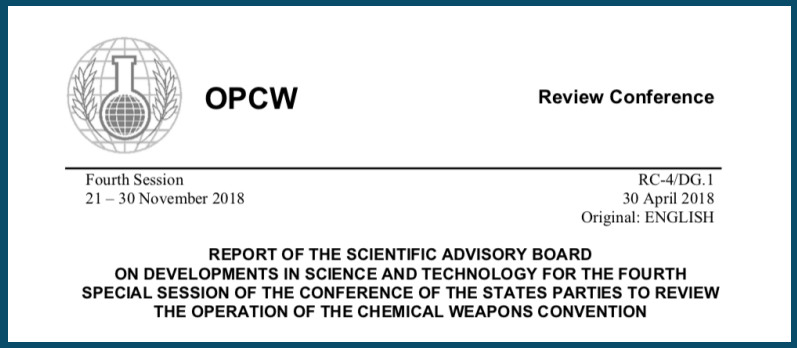
Executive Council

Eighty-Fourth Session
7 – 10 March 2017

EC-84/DG.9
18 January 2017
Original: ENGLISH

NOTE BY THE DIRECTOR-GENERAL

RESPONSE TO THE REPORT OF THE TWENTY-FOURTH SESSION OF THE SCIENTIFIC ADVISORY BOARD



OPCW

Review Conference

Fourth Session
21 – 30 November 2018

RC-4/DG.1
30 April 2018
Original: ENGLISH

REPORT OF THE SCIENTIFIC ADVISORY BOARD ON DEVELOPMENTS IN SCIENCE AND TECHNOLOGY FOR THE FOURTH SPECIAL SESSION OF THE CONFERENCE OF THE STATES PARTIES TO REVIEW THE OPERATION OF THE CHEMICAL WEAPONS CONVENTION

- OPCW/VERIFIN Workshop "Chemical Forensics: Capabilities across the Field and the Potential Applications in CWC Implementation" Helsinki 2016
- SAB Session Reports, SAB-22
- TWG on Verification Final Report
- OPCW/IUPAC/ABC/AAS “International Workshop on Innovative Technologies for Chemical Security” Brazil 2017

BACKGROUND

- The OPCW/VERIFIN convened a Workshop on "Chemical Forensics: Capabilities across the Field and the Potential Applications in CWC Implementation" in Helsinki 2016.

- In its report from the workshop, the SAB recommended (SAB-24/WP.1) that additional workshops or a temporary working group (TWG) could be considered to strengthen the understanding of technologies, procedures and capabilities that forensics can bring to investigations.

- The SAB also highlighted the importance of engagement with forensic experts, forensic practitioners and OPCW inspectors and laboratories, to explore methods and capabilities relevant to the verification of the Chemical Weapons Convention.

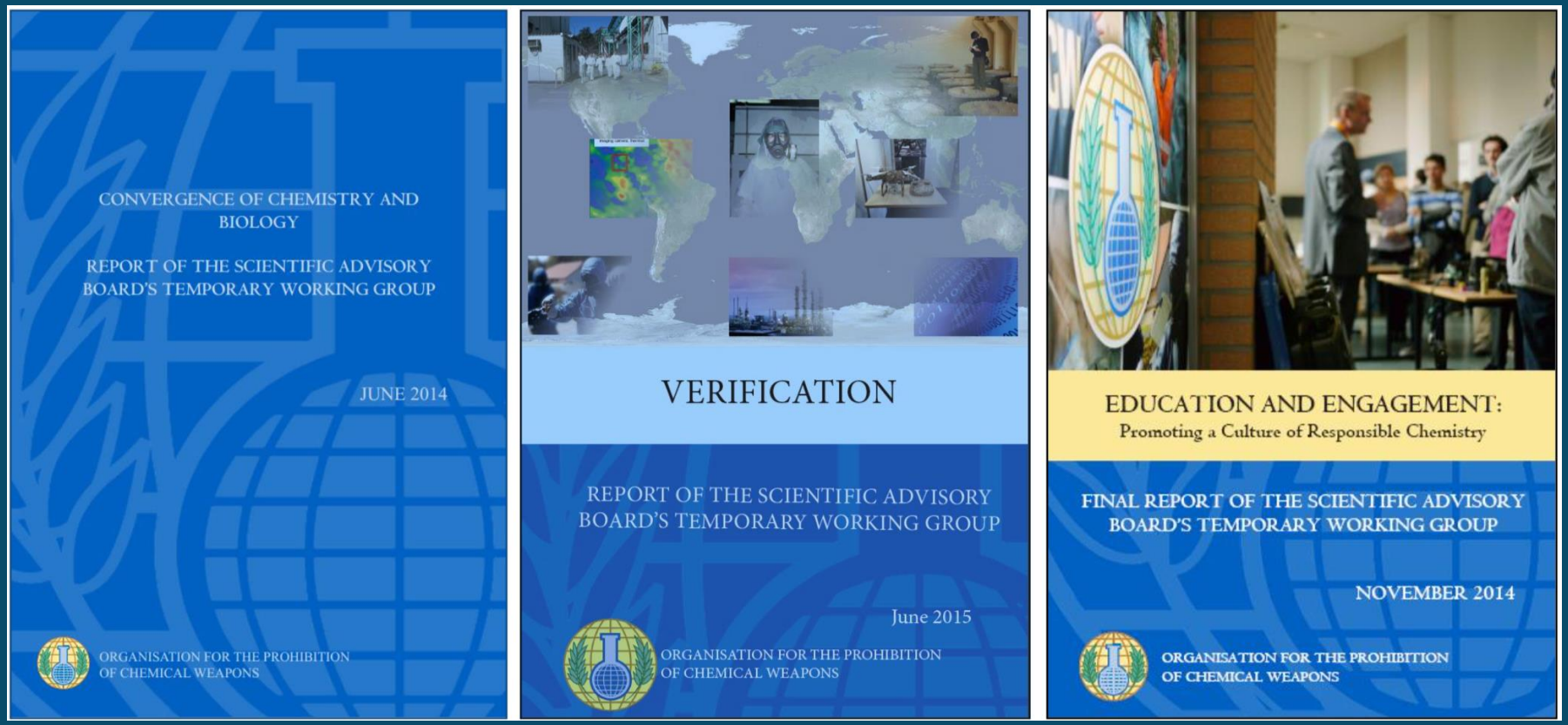
REPORTING

TWG established by the SAB at the direction of the OPCW Director General

TWG report and recommendations reviewed and approved by SAB (Scientific Advisory Board)

SAB provides TWG report to the Director General for consideration

REPORTING



Recent TWG Reports

TWG ON INVESTIGATIVE SCIENCE AND TECHNOLOGY

TERMS OF REFERENCE

OBJECTIVES: To review science and technology relevant to investigative work, especially for the validation and provenancing (determining the chronology of ownership, custody and/or location) of evidence, and the integration of multiple and diverse inputs to reconstruct a past event.

TWG will consider key questions and in addition, "… will provide advice on Technical Secretariat proposals for methodologies, procedures, technologies, and equipment for investigative purposes".

Gaps and new technologies

TWG ON INVESTIGATIVE SCIENCE AND TECHNOLOGY

MEMBERS

- Veronica Borrett (Australia); TWG Chair *
- Ed van Zalen (Netherlands Forensic Institute (NFI); TWG Vice Chair
- Cheng Tang (China); SAB Chair *
- Christophe Curty (Switzerland); SAB Vice-chair *
- Robert Mikulak (USA) *
- Syed Raza (India) *
- Farhat Waqar (Pakistan) *
- Daan Noort (TNO, The Netherlands)*
- Crister Åstot (FOI, Sweden)
- Brigette Dorner (RKI, Germany)
- Carlos Fraga (Pacific Northwest National Laboratory, USA)
- Paula Vanninen (VERIFN, Finland)
- Francois van Straten (South Africa)
- Christopher Timperley (United Kingdom); Former SAB Chair
- Augustin Baulig (France)
- David Gonzalez (Uruguay)

- Valentin Rubaylo (Russian Federation)

*** SAB Members**

TWG ON INVESTIGATIVE SCIENCE AND TECHNOLOGY

MEMBERS

VALE

Valentin Rubaylo (Russian Federation)

Valentin, a colleague, a friend, and a scientist, will be dearly missed.

The Temporary Working Group on Investigative Science and Technology recognises the expertise and contributions of Mr Valentin Rubaylo who passed away in June 2019.

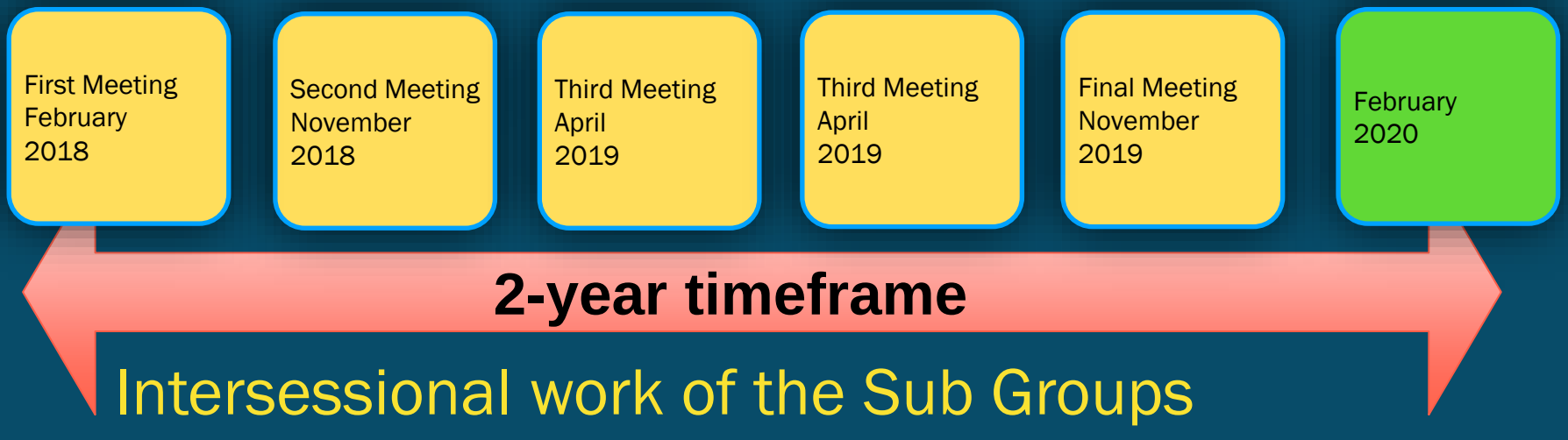
Mr Rubaylo, a member of the TWG, and also the SAB since 2014, had also served on the SAB's TWG on Verification. He was one of the first Chemical Demilitarisation Officers to be appointed to the Secretariat at the time of the entry-into-force of the Convention.

TIMELINE

- First meeting was held 12 to 14 February 2018
- Second meeting was held 14 to 16 November 2018
- Third meeting 2 to 4 April 2019
- Forth meeting 18 to 20 September 2019
- Final meeting 18 to 20 November 2019

REPORTING

- Report to the SAB Sessions 27 and 28
- Interim Recommendations endorsed by SAB at it 28th Session June 2019
- Final Report Complete and to be considered by the SAB

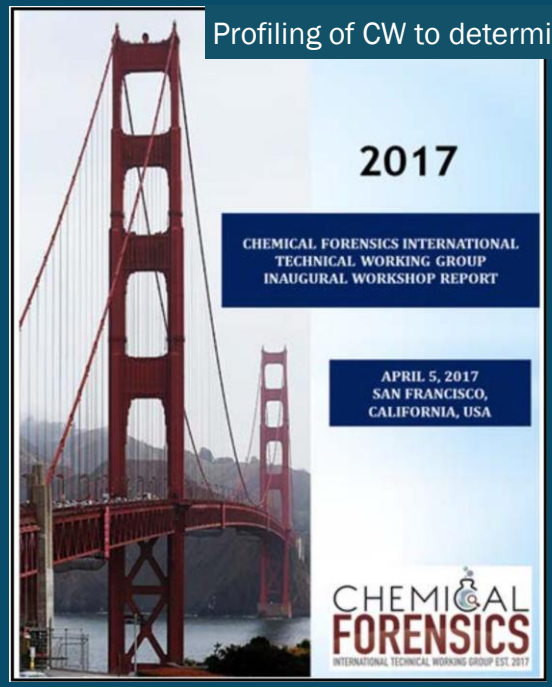


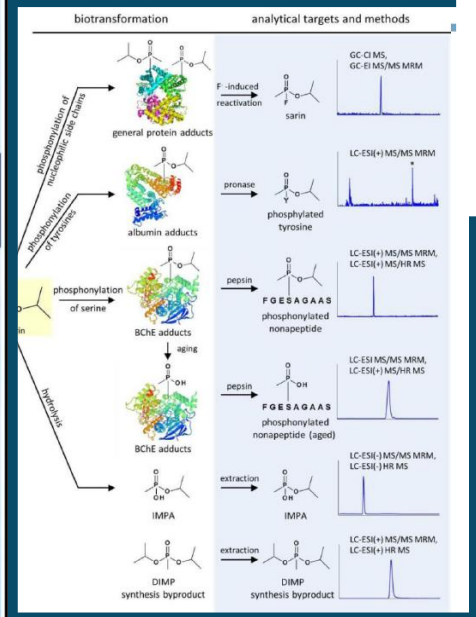
SETTING THE SCENE

Image: OPCW

Profiling of CW to determine provenance

AS 5388 Forensic Analysis			
AS 5288.1 Recognition, recording, recovery, transport and storage of material	AS 5288.2 Analysis and examination of material Analysis	AS 5288.3 Interpretation	AS 5288.4 Reporting
5. Systematic Approach to	5. Acceptance of Physical	5 Transforming Data into	5. General Provisions





RECOMMENDED OPERATING PROCEDURES FOR ANALYSIS IN THE VERIFICATION OF CHEMICAL DISARMAMENT

2017 Edition

Part I

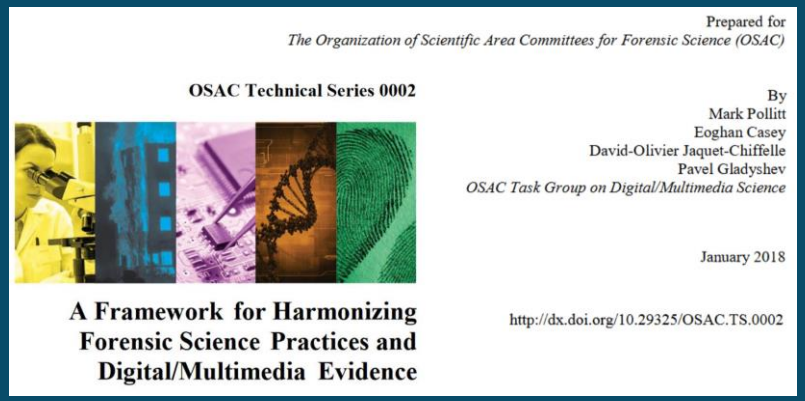
RECOMMENDED OPERATING PROCEDURES FOR ANALYSIS IN THE VERIFICATION OF CHEMICAL DISARMAMENT

2017 Edition

Part II

VERIFIN
HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

TECHNOLOGY


Prepared for
The Organization of Scientific Area Committees for Forensic Science (OSAC)

OSAC Technical Series 0002

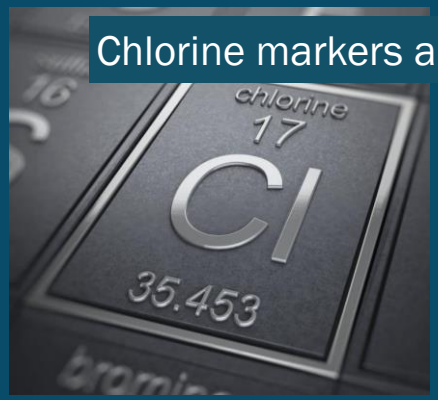
By
Mark Pollitt
Eoghan Casey
David-Olivier Jaquet-Chiffelle
Pavel Gladyshev
OSAC Task Group on Digital/Multimedia Science

January 2018

A Framework for Harmonizing Forensic Science Practices and Digital/Multimedia Evidence

http://dx.doi.org/10.29325/OSAC.TS.0002

Authentication and validation of data



Chlorine markers and biomarkers

UAV/UGV and robotics for sampling

Imagery: Value and need for expert interpretation

UNOSAT

unitar
United Nations Institute for Training and Research

TWG ON INVESTIGATIVE SCIENCE AND TECHNOLOGY

REPORTING

SAB-27/WP.1	Summary of the First Meeting of the Scientific Advisory Board's Temporary Working Group on Investigative Science and Technology	26 February 2018
SAB-28/WP.2	Summary of the Second Meeting of the Scientific Advisory Board Temporary Working Group on Investigative Science and Technology	21 January 2019

TWG ON INVESTIGATIVE SCIENCE AND TECHNOLOGY

GENERIC INTEGRATED FORENSIC TOOLBOX

Forensic processes and techniques
Importance of advice, oversight and training

Forensic biometrics and data validation

Forensic BIGdata analysis

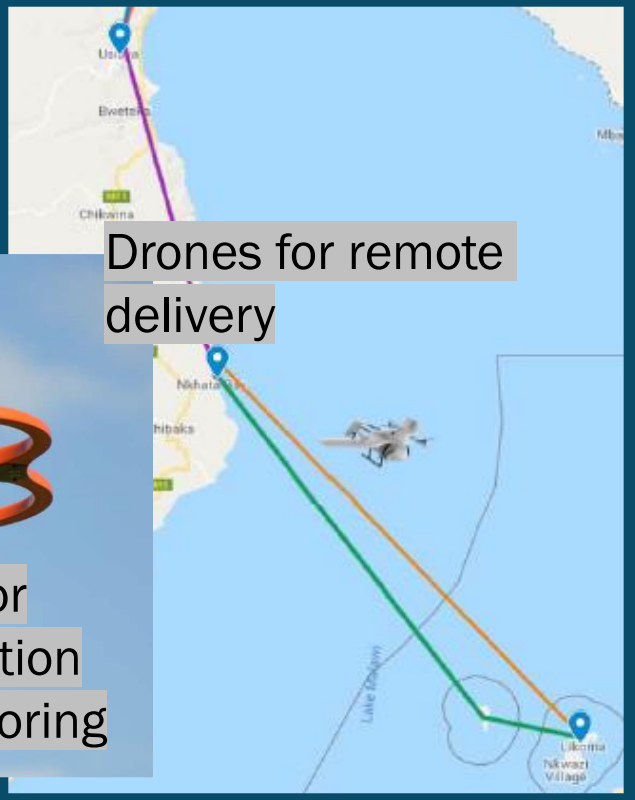
Database for evidence collection, retention and organisation

DAY 2 Hosted by NFI

Using mobile phone apps to record events

Remote verification OPCW HQ

UAV for Radiation monitoring



Drones for remote delivery

RECOMMENDATIONS ENDORSED AT SAB 28

- Pursuant to the deliberations of the SAB at its Twenty-Eighth Session, the Board recommends the following to the Director-General through its report:

- 1. A forensic advisor with broad experience in forensic science and international law should be considered to provide advice to the Director-General and the OPCW. An independent external expert could be considered.

- 2. The Secretariat should ensure that forensic issues are included in standard operating procedures (SOPs) or working instructions including those related to on-site sample collection, handling, curation and storage, and annotation, in accordance with forensic best practices.

- 3. Relevant OPCW staff should receive training on forensic processes, procedures, and techniques relevant to their role.

- 4. Scenarios developed for mission planning and training should be adapted for the purpose of evaluating sampling and detection systems to meet mission conditions.

TWG4 18 to 20 September 2019

https://www.opcw.org/sites/default/files/documents/2019/11/sab-29-wp01%28e%29.pdf

Focus on:

information management

digital approaches for tracking chain-of-custody and determination of provenance, including distributed ledger technologies and track/trace systems, and

some further laboratory and analytical approaches to analysis of CWC related chemicals

Important to the work of the TWG has been the engagement with the Secretariat in all of the TWG meetings. Presentations and input to discussions from senior management and staff, including inspectors experienced in non-routine missions and the OPCW Laboratory.

Presentations and input from external experts experienced in forensic operations and research.

This supported an iterative process where the Secretariat provided the critical operational requirements to the TWG, while having the opportunity to engage with the external experts. Perhaps a model for any future TWG.

TWG ON INVESTIGATIVE SCIENCE AND TECHNOLOGY

FINAL REPORT

- Over 60 pages, 36 Recommendations – including 4 already considered at SAB28

- These cover the general areas of:
- Access to forensic advice to support the preparation for, conduct of and review of outcomes of non-routine missions
- Access to a broader base of laboratory and technical capabilities, such as forensic labs and specialist equipment
- Enhanced capabilities for sampling, detection and analysis
- Remote and automated capabilities for assessing a site and collecting information/samples
- Approaches for ensuring chain of custody, including new technologies for digital tracking
- Approaches to information management
- Strengthening capabilities for chemical profiling/provenancing
- Harness expertise of current and former OPCW personnel who have participated in non-routine missions

ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Working Together For a World Free of Chemical Weapons

Temporary Working Group on Investigative Science and Technology

Reporting to the Scientific Advisory Board (SAB), the Temporary Working Group (TWG) will in particular consider the following questions:

Question 1:

Which methods and capabilities used in the forensic sciences could usefully be developed and/or adopted for Chemical Weapons Convention-based investigations?

Question 2:

What are the best practices and analysis tools used in the forensic sciences for effectively cross-referencing, validating, and linking together information related to investigation sites, materials collected/analysed, and individuals interviewed?

Question 3:

What are the best practices for management of data collected in investigations, including compilation, curation, and analytics?

Question 4:

What are the best practices for the collection, handling, curation and storage, and annotation of evidence?

Question 5:

Which technologies and methodologies (whether established or new) allow point-of-care and non-destructive measurements at an investigation site to help guide evidence collection?

Question 6:

Which technologies and methodologies (whether established or new) can be used in the provenancing of chemical and/or material samples collected in an investigation?

Question 7:

Which methods are available (or are being developed) for the sampling and analysis of environmental and biomedical materials and can be used in the detection of toxic industrial chemicals relevant to the Chemical Weapons Convention?

Question 8:

Which technologies and methodologies (whether established or new) can be used in ensuring chain of custody and verifying authenticity (especially in regard to digital images and video recordings)?

Question 9:

Which technologies and methodologies (whether established or new) can be used to ensure the integrity of an investigation site?

Question 10:

Do collections of physical objects, samples, and other information for chemical weapons-related analysis exist and can they be made available to investigators for retrospective review? How might these collections be used to support investigations?

Question 11:

Are there stakeholders that the Technical Secretariat could usefully engage with to leverage their capabilities on investigative matters?

In addition, the TWG will provide advice on Technical Secretariat proposals for methodologies, procedures, technologies, and equipment for investigative purposes.

Subgroup A. Forensic Methods and Capabilities

- 1. Which methods and capabilities used in the forensic sciences could usefully be developed and/or adopted for Chemical Weapons Convention-based investigations?

- 11. Are there stakeholders that the Technical Secretariat could usefully engage with to leverage their capabilities on investigative matters?

Sub-group A, forensic methods, and capabilities

The sub-group identified the need for an impartial forensic advisor as a critical function for any investigation team. This advisor would act as an intermediate between the investigating team and the forensic laboratory. The advisor must have a broad background in forensic analysis and familiarity with chemical weapons issues, knowledge of applicable (inter)national laws, and knowledge of networks of forensic laboratories as well as the DLs. Operationally, the forensic advisor provides advice for the selection of exhibits to be examined in relation to the incident occurred and investigative questions, guides the phrasing of forensic questions and explains the outcome of the forensic analysis. Any individual in this role must also possess strong communication skills.

The sub-group also discussed the selection of laboratories for forensic analysis beyond what the DLs can provide. Considerations should include ISO 17025 accreditation, whether the labs participate in relevant proficiency testing (which should be broader than just laboratory tests, including exhibit sampling and interpretation/conclusion), capability to handle (possible) contaminated evidence, capabilities matched to investigative needs, and ensuring confidentiality requirements.

There is a need for identifying laboratories with geographic diversity, and establishing memorandums of understanding or other suitable relationships. The roles of government ministries, delegations and National Authorities in the working relationships with any potential partner laboratory must also be considered.

Subgroup B. Data Collection and Management

- 2. What are the best practices and analysis tools used in the forensic sciences for effectively cross-referencing, validating, and linking together information related to investigation sites, materials collected/analysed and individuals interviewed?

- 3. What are the best practices for management of data collected in investigations, including compilation, curation, and analytics?

Sub-group B, data collection, and management

In regard to best practices and analysis tools used in the forensic sciences for effectively cross-referencing, validating, and linking together information related to investigation sites, materials collected/analysed and individuals interviewed, the sub-group reviewed literature on management of digital and physical evidence.

The sub-group noted that the Generic Integrated Forensic Toolbox for CBRN incidents (GIFT Forensics) has been completed and the tools which it had developed may be of interest to evaluate.

In regard to the best practices for management of data collected in investigations including compilation, curation, and analytics, the sub-group noted the work of other agencies on forensic science SOPs.

Subgroup C. Sampling, Detection and Analysis

- 5. Which technologies and methodologies (whether established or new) allow point-of-care and non-destructive measurements at an investigation site to help guide evidence collection?

- 7. Which methods are available (or are being developed) for the sampling and analysis of environmental and biomedical materials and can be used in the detection of toxic industrial chemicals relevant to the Chemical Weapons Convention?

Sub-group C, sampling, detection, and analysis

Sub-group C has compiled information on fieldable point-of-care tests for assessing exposure to classical agents (nerve agents and sulfur mustard), point-of-care devices and technologies for detection of ricin, commercially available technologies for on-site chemical detection/identification in the environment, and point-of-care devices and technologies for detecting toxic industrial chemicals and toxins (ricin and saxitoxin).

New developments for identifying potential biomarkers in biomedical samples.

Subgroup D. Integrity of Scene and Evidence Collection

- 4. What are the best practices for the collection, handling, curation and storage, and annotation of evidence?

- 8. Which technologies and methodologies (whether established or new) can be used in ensuring chain of custody and verifying authenticity (especially in regard to digital images and video recordings)?

- 9. Which technologies and methodologies (whether established or new) can be used to ensure the integrity of an investigation site?

Sub-group D data collection and integrity of scene, evidence and evidence collection

In regard to best practices for the collection, handling, curation and storage and annotation of evidence, the sub-group has been reviewing operating protocols and procedures to identify areas that might benefit from the exploration of new tools and methods..

In regard to exploring how others approach the reconstruction of past events and physical locations, the sub-group reviewed operating procedures used by others for the evaluation of inspected areas, the application of integrated approaches to forensic investigations of threat agents.

Site mapping and documentation, which could review UAVs, imaging analysis, 3D and 2D scanning, new sensors, and RFID tagging was assessed.

Review the procedures and equipment for sample packaging and transport.

Subgroup E. Provenance

- 6. Which technologies and methodologies (whether established or new) can be used in provenancing of chemical and/or material samples collected in an investigation?

- 10. Do collections of physical objects, samples and other information for chemical weapons-related analysis exist and can they be made available to investigators for retrospective review? How might these collections be used to support investigations?

Sub-group E, provenance

In regard to coordination with, and encouragement of laboratories to be more actively engaged with, the CFITWG, the TWG, and OPCW Secretariat have provided contacts and support to the CFITWG leadership for the recruitment of experts from DLs and other international organisations.

In regard to identifying others whose work relies heavily on provenancing, the sub-group engaged with experts from areas such as food forensics, environmental forensics, illicit drug forensics and toxin analysis. There is a need to learn best practices on the standardisation, storage, and maintenance of instrumental data (raw and/or process) for chemical forensics application.

The sub-group highlighted the value of keeping samples and raw data in a format that can be used in the future for chemical forensics applications.

Subgroup F.

Sub-group F will address additional considerations, with focus on paragraph of the TWG TOR, providing advice on Technical Secretariat proposals for methodologies, procedures, technologies and equipment for investigative purposes.

Sub-group F, additional considerations

Traditional approaches are not suitable for situations in which inspectors are not able to travel to sites to be inspected or in which witnesses are unable to meet with inspectors because of travel difficulties.

Inspector time on-site may be very limited and return visits not possible. Thus, there is a need to identify and discuss possible ways to enable inspectors to document a site rapidly and to collect as much relevant information on-site as possible.

A number of non-traditional means for collecting relevant information have been identified and assessed. Possibilities include: use of unmanned aerial vehicles to conduct tasks at the site of interest, perhaps in combination with actions by local personnel; smartphone apps to assist in collection and authentication of information; and use of open-source imagery or other information, including means to confirm its authenticity.

Technical investigative assistance to States Parties may involve OPCW personnel in a process leading to domestic criminal prosecution. This could raise a number of potential complex legal issues that may require consideration.

EC-92/DG.12 DG RESPONSE TO THE SAB28 REPORT

- The Director-General thanks the SAB for the recommendations submitted through SAB-28/1. The scientific methodologies employed by the Secretariat must be rigorous and robust, and the Director-General is pleased to see these principles underpinning the SAB-28 recommendations. The Director-General submits the following perspectives on the SAB's recommendations:
- (a) Given the high standards to which information collected in non-routine operations is held when used for decision making, the recommendation of sub-paragraph 1.3(a) of SAB-28/1, i.e., to provide the Director-General access to forensic advice through an expert advisor, is of particular relevance. The Secretariat is exploring the modalities of how such an advisory role might be operationalised.
- (b) In response to sub-paragraphs 1.3(b) and 1.3(c) of SAB/28-1, which contain recommendations looking to ensure that Secretariat staff are suitably trained and follow appropriate operating procedures for any mission with an investigative dimension, the Director-General notes that the Secretariat's training programmes and operating procedure review process have taken these approaches into account and will continue to do so.
- (c) In response to sub-paragraph 1.3(d) of SAB-28/1, the Director-General recognises that an ongoing evaluation process for new equipment benefits immediate capability needs and helps to ensure that the Secretariat keeps pace with technological changes. The Director-General has encouraged the Secretariat to identify capability needs and the situations where such capabilities are beneficial. Training scenarios that match these needs with suitable enabling technologies are ideally suited for equipment evaluation.

GENERAL CONSIDERATIONS

- Operational context - challenges and requirements
- Laboratory capabilities
- Current best-practice and SOPs
- What new capabilities and connections are required?
- Connections with forensic community and other experts
- Forward thinking and emerging technologies from broader scientific community
- Approaches to combine multiple information streams

TECHNOLOGY SOLUTIONS

- Ability to apply a Systems Approach to equipment, data and processes (implications at acquisition phase)
- The ability to access and apply new technology solutions for evaluating and documenting a scene or equipment, and detection and sampling.
  - help highlight sampling hotspots (the best place to take a sample)
    - can reduce the number of samples and increase their utility, reduce logistic burden and workload for OPCW lab and DL
    - increase effectiveness of time spent at the scene
  - support risk assessment for inspectors
  - support planning to reduce the time required at a scene - e.g. to reduce hazards that may be associated with working in personal protective equipment
  - to provide a record for retrospective evaluation - e.g. using 3D scanning
- Robust forensic methods to ensure the integrity of information and sampled materials
  - Best practice for chain of custody, scene documentation, detection and analysis
- Site assessment, documentation, sampling and analysis, and Chain of Custody may benefit from the application of technology solutions, such as:
  - UGV/UAVs,
  - imaging (particularly satellite imaging),
  - new approaches to information gathering
  - 3D and 2D scanning, and
  - inclusion of electronic tags (e.g RFIDs) for monitoring, tracking and Chain of Custody.