UNSGM Designated Laboratories Workshop Report

Spiez, Switzerland
14 – 16 September 2022

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Acknowledgements

The seventh UNSGM Designated Laboratories Workshop took place from 14 – 16 September 2022 in Spiez, Switzerland.

The following Swiss Federal Departments made the workshop possible:

- Federal Department of Foreign Affairs
    - State Secretariat, International Security Division
- Swiss Federal Department of Defence, Civil Protection and Sport
    - Armed Forces Staff, International Relations Defence
    - Federal Office for Civil Protection, Spiez Laboratory

The organisers express particular thanks to Ralf Trapp (International Disarmament Consultant) for his help in preparing this report and María Garzón-Maceda (United Nations Institute for Disarmament Research) for her work as a rapporteur.

Spiez Laboratory, the Swiss Federal Institute for NBC-Protection, is responsible for the content of the report. It does not reflect an official Swiss position.

Executive summary

This report presents the outcomes of the seventh Swiss UNSGM Designated Laboratories Workshop organised by Spiez Laboratory on a network of trusted laboratories designated under the United Nations Secretary-General's Mechanism (UNSGM)[1] to investigate allegations of the use of chemical, biological and toxin weapons. The workshop series is a Swiss contribution to strengthen the operational capacity and capability of the UNSGM, which implements this important aspect of Switzerland's Arms Control and Disarmament Strategy 2022-2025[2]. The initiative also links to the Secretary-General's Disarmament Agenda[3], which asks for adequate preparations to respond to any credible allegation of use of biological weapons.

The UNSGM depends heavily on what Member States invest into its key components. Analytical laboratories nominated by Member States particularly play a central role. Therefore, the Swiss workshop series has placed particular attention to the establishment and promotion of a functional, robust and trusted network of UNSGM designated laboratories.

To reach this goal, designated laboratories need to engage and actively contribute towards such a collaborative network. The Swiss workshop series has become an important influential platform to take the necessary steps and gradually strengthen the UNSGM by providing transparency and confidence in scientific competencies, analytical skills as well as quality assurance systems.

Since 2015, the workshops in Spiez have served the growing community of dedicated laboratories to share information, consult concepts and ideas, and most importantly to plan and synchronise the many activities of relevance for the designated laboratories. This has resulted in the development of guidance documentation and templates as well as the organisation of an increasingly diverse set of laboratory exercises in line with the inter-laboratory calibration studies outlined in the UNSGM Guidelines and Procedures[4]. In particular the laboratory exercises have proved to be a true asset for the UNSGM and a decisive benefit for participating laboratories, since it allows for benchmarking capabilities, undertaking self-assessments, promoting collaborations, facilitating access to resources, and through all this the gradual improvement of performance levels.

This seventh UNSGM Designated Laboratories Workshop covered the many recent activities of relevance for the designated laboratories: the latest laboratory exercises, followed by several other topics, such as laboratory reporting, sampling guidance and specialised equipment, sample transfer, and activities of the OPCW with its biotoxins exercises scheme and the OPCW Scientific Advisory Board's Temporary Working Group on analysis of biotoxins.

The project RefBio – 'Germany's contribution to strengthening the Reference Laboratories capacity of the UNSGM' – started in 2017 and continues until 2024. The project is led by the Robert Koch-Institute and provides annual external quality assurance exercises (EQAE) in the fields of bacteria, viruses and toxins, which allow participating laboratories to evaluate their capabilities based on their achieved performance levels. The EQAEs conducted in 2021 concerned bacteria (Brucella species), viruses (unknown haemorrhagic fever virus), and a toxin (botulinum neurotoxin).

Over time, the geographical spread of participating laboratories has gradually increased

[1] https://www.un.org/disarmament/wmd/secretary-general-mechanism

[2] https://www.eda.admin.ch/content/dam/eda/en/documents/aussenpolitik/strategien/strategie-ruestungskontrolle-und-abruestung-2022-2025-EN.pdf

[3] https://www.un.org/disarmament/sg-agenda/en

[4] Guidelines and Procedures for the timely and efficient investigation of reports for the possible use of chemical and bacteriological (biological) or toxin weapons. https://undocs.org/a/44/561

from 12 laboratories from 12 countries in 2017 to 38 laboratories from 21 countries in 2022. Despite this promising progress, more efforts are necessary to generate further interest in this laboratory exercise scheme, particularly from Africa, the Middle East and parts of Asia. A growing concern are the significantly increasing costs of sample transportation and issues encountered with import regulations related to living organisms and certain types of matrices. The performance levels of participating laboratories display a distinct improvement over time. In order to facilitate the selection of appropriate laboratories for a given investigation, most laboratories participating in the RefBio exercises have agreed to share their results with UNODA for an anonymised evaluation.

The OPCW's exercise scheme on biotoxin analysis is part of an effort to enhance the OPCW's capabilities in toxin analysis, complementing its existing network of designated laboratories. Over the course of the six biotoxin analysis exercises the levels of difficulty were gradually increased, and a next logical step could be a move towards a scheme of proficiency tests. The OPCW Scientific Advisory Board's Temporary Working Group on the analysis of biotoxins is expected to give valuable input and make recommendations in the near future. One key aspect will certainly be the continued and broadened engagement with other relevant international partners and the building of stronger links with existing regional initiatives and networks.

The State Key Laboratory of Infectious Disease Prevention and Control (SKLID) of the China Centre for Disease Control (China CDC), supported by the Chinese Ministry of Foreign Affairs and UNODA, very recently organised a laboratory exercise aimed at identifying a currently unknown pathogen, i.e., a pathogen not previously described (disease X). Tasks for participating laboratories included the identification and characterisation of both the pathogen and the animal of origin. A more detailed feedback is expected at a later date.

Building on the experience gained from previous activities, the Robert Koch-Institute, the Danish Technical University and the Swedish Defence Research Agency (FOI), with support from the Department of State of the United States, organised a new set of dry-lab exercises focusing on the detection, identification and characterisation of viral pathogens as biological weapons using DNA sequencing data. The effort is geared at providing UNODA with a capability for rapid, accurate, forensically sound analysis, and to enable determinations of the origin of an agent and possibly attribution. While most laboratories were very capable in successfully identifying "natural" virus species, certain challenges remain with modifications and hybrid variants as well as sample types and matrix effects.

In terms of interfaces with laboratories, workshop participants were briefed about the Capstone Exercise, offered by Germany and implemented by the Robert Koch-Institute, which took place back-to-back to this workshop. This full-scale field exercise was geared at testing and enhancing the operational capabilities of the UNSGM. Of relevance for the designated laboratories was the inclusion of laboratory aspects, such as the interface between the mission team and the designated laboratories, and the collection of samples to be analysed. It is expected that the outcomes will help identify needs to be addressed in the future.

In past workshops laboratory reporting has emerged as a central issue, leading to efforts to develop guidance and templates. Based on practical law enforcement experience, the necessary elements of an analytical plan and laboratory report were highlighted. In essence, a laboratory report should summarise the conclusions drawn from the analytical results. Interpretations should be strictly limited to the acquired data sets. In the context of the project RefBio, a working group on "Laboratory Reporting in UNSGM" is now actively working on the specifics of a reporting template.

In an attempt to further align work in support of the UNSGM with the efforts of the OPCW to develop its capacity in toxin analysis, workshop participants received a briefing on the latest work of the Temporary Working

Group (TWG) of the OPCW's Scientific Advisory Board on the analysis of biotoxins. Laboratory skills for the characterisation of low molecular weight toxins differ significantly from those required for high molecular weight toxins. Therefore, the TWG has looked at international (global and regional) as well as national actors and networks in the field of toxin analysis to identify possible synergies. The TWG also tentatively proposed the creation of an informal coordination mechanism and a cooperation agreement for an informal network of laboratories with expertise in toxin analysis. It is evident that the outcomes of the TWG will be of high interest to the designated laboratories of the UNSGM and that future exchanges would be of equal benefit to both communities.

Canada reported on the recent submission of a package of guidance documentation to UNODA, including sampling, which presents options for future training for experts. In addition, a list of suggested equipment was also submitted. To ensure availability in a mission, also under special circumstances, e.g. in a pandemic situation, strategic options for access include a retainer concept, donations from Member States, and Memorandums of Understanding with international entities that may have stocks of specialised equipment.

The emerging issue of transfer of samples has been addressed with a first table-top exercise earlier this year, which helped identify *inter alia* the need for mitigation strategies, expert trainings and certifications as well as the creation of a number of templates. A particular issue that will require increased awareness is tied to the matrix of samples that may be strictly regulated, depending on the itinerary of a sample. It also helped identify the need for further work exploring the challenges associated with concurrent public health and forensic investigations.

In conclusion, the growing diversity of laboratory exercise schemes has demonstrably benefitted the UNSGM in various aspects that include gradually rising performance levels and an increasing geographical distribution of participating laboratories. Continued efforts are however needed to maintain this momentum by leveraging existing capabilities and expertise of currently underrepresented regions and targeting capacity building. This will assist the formation of a sustainable network of laboratories that both improves capabilities globally and strengthens the UNSGM capacity.

The sizeable number of practical activities of relevance for designated laboratories highlights the importance of continued collaboration with international partners, including the OPCW with a particular focus on the analysis of biotoxins. More work needs to be conducted on practical issues and guidance, such as a finalised reporting template, refined sampling guidance, sample storage and transfer, the secure work area concept, and equipment accessibility to name but a few. Future work will also aim at drafting a Technical Agreement template as a basis for negotiations with roster laboratories, in the event of a mission taking place.

In more general terms, this seventh UNSGM Designated Laboratories Workshop brought together a dedicated community and motivated participating laboratories to further engage and redouble efforts, since the sum of all activities will benefit an operational and fit-for-purpose network of trusted laboratories for the UNSGM. At the same time, the support, coordination and outreach of UNODA stays central in sustaining interest and securing funding. Since continuity is key, the Swiss workshop series will continue to serve its role as an important influential platform geared at furthering the network of trusted and capable laboratories for UNSGM investigations. To that end, the eighth UNSGM Designated Laboratories Workshop will take place from 12 to 14 September 2023.

1. Introduction

The seventh workshop organised by Spiez Laboratory on a network of Designated Laboratories of the United Nations Secretary-General's Mechanism (UNSGM) was held from 15 to 16 September 2022 and convened 73 participants from 17 Member States as well as the UN Office for Disarmament Affairs (UNODA), the Organisation for the Prohibition of Chemical Weapons (OPCW), the Biological Weapons Convention Implementation Support Unit (BWC ISU), the World Health Organization (WHO), and the World Organisation for Animal Health (WOAH, prev. OIE).

This workshop series is a Swiss contribution to strengthen the operational capacity of the UNSGM. These efforts are part of Switzerland's arms control, disarmament and nonproliferation strategy[5]. Switzerland provides technical advice and analytical services, supports expert training, has made Spiez Laboratory available as a platform for sharing information and promoting activities towards a network of UNSGM designated laboratories, and currently coordinates the work of the Friends of the UNSGM.

The UNSGM Designated Laboratories workshop series is synchronised with wider efforts to strengthen the UNSGM. In the biological field, the UNSGM is the only international mechanism dedicated to investigating allegations of the use of biological weapons.

In order to do so, the UNSGM relies on capacities and expertise that Member States make available to it: 530 qualified experts to conduct investigations, 59 expert consultants to advise the UN Secretary-General, and 83 laboratories to conduct analyses of samples and perform other tasks, as contained in the UNSGM Guidelines and Procedures. The designated laboratories are nominated by 30 Member States. The UNSGM can also request support and expertise of international partners such as the OPCW, the WHO and the WOAH.

As custodian of the UNSGM, the United Nations Office for Disarmament Affairs (UNODA) works with expert consultants to refine operational concepts and technical support systems for preparing, planning and conducting investigations. It coordinates the planning and delivery of training for qualified experts and supports the conduct of exercises offered by Member States. UNODA also supports the conduct of interlaboratory calibration studies of designated laboratories, as foreseen by the UNSGM Guidelines and Procedures.

UNODA and Member States are implementing a strategic roadmap for the UNSGM, including arrangements with partner organisations. A UN Internal Task Force has so far held two coordination workshops. Recent steps implemented by UNODA include:

- Outreach to Member States, enhanced communications and visibility measures;
- Keeping the rosters of qualified experts, expert consultants and laboratories current (active nomination processes, gap analyses, onboarding sessions, roundtables and workshops);
- Completion of a training compendium;
- Callout exercises for qualified experts;
- A clearinghouse function and support for training and exercises[6];
- An eLearning platform;
- Facilitation of the participation of experts and laboratories from underrepresented low-income Member States;
- Development of a list of recommended equipment which is currently under review;
- Development of a retainer mechanism (vendor-managed inventory) for on-demand dispatch of critical equipment to ensure operational readiness and equipment interoperability;

[5] https://www.eda.admin.ch/content/dam/eda/en/documents/aussenpolitik/strategien/strategie-ruestungskontrolle-und-abruestung-2022-2025-EN.pdf

[6] For training activities in support of the UNSGM (2009 – 2022) and laboratory quality assurance exercises (2016-2022) see https://front.un-arm.org/wp-content/uploads/2022/08/SGM-Website-Sidebar-Training-Activities-and-Lab-EQAEsJul22.pdf.

- Review of a package of guidance documents related to sampling, packaging, interviewing and other procedures received from Canada;
- Evaluation of the results of external quality assurance exercises (EQAEs) by expert consultants to assess existing capabilities and gaps.

Whilst UNODA itself is not providing capacity building measures, certain measures offered by Member States include capacity building elements. For laboratories, this includes individual feedback on performance levels achieved in EQAEs, specialised training, and potentially laboratory twinning.

UNODA and Member States are continuing efforts to broaden the geographical diversity of participating laboratories. This is essential for the credibility of the UNSGM: whilst many high-quality bioanalytical laboratories worldwide have the scientific qualification to analyse human, animal and plant pathogens as well as toxins, UNSGM designated laboratories need to meet certain requirements specific to the UNSGM. These requirements have been elaborated during previous UNSGM Designated Laboratories workshops in Spiez. The discussions of forming a network of UNSGM designated laboratories began in 2015,[7] and since 2017, several countries[8] have organised exercises to gain experience and share best practices.

Key findings from past discussions include:

- UNSGM analytical investigations break down into three distinct stages: agent identification, agent characterisation (unexpected or unusual features of the agent, epidemiological anomalies) and examination of evidence to support the identification of possible sources and perpetrators of an agent released;
- UNSGM designated laboratories must command the required scientific competencies, have strong quality assurance systems in place, meet the highest biosafety standards, and meet forensic and procedural requirements including an unbroken chain of custody;
- Unambiguous agent identification will typically require the use of multiple orthogonal analytical techniques, i.e. there is a need for validated methods, recommended operating procedures and agreed acceptance criteria, access to reference standards and curated databases, and accreditation is desirable;
- The analysis aims at differentiating between natural outbreaks and manmade biological events, therefore the target agents and sample types may differ from the agents public or animal health laboratories usually investigate;
- Guidance is needed regarding sample collection, packaging and shipment for off-site analysis, and close interaction is desirable between field teams and the analytical laboratories;
- Laboratory expertise should be embedded in field teams, and options for the work to be performed in the 'secure work area' (e.g. designated laboratory performing an assistance / coordination role, mobile laboratory) have been proposed;
- Reporting of analytical results must withstand both technical and political/legal scrutiny: it must demonstrate an unbroken chain of custody as well as the quality assurance and validation processes applied, and describe findings as specifically as capabilities allow.

[7] Previous workshops that discussed the idea of a UNSGM designated laboratories network were held in Stockholm (June 2015), Umeå (October 2016), Geneva (April 2016) and Spiez (November 2015, June 2016, June 2017, September 2018, September 2019 and September 2021). Complementing these discussions were a workshop on toxin analysis (Berlin 2020), toxin analysis exercises organised by the OPCW (2016-2020), and EU projects EQuATox (2012-2014) and EuroBioTox (2017-2023). In 2021, the OPCW has established an SAB Temporary Working Group on biotoxins analysis.

[8] In 2017, Germany started its RefBio project which involves EQAE and workshops in the areas of bacteriology, virology and toxinology. Sweden and Denmark with financial support by the United States organized a first dry lab genomics analysis test in 2018/19. Germany, Sweden and Denmark with financial support by the United States organized a second dry lab genomics analysis test in 2021/22. China hosted an exercise for the identification and characterisation of an unknown disease outbreak (disease X) in 2022.

Setting up a network of UNSGM designated laboratories is a step-by-step process that needs to be driven by the participating laboratories. The workshops in Spiez have become a platform for taking this process forward. Technical guidance documents and templates for the different steps have been proposed or are being developed. Wet and dry lab exercises help laboratories test and benchmark their capabilities, undertake self-assessments and improve performance levels. Exercises also promote collaborations between participating laboratories and facilitate access to resources such as databases, reference materials, methods and specific expertise.

These efforts are intertwined with the conduct of practical exercises to test and enhance the operational capabilities of the UNSGM. The most recent example is the Capstone Exercise. It started with a table-top exercise (TTX) of predeployment activities in 2020. The full-scale field exercise was held from 19 to 28 September 2022 in Germany. It involved 19 qualified experts simulating the UNSGM mission team. The exercise was organised by the Robert Koch-Institute (RKI), and its preparation and conduct were supported by UNODA, the Swedish Defence Research Agency (FOI), Spiez Laboratory, Training in Aid, Charité, the Berlin Fire and Rescue Service Academy, the Bundeswehr Institute for Microbiology, Senova Immunoassay Systems, and other partners.

Cooperation between the mission team and designated laboratories formed part of the exercise scenario. This included activities at the interface between mission team and laboratories along the entire chain from planning to sample collection, processing, packaging, transport, analysis and laboratory reporting as input for the final mission report. The exercise tested skills acquired in previous training, including HEAT module and eLearning on PPE.

During the field exercise, the interface between laboratories and mission team were exercised, and different sampling options and situations simulated. Critical steps were evaluated, including safety, sample handling, chain of custody and quality assurance. Capability gaps and training needs will be identified and lessons will be extracted in feedback round-table discussions, a formal evaluation report, and a Lessons-learned workshop hosted by UNODA.

The following is a summary of the discussions and outcomes of the 7th UNSGM Designated Laboratories Workshop.

2. Laboratory exercises

The workshop received an update on past activities, results, and future plans in relation to several laboratory exercise schemes implemented by Member States since the 6th UNSGM Designated Laboratories workshop.

Germany's RefBio Project

Germany's RefBio project aims at strengthening the capability of biological laboratories for the UNSGM by conducting EQAEs in three areas: bacteria, viruses, and toxins. It is funded by the German Federal Foreign Office and implemented by the RKI. Phase 1 lasted from 2017 to 2021, a prolongation (phase 2) continues until the end of 2024.

Phase 1

During the first project phase, four bacterial EQAEs, four viral EQAEs, and two toxin EQAEs were conducted, together with four in-person and two virtual workshops as well as one laboratory training on bacterial characterisation. The geographical spread of participating laboratories has gradually increased from 12 laboratories from 12 countries in 2017 to 38 laboratories from 21 countries in 2022. Key challenges are to increase the participation from certain regions, particularly from Africa, the Middle East and parts of Asia, and to manage the increasing costs of sample transportation as well as import regulations of certain countries related to living organisms and certain types of matrices.

Phase 2

During Phase 2 of RefBio, the annual EQAEs, workshops, and laboratory trainings are continuing. In addition, a curated genome database of high-quality data will be set up, and a template for laboratory reporting will be further developed. Building on a current project at RKI to sequence the genomes of 1500 bacterial strains of an in-house collection, the project plans to acquire new isolates from missing regions to add genomes from strains with well-known history and the broadest possible geographical and temporal distribution. A set of reference strains will be defined, technical procedures will be optimised and a bioinformatics pipeline established. Sequences from public databases may also be integrated. Minimum standards for sequencing and other data will be defined, and a secure IT infrastructure will be set up. A decision on accessibility of the database is pending.

Further project goals during Phase 2 of RefBio include:

- the strengthening of the network of roster laboratories and long-term continuous funding,
- establishment of databases for bacteria and enhanced microbial forensics,
- the discussion of databases for relevant viruses and biotoxins,
- broadening the geographical participation,
- closer involvement of qualified experts and expert consultants to foster cooperation and linkages, and
- implementation of laboratory twinning to provide mutual long-term benefits for established and candidate laboratories.

EAQEs on bacteria

The recent EQAE involved the identification and characterisation of *Brucella* species. It was conducted between October 2021 and May 2022. Twenty-four laboratories from 16 countries participated, amongst them 20 UNSGM roster laboratories.

With increasing levels of difficulty, the laboratories were asked to identify samples testing positive or negative for *Brucella* as well as identify the *Brucella* species, and to identify the agent at bacterial strain level and perform a molecular characterisation (MVLA and MLST profile, antibiotic resistance, virulence genes).

The samples were shipped under non-stop cooling and temperature logging. The average shipping time was 94 hours. However, individual shipping times varied significantly.

Most laboratories correctly identified *Brucella*-negative and positive samples. The species identification was more challenging, but good results were achieved. Results of identification at strain level varied significantly, indicating a need to exchange practices and methods among the participating laboratories. Screening capabilities for antibiotic resistances and virulence genes were available in many of the laboratories, although the reported findings would not have allowed conclusions to be drawn about possible antibiotic resistance. Also, standard molecular assays might be hampered by difficult matrices.

The next EQAE will be conducted between October 2022 and May 2023, involving the identification and characterisation of *Burkholderia pseudomallei* and *B. mallei*. Twenty-seven laboratories from 21 countries have registered, including 18 rostered laboratories.

EQAEs on viruses

A viral EQAE was conducted to exercise the detection and identification of haemorrhagic fever viruses. Twenty-four laboratories from 17 countries took part. Laboratories were tasked to undertake identifications at species and strain levels, and to report peculiarities in the samples.

With regard to species identification, 97.9 % of the samples were identified correctly, and the proficiency of the laboratories was considered high.

Identification at strain level was more challenging, with most difficulties related to samples containing low concentrations of virus. Best results were achieved by laboratories using next generation sequencing (NGS) techniques.

With regard to reporting peculiarities, database errors and contamination of reagents underscored that the insertion of “real” peculiarities is difficult in wet-lab exercises and should probably be left to dry lab tests.

A next virus EQAE involving unknown encephalitis viruses will begin in October 2022. Laboratories are requested to detect unknown viruses, identify them at species and strain levels, and identify peculiarities in the samples.

EQAEs on biotoxins

After a successful ricin EQAE conducted in 2019/2020, a second EQAE was organised from October 2021 to May 2022 to exercise the identification and characterisation of *Botulinum* neurotoxins (BoNT). Fifteen laboratories from 13 countries took part, amongst them 11 rostered laboratories.

Laboratories were tasked to identify the samples positive / negative for BoNT A/B, and to quantify and characterise the toxins by activity and subtype. In addition, a series of questions related to possible source attribution were posed.

Almost all positive and negative samples were correctly identified, resulting in an overall success rate of 97.3 %. Five of the 15 laboratories also confirmed the absence of DNA and/or other proteins as an indicator for purification, interpreted the presence of two different toxins in the same sample as an indicator for deliberate production, and provided information on the matrix composition.

Fourteen laboratories undertook the qualitative assessment, ten reported BoNT activity data as well as quantitative data, and seven reported data sets on BoNT subtypes.

Overall, performance met expectations. The most difficult tasks related to samples with rare subtypes, or samples containing a combination of two toxins. There is a need for reference materials, in particular for quantification purposes.

A next biotoxin EQAE is scheduled for October 2022 to May 2023, dealing with the identification and characterisation of clostridial neurotoxins pathogenic to humans. Thirteen laboratories from 12 countries have registered, including 9 roster laboratories.

General observations regarding the EQAEs conducted under RefBio

The performance of the laboratories participating in the RefBio exercises shows a clear improvement over time. Participants have gained a better understanding of what is expected in a UNSGM mission. Most laboratories have agreed to share their results with UNODA for anonymised evaluation. This would facilitate the selection of appropriate laboratories should a UNSGM investigation be triggered.

Sample shipment continues to need attention, despite the use of an experienced courier service with global operations and expertise in shipping biological samples, and advance information of the recipient laboratories to facilitate customs clearance. One problem was the shipment of living organisms, another was regulations on the import of certain matrices.

The reporting sheet used allows for chain of custody checks. There was no mandatory reporting of methods used or transfer of raw data.

OPCW Biotoxin Exercise 6

The 6th OPCW exercise on biotoxin analysis is part of an effort to enhance the OPCW's capabilities in toxin analysis, complementing its existing network of designated laboratories – one type of designated laboratories for environmental samples, another for biomedical samples. Designation is based on a set of criteria including the existence of a recognised quality assurance system (e.g., ISO 17025), regular participation in OPCW proficiency tests (PT), and successful scoring in these tests in accordance with agreed performance criteria. This ensures high quality and analytical skills of the designated laboratories, their knowledge of what and how to report, and their competence to comply with detailed reporting requirements including an unbroken chain of custody. Based on Technical Arrangements between the designated laboratories and the OPCW, they can be selected for the analysis of authentic samples for verification purposes.

As of August 2022, the OPCW has designated 16 laboratories for the analysis of both environmental and biomedical samples, 9 laboratories for environmental samples only, and another 4 for biomedical samples only. For toxin analysis there are no designations yet. Exercises conducted so far aimed at building expertise and examine specific requirements for toxin identification. The focus has been on the toxins listed in Schedule 1 (saxitoxin and ricin; abrin was included to test the ability to distinguish it from ricin). The exercises did not have the character of a PT and test periods were extended to several months.

The 6th exercise began in November 2021. Twenty-six laboratories from 20 States Parties participated. The exercise scenario was designed around a request for assistance by a State Party that was responding to a poison incident and lacked advanced analytical capabilities. Participants were tasked to analyse one set of samples for saxitoxin, related chemicals and other members of the saxitoxin family; another sample set was to be analysed for ricin and related chemicals. Laboratories were encouraged to perform quantification, to "match" samples by their toxin profiles or by impurities present, and to provide comments on the sophistication of the toxin preparation.

An elaborate scoring system allocated identification points in accordance with the types of tests performed (MS based, activity tests, molecular weight determination, LFA and ELISA with quantification), the information content and density that the chosen tests can deliver, and the degree to which these tests independently corroborate each other. Various confirmation levels were calculated based on the identification points awarded, ranging from unambiguous identification to confirmed, provisional, and unconfirmed.

For saxitoxin – a low molecular weight toxin - a scoring scheme closer to common OPCW PT rules was used, based on two independent techniques, one of which must be data rich. It only distinguished between confirmed and unconfirmed identification, which posed a challenge with regard to the low saxitoxin concentration used.

Twenty-three of the participating 26 laboratories submitted a report. Fourteen of them unambiguously identified ricin, 15 assessed ricin activity, 10 reported results related to the attribution of ricin-containing samples, and 15 confirmed the identity of saxitoxin.

After six biotoxin analysis exercises with increasing levels of difficulty, the next logical step would be to organise an OPCW PT. That, however, will depend on sufficient interest and willingness among the laboratories. It would also require an update of the relevant OPCW quality management system documents and of the ISO 17043 accreditation of the OPCW Laboratory as a PT provider. The focus would at least initially remain on ricin and saxitoxin. The OPCW is eager to engage with relevant international partners. Additional input and recommendations are expected from the SAB's Temporary Working Group on Analysis of Biotoxins. The work towards designating laboratories for biotoxin analysis, and in general for enhancing collaborations between the OPCW and its designated laboratories as well as other scientific institutions of States Parties will be further enhanced with the move of the OPCW Laboratory into the new OPCW Centre for Chemistry and Technology, planned for the end of 2022.

The progress on biotoxin analysis at the OPCW prompted discussions about how best to bring together the different initiatives in the field of toxin analysis. There remain differences in reporting requirements between the OPCW and the UNSGM, and the UNSGM will potentially deal with many more toxins than the OPCW. Discussions about how to best coordinate these efforts are under way. It would also be desirable to link up with initiatives such as EuroBioTox in Europe, and similar networks in other regions such as in Asia or the Americas.

Disease X exercise organised by the State Key Laboratory of Infectious Disease Prevention and Control of China CDC

The State Key Laboratory of Infectious Disease Prevention and Control (SKLID) of the Chinese Centre for Disease Control and Prevention, supported by the Chinese Ministry of Foreign Affairs and UNODA, organised a laboratory exercise involving a pathogen not previously described (disease X). Eleven roster laboratories participated. They were tasked to identify the possible new pathogen as well as certain other pathogens, and to investigate their animal origin.

The scenario was designed around an outbreak involving patients presenting fever, headache, and cough of unknown etiology. Some early cases had been exposed to animals. The pathogens selected for the exercise were a Mammarenavirus (pathogen X), Dabie bandavirus and *Gemella spp*.. The animals considered as possible origin of disease X included *Rattus norvegicus*, *Marmota himalayana* and *Oryctolagus cuniculus*.

Clinical samples (Mammarenavirus) included nasopharyngeal swab, fecal swab and serum. Animal samples (Mammarenavirus and *Gemella spp*.) included plasma, organ and intestinal content. A vector sample (Dabie bandavirus) was prepared using *Haemaphysalis longicornis*.

Of the 11 laboratories participating in the exercise, 6 correctly identified pathogen X, and 5 also identified its animal carrier (*Rattus norvegicus*). Four of the 6 laboratories submitted high-quality assembled genomes of pathogen X. All 6 reported the correct phylogenetic tree of pathogen X.

A scoring system was applied to rank performance across all elements of the exercise: correct identification of the pathogen X, correct identification of the animal of origin, identification of the most closely related strain of Mammarenavirus, uploading the assembled genome, the percentage of coverage of the uploaded genome, the concentration of Mammarenavirus in the positive clinical samples, the uploading of the phylogenetic tree of the Mammarenavirus, and the correctness of the uploaded tree.

With regard to the other viruses included in the test, 8 laboratories correctly identified Dabie Bandavirus and the animal samples that carried it. Five of them submitted a high-quality assembled genome, and four the correct phylogenetic tree. Four of the 11 labs also correctly identified *Gemella spp*., only

one correctly identified the animal species (*Marmota himalayana*) as the carrier and submitted the correct phylogenetic tree, and none submitted a high-quality assembled genome.

A scoring scheme similar to the one used for Mammarenavirus identification and characterisation was applied for the two other pathogens. Finally, all scores were combined into (a) an overall Hard Quota score for identification, source confirmation and genome analysis of pathogen X; (b) an overall Soft Quota score for the analysis of the other pathogens and for determining the pathogen X concentration; and (c) an overall total score that combined the above scores with a participation score.

The participating laboratories have received summary feedback on their performance. Detailed feedback is expected at a later date. This was the first laboratory exercise organised by China in the context of the initiative to enhance the operational capacity of the UNSGM.

Dry lab exercises on analysis of genomic sequences

Dry lab exercises organised by Denmark (DTU), Germany (RKI) and Sweden (FOI) have been supported by the United States as part of its contribution to strengthen the UNSGM. These measures aim at building an effective operational capability for international investigations of suspected uses of biological and toxin weapons, providing UNODA with a capability for rapid, accurate, forensically sound analysis, and enable attribution determinations.

Dry lab exercises also have a capacity building effect and help participating laboratories improve quality systems, implement chain of custody and other requirements related to security and forensics, and clarify reporting demands.

A first dry-lab exercise organised by DTU and FOI in 2017-2019 involved the genomic identification and characterisation of bacteria. It raised awareness and interest in laboratories potentially suitable for roster nomination to the UNSGM. 64 laboratories worldwide participated.

A second series of dry-lab exercises was then jointly organised by DTU, RKI and FOI in 2021. It involved the identification and characterisation of viruses in sequencing data sets, including the characterisation of a “novel” agent, identification of signs of genetic engineering or synthesis, and source attribution. The project spans over a two-year period and involves two EQAEs and two virtual workshops.

42 laboratories from 17 countries took part in the first EQAE in 2021, including 9 roster laboratories. In the second exercise (2022), 63 laboratories from 38 countries participated, again with 9 roster laboratories.

The first exercise scenario was designed around an unusual and severe outbreak with pox-like symptoms among humans and wildlife, occurring in a conflict zone. Laboratories were asked to identify the viral reads (species identification, viral read numbers), characterise the genome (assembly of the viral genome, viral species identification, viral strain identification, identification of genetic engineering, viral genome length), compare genomes to find genome regions that were identical, and evaluate the genomes to find clues about genetic engineering and biological weapon use.

Most participating laboratories were successful with regard to viral reads / species identification, correctly assembled the genome and identified the species for the “natural” virus. Only half of them succeeded with regard to the hybrid virus. Genetic modifications were identified by more than two thirds of the laboratories, and half of the participants reached at least a 75 % overall score. Major challenges included low concentration, quality of the reads, DNA modifications and matrix effects.

With regard to discrimination between a natural or manmade event, 79 % of the labs concluded that the outbreak had been caused deliberately, 31 % attributed an accidental release, and 7 % thought it had been a natural outbreak.

The second EQAE was conducted from June to August 2022 and the scenario was a dispersal of a suspected agent by a person “X” in an official building resulting in several initial patients. The agent rapidly spread outside, resulting in additional patients and dead wildlife. A UNSGM investigation was requested 30 days after the original event.

An exercise webinar was conducted in June 2022, the final exercise report is due in November 2022. A concluding webinar will be held in November/December 2022.

3. Laboratory reporting

Reporting by designated laboratories to a UNSGM mission has been identified as a critical element in mission conduct. Past discussions identified a need to develop templates to help laboratories understand the context and requirements of their reporting.

The content of an Analytical Plan and a Final Report on the Analysis were presented for discussion, based on practical law enforcement experience. These were to highlight the elements that such documents ought to contain.

Both types of documents need to correctly interface with other mission documents, and with each other. This concerns issues such as the unique identification of the laboratory conducting the analyses, and unique identifiers of key processes, items and documents such as each submission received from the mission team and each individual piece of evidence. There also needs to be lists of / references to evidence received for analysis, analytical tasks agreed, dates of key steps from evidence receipt to processing and sample analysis, key quality assurance documents such as procedures used, statements regarding any deviation from UNSGM Guidelines and Procedures or any other non-conforming work, and accreditation documents. The final analysis report should summarise the conclusions drawn from the laboratory results. Interpretations should be strictly limited to the acquired data sets.

Such appendices should set out details on the maintenance of an unbroken chain of custody, any photographs taken of the evidence or samples, accreditation certificates associated with the examinations conducted, protocols used, validation data defining assay performance and support accreditation (for non-accredited methods, data required to validate the assay used), and potentially the raw data of analyses.

In the context of the German RefBio project, a working group on “Laboratory Reporting in UNSGM” has been set up to work on a reporting format. Based on the UNSGM Guidelines and Procedures and using the results of discussions at previous workshops, the working group aims at developing a universal template for the reporting of results of analytical laboratories.

A general content table has been developed and tested in RefBio EQAEs. It is currently structured as follows:

1. Identification of the commissioned analytical laboratory
   1.1. Information on departments / laboratories involved in the analysis of the samples
2. Results on agent identification and characterisation
   2.1. List of samples and summary of identification of the agent
   2.2. Isolation of bacterial / viral agent
   2.3. Characterisation of agent by typing methods
   2.4. Identification of virulence genes / epitopes
   2.5. Functional activity (infectivity / toxicity)
   2.6. Identification of peculiarities not mentioned above
3. Results on specific questions
4. Information on analytical methods
   4.1. Isolation / purification
   4.2. Amplification-based assays (e.g., PCR, qPCR, LAMP)
   4.3. Mass spectrometry (non-functional)
   4.4. Functional assays (e.g. MS-based, cytotoxicity assay, animal testing)
   4.5. Others
5. Further comments on analyses
6. Information on the chain of custody
   6.1. Information on the shipment of samples
   6.2. Sample documentation, items reception and accessioning
   6.3. Handling of and access to samples and data
   6.4. Final disposal of samples
   6.5. Comments on the chain of custody

Data used to respond to questions must be made available on request. All original analytical data must be stored in a protected area and must be provided on request.

Some issues raised at previous workshops still remain under consideration:

- Is it possible to collect all types of samples (including negative controls) in the field, since this is scenario dependent and may not be possible in all cases?
- Accreditation is important, but at the moment specific methods are often not accredited
- Next generation sequencing should be included in the toolkit
- Management and access to data is often not secure at this stage
- Curated databases for reference data are not yet available
- Is it advisable to use open-source software?
- Should laboratories state their level of confidence in the results reported?

These issues will be taken up by the working group as the reporting template is refined and tested in future EQAEs. The following points of reference have been identified for the working group:

1. Task: Development of a Reporting Template for Reference Laboratories in the framework of an UNSGM investigation
2. Attributes: Internationally court-proof and politically correct, short main document with key information, identification of supplement identification, consideration of data protection
3. Basis: Previously developed documents and discussions conducted in RefBio including documents by US experts and internationally available relevant documents (OPCW, WOAH, WHO, relevant national reporting, etc.)
4. Clarification: One general template, or individual templates for all classes of biological agents (bacteria, viruses, biotoxins), affiliation of biotoxins either with procedures and templates used by the OPCW (to be developed by OPCW) or a separate UNSGM reporting sheet (to be developed)
5. Working method: Two main consultants supervised by a representative of RefBio, additional consultants on a voluntary basis; newly developed reporting sheets will be reviewed by RefBio coordination and presented at RefBio workshops, to UNODA, at UNSGM Designated Laboratories workshop, OPCW, and other stakeholders; continuous improvement as much as possible
6. Deliverable: Reporting sheets ready to be approved by UNODA and other international stakeholders

Differences to the OPCW reporting scheme became apparent again. OPCW laboratory reports contain a large amount of detail, whilst laboratory reports relevant to a UNSGM mission should essentially summarise the findings of the analyses conducted, but not present raw data. This tends to favour a checklist approach as a reporting template. At the same time, administrative details and analytical raw data need to be available if findings and conclusions were to be challenged. It is important that the entire administrative process is well documented, and that data sets are lined up to allow cross-referencing.

It was also suggested to take a look at the experience of other international organisations that have prepared reporting templates for field missions or actually prepared such reports, such as the CTBTO or the JIM. It was understood that UNSGM reports, including reports on analytical findings, may be challenged. A balance needs to be struck between providing all information upfront to make the report as comprehensive as possible, and providing information in a more incremental manner. Many aspects related to methods validation can be captured through standard operating procedures and accreditation documents. Other issues that affect the degree of detail in a UNSGM report include confidentiality and the protection of individuals and institutions involved in the investigation. A UNSGM mission report may also receive input from other entities such as

experts in reporting, legal and political council. Primary data and evidence are UN property and will be archived in accordance with established UN rules and practices.

Guidance documents such as an information sheet for laboratories, reporting templates and recommended operating procedures that emerge from the work of this group could be handed over to UNODA, reviewed and made available, perhaps similar to how the corresponding guidelines and criteria in the field of chemical weapons verification have evolved.

4. OPCW SAB TWG on toxins

The workshop received an update on progress made by the Temporary Working Group (TWG) on Analysis of Biotoxins of the OPCW Scientific Advisory Board. The TWG began work in January 2021 and comprises of 15 experts from CWC States Parties. Financial support comes from the European Union. The group has organised its work into several subgroups:

- Subgroup 1: What are the underlying requirements for the analysis of biological toxins in order to investigate alleged use of toxic chemicals as weapons?
- Subgroup 2: What classes of biological toxins are most likely to be relevant in investigations of alleged use? Are there other relevant compounds of biological origin that should also be considered based on their potential for misuse or technological change associated with them?
- Subgroup 3: What are the technical requirements for analysis of the most relevant types of biological toxins?
- Subgroup 4: What are the analytical standards and requirements of other international and national investigative authorities and how do these compare and/or factor into OPCW considerations and operations? How can programs of analytical exercises conducted by different networks of laboratories be coordinated or harmonized to minimize duplication, promote consistent practices, and develop a comprehensive picture of laboratory capabilities?
- Subgroup 5: What institutional or legal measures need to be established to facilitate cooperation between the OPCW and other organisations working on development of capabilities for analysis of biological toxins?

The initial focus of the OPCW has been on the toxins listed in Schedule 1 of the CWC: Ricin – a high-molecular weight toxin from the castor oil plant, and saxitoxin – a low molecular weight toxin from dinoflagellates that can be obtained from natural sources or synthesised in laboratory. These two toxins illustrate the range of capability requirements necessary for toxin analysis.

Other toxins, too, may be of relevance for investigations of alleged toxin weapons use. Several criteria were considered to narrow down the number of toxins of highest relevance (production, historical use, toxicity, stability, means of storage, detection and identification methods, clinical manifestation), and nine are being considered in detail: Abrin, Aflatoxin, Botulinum Neurotoxin A (BoNT A), Epsilon Toxin, Ricin, Saxitoxin, Staphylococcus Enterotoxin B, Tetrodotoxin and T2 Mycotoxin.

A review of analytical methods for the identification of toxins shows that laboratory skills for the characterisation of low molecular weight toxins differ from those required for high molecular weight toxins.

High molecular weight toxins require enzymatic digestion for traditional chemical analytical methods to be employed. Analysis is complicated by matrix effects, for example protein content of biomedical samples. Samples may however contain useful contextual clues (e.g., DNA), even though further analysis greatly increases the complexity of the analysis. High molecular weight toxin identification will require reagents and procedures that have been rigorously characterised and standardised. Laboratories are typically skilled for one type of toxin.

Most low molecular weight toxins can be analysed using traditional spectrometric and chromatographic techniques. Polar toxins may pose difficulties if present in small quantities or in complex matrices. Standardisation is expected to be a major challenge with regard to retention times in various matrices.

The TWG has looked at international, regional as well as national actors and networks in the field of toxin analysis to identify possible synergies. An example is the participation of OPCW designated laboratories in

the RefBio project. There is a desire to coordinate the different initiatives and processes, learn from each other, and share information about existing capabilities and current limitations. More work is needed to identify capabilities at national and regional levels, and laboratories might consider addressing harmonisation of methods and standards. Accreditation may be a useful approach to this end.

The TWG has tentatively proposed the creation of an informal coordination mechanism and a cooperation agreement for an informal network of laboratories undertaking biotoxin analysis. This could lead to harmonisation of quality assurance mechanisms, information exchanges, and other collaborations. The harmonisation of reporting requirements will be a challenge given the OPCW's strict requirements, but as biotoxins are different from most compounds relevant to the CWC, there might be room for different reporting standards for biotoxins.

Further meetings of the TWG have been scheduled in 2022, and a final report will be prepared in 2023.

5. Sampling guidance and specialised equipment

Canada submitted to UNODA a package of sampling guidance documentation, with options for training experts in good sampling practice and alternatives for ensuring availability of specialised equipment. The work was coordinated by the Canadian National Microbiology Laboratory (NML and drew from learnings of the Canadian Laboratory Response Network (CLRN/RCLI) and Canada's multiagency National CBRNE Response Team.

This material benefited from lessons learned during the COVID-19 pandemic, when NML was heavily involved in measures to increase resilience in Canada's testing infrastructure. The supply chain for chemicals and consumables was the most vulnerable aspect of the response. Unlike personal protective equipment, reagents are often platform specific, which complicates procurement. Mitigation strategies included bulk procurement of reagents and supplies, manufacturing of open-source reagent formulations, production of compatible "generic consumables", and temporary agreements to obtain production rights and reagent formulations.

The sampling guidance documentation, together with other documents submitted to UNODA has been peer-reviewed by experts from Australia, Canada, France, Germany, Switzerland, the United Kingdom and the United States. It includes a comprehensive collection of guidance and a UNSGM mission equipment list which has been discussed in the group of Friends of the UNSGM. This package relates to the quality management structure set out in the UNSGM Guidelines and Procedures, covering all aspects of a mission from policy to field guides. Key areas are general quality management; mission planning and support; command, control and communications; health, safety and security; confidentiality and information management; investigation-related activities; and sampling.

This submission marks an important step from national perspectives on sampling and discussions on environmental and clinical sample collection and field screening, to an agreed set of UNSGM sampling guidance. It will need to be updated based on practical experience and as new opportunities present themselves.

Examples of the package content include guidance on the composition of a sampling team, the implementation of the UNSGM sample splitting / replication requirements under field conditions, sample data sheets to document chain of custody, an aide memoire on environmental biological sampling, and a guide on sample packaging and transportation.

Next steps in Canada's contribution will include an assessment and scoping of training options, a cross-reference with evidence management training provided under the UNSGM to ensure synergy and avoid duplications, and potentially the development of a specialised training course.

The list of suggested equipment included is neither definitive nor prescriptive. Feedback has been received from more than a dozen countries and international organisations. The document can serve as a point of reference across seven technical areas: general equipment, documents, personal protective equipment, sampling, communications, transportation, decontamination and waste management.

Some of the equipment may be available from UN resources. With regard to specialised equipment, the Friends Group and the UNSGM workshop platform are frameworks to further refine the requirements. Agreement on personal protective equipment is essential. Other equipment may be mission-dependent and deployment decisions would depend on mandate, context and conditions of a given mission.

To ensure availability in a mission, strategies for access need to be developed. Options identified so far include:

- Biotechnology / biomanufacturing retainer concept;

- Donations from Member States;
- MoUs with international entities that may have stocks, such as WHO or WOAH.

Clarity regarding supply and expectations is essential, particularly in light of potential shortages, e.g. caused by a simultaneous pandemic. To take the process forward, it was suggested to:

1. Re-assess equipment needs based on the lessons learned from the Capstone Exercise;
2. Identify training opportunities to test guidance documentation and procedures;
3. Agree on the scope of equipment/testing for a potential mission and on standards and processes for decision making on the scope of in-field testing;
4. Take further steps to ensure availability of equipment supplies and clarify the scope of pre-agreements / arrangements needed;

Clarify the technical agreements required for deploying roster laboratories / qualified experts.

6. Sample transfer

The transfer of biological samples has been identified in previous workshops as a critical step in a UNSGM mission. The United States presented the results of a table top exercise it organised, with the participation of governmental bodies of Kenya, Malaysia, Switzerland and the USA, and with UNODA, the WHO, and the UK-based Verification Research, Training and Information Centre (VERTIC).

The exercise explored technical challenges in sample transfer, as well as legal, regulatory and political obstacles, and it identified mitigation steps.

The scenario involved a request for a UNSGM investigation of a possible terrorist BW attack. Problems encountered were discussed in the pre-deployment phase as well as at each step of the sample transfer process.

A number of issues were identified:

- Lack of clarity on roles and responsibilities on key points;
- Adequate preparations at the stage of pre-deployment;
- Potential impact of public perceptions and external security factors;
- Need to ensure that plans are sufficiently resilient to withstand unexpected events;
- Mitigation strategies may exceed a Mission's capacity.

These findings and the discussions during the table top exercise resulted in the following top-line recommendations:

1. Allocate resources to implement mitigation strategies and contingency actions at the mission's beginning;
2. Establish coordination cells at national and international levels early in the planning process;
3. Ensure that lists of personnel, both UN staff and UNSGM experts, include relevant trainings and certifications;
4. Create templates for key documents such as material transfer agreements and memoranda of understanding.

An after-action report of the exercise was prepared, which includes observations and recommendations on a material transfer agreement, cross-border negotiations / planning, pre-deployment preparations for sample transfer, preparations for transfer after sample collection, air lift, and land transit.

A further table top exercise is planned for the first quarter of 2023, to explore the challenges related to concurrent public health and forensic investigations. The exercise will again use a realistic scenario based on real countries.

Given the context of a UNSGM investigation, cooperation by security agencies, border control agencies and other actors will be important. It would be useful to collate experiences from real events as well as exercises from a wide range of countries and international organisations.

One complication was transfer restrictions related to the matrix rather than the pathogen or toxin itself. This potential issue should be taken up in training. Additional complications may also arise from the application of the Convention on Biological Diversity and related protocols and regulations.

There are exemptions that a UNSGM mission could use to work around certain restrictions (e.g. property rights). Such arrangements would have to be negotiated during the pre-deployment phase. However, problems may still be encountered in a real situation.

It was underlined that whilst table top and other exercises are useful to identify challenges and possible solutions, it is critical to test procedures in the real world. Solutions might involve the employment of specialised shipping companies, or transport arrangements provided by governments. Another suggestion was to include among the qualified experts, specialists on transfer licensing and transfer of biological samples and materials.

7. Conclusions and next steps

The UNSGM Designated Laboratories Workshop series organised by Spiez Laboratory has evolved into an important influential platform to discuss and plan activities related to establishing a network of trusted and capable laboratories for UNSGM investigations. It has created momentum towards the creation of, and clarified roles, responsibilities and expectations for, such a network.

The workshop series has also addressed more general issues related to the UNSGM, and provided a space for discussing national contributions to enhance its capacity. Member States support the UNSGM with experts, expert consultants and rostered laboratories, and by organising training, field exercises, and laboratory exercises and collaborations. UNODA has adopted a strategic and systematic role as the mechanism's custodian (including a dedicated team at UNODA), with financial support from Canada and the EU.

All these steps deliver results: a broader knowledge base and more confidence regarding the selection of laboratories for UNSGM investigations, more clarity about the division of labour between UNODA and partners such as the OPCW in the biotoxin area, the Capstone Exercise which will allow to test competencies and procedures, draft guidance documents to support (and be refined through) training and exercises and to facilitate the conduct of a real mission, and more.

Yet, much more remains to do be done. Continuity is important - what comes after this year's Capstone Exercise? How can the trust in the tools and capabilities that can be deployed by the UNSGM be increased? Ultimately, UNSGM investigations may lead to attribution of responsibility for a biological weapons attack, which poses unique political and legal challenges. Attribution is not mentioned per se in the UNSGM Guidelines and Procedures, but it may be part of a particular mission. An attribution mandate would affect team composition and the types of samples and forensic analyses required, and results would be scrutinised in a highly charged environment.

This underscores the importance of a wide geographical participation in the different activities towards strengthening the UNSGM, including with regard to roster laboratories. It calls for leveraging existing capabilities and expertise of currently underrepresented regions. It also requires capacity building, for example through specialised training, access to methods and standards, and laboratory twinning. Developing the network of UNSGM designated laboratories helps to improve capabilities globally and strengthen the UNSGM capacity.

Collaboration with international partners is essential. There is now an opportunity to deepen the collaboration with the OPCW and agree on a division of labour regarding biotoxin analysis. It would also be desirable to learn from other partners, including CTBTO and WHO.

The work on practical issues and guidance needs to continue: reporting templates, refinement of sampling guidance documents, sample storage and transfer, the secure work area concept, storage of perishable equipment and the equipment retainer approach are examples. It is important to raise awareness with relevant stakeholders. There also remain capability gaps that have yet to be addressed, such as plant pathogens or electronic media forensics.

With regard to reporting, further exchanges through the existing information sharing platforms and the RefBio project are expected to result in a template that could soon be agreed and submitted to UNODA.

A Technical Agreement template for negotiations with roster laboratories selected for a particular mission would facilitate the implementation of future UNSGM missions. It

would also help roster laboratories understand the expectations and requirements they would encounter should they be selected for a mission. OPCW's TA template may be a useful starting point. Switzerland, the US and the OPCW, in consultation with UNODA, have volunteered to prepare an initial draft.

Given the progress made, the time is ripe for a real-time field sampling and sample transfer exercise. Such an exercise would be a logical follow-on to the German RefBio project, enabling to test procedures and guidance documents under realistic conditions.

Maintaining momentum in this process will require strengthening and broadening the engagement with all partners, and encouraging sustained national contributions such as funding, training offers, laboratory and field exercises and other contributions. The 7th UNSGM workshop held by Spiez Laboratory has again proven to be an effective platform for discussions, information sharing and planning of the efforts towards a UNSGM Designated Laboratories network. The next workshop will be held in Spiez from 12 to 14 September 2023.


Schweizerische Eidgenossenschaft
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UNSGM Designated Laboratories Workshop
14 – 16 September 2022, Spiez, Switzerland