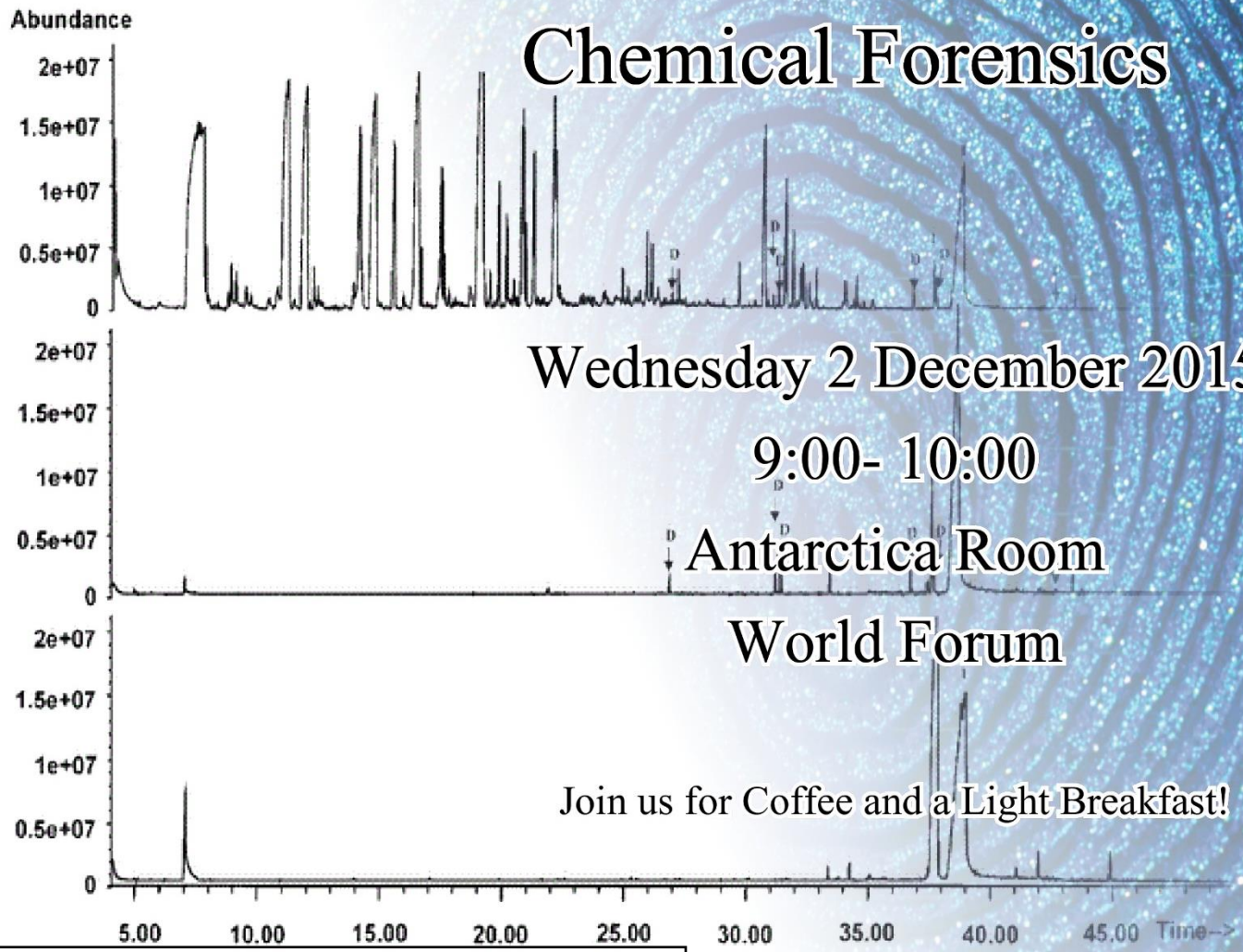
ORGANISATION FOR THE
PROHIBITION OF CHEMICAL WEAPONS

Working together for a world free of chemical weapons

Science For Diplomats at CSP-20

Chemical Forensics



Wednesday 2 December 2015

9:00- 10:00

Antarctica Room

World Forum

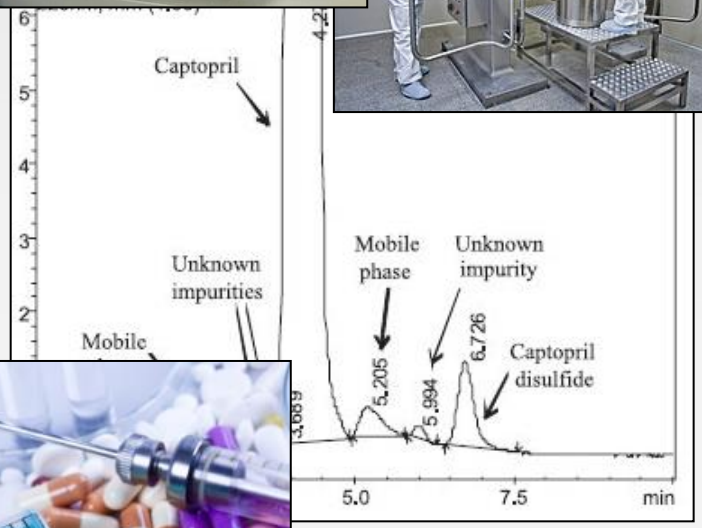
Join us for Coffee and a Light Breakfast!

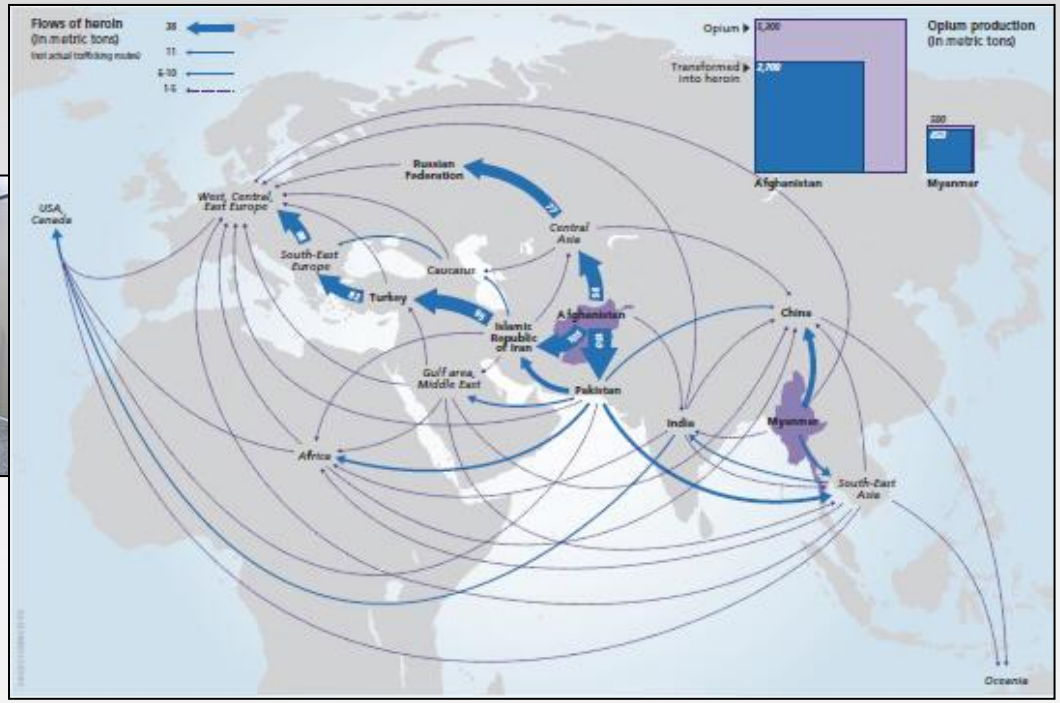
Professor Paula Vanninen
Director Verifin

Jonathan E. Forman, Ph.D.
OPCW Science Policy Adviser
jonathan.forman@opcw.org

ORGANISATION FOR THE
PROHIBITION OF CHEMICAL WEAPONS

Chemical Fingerprinting



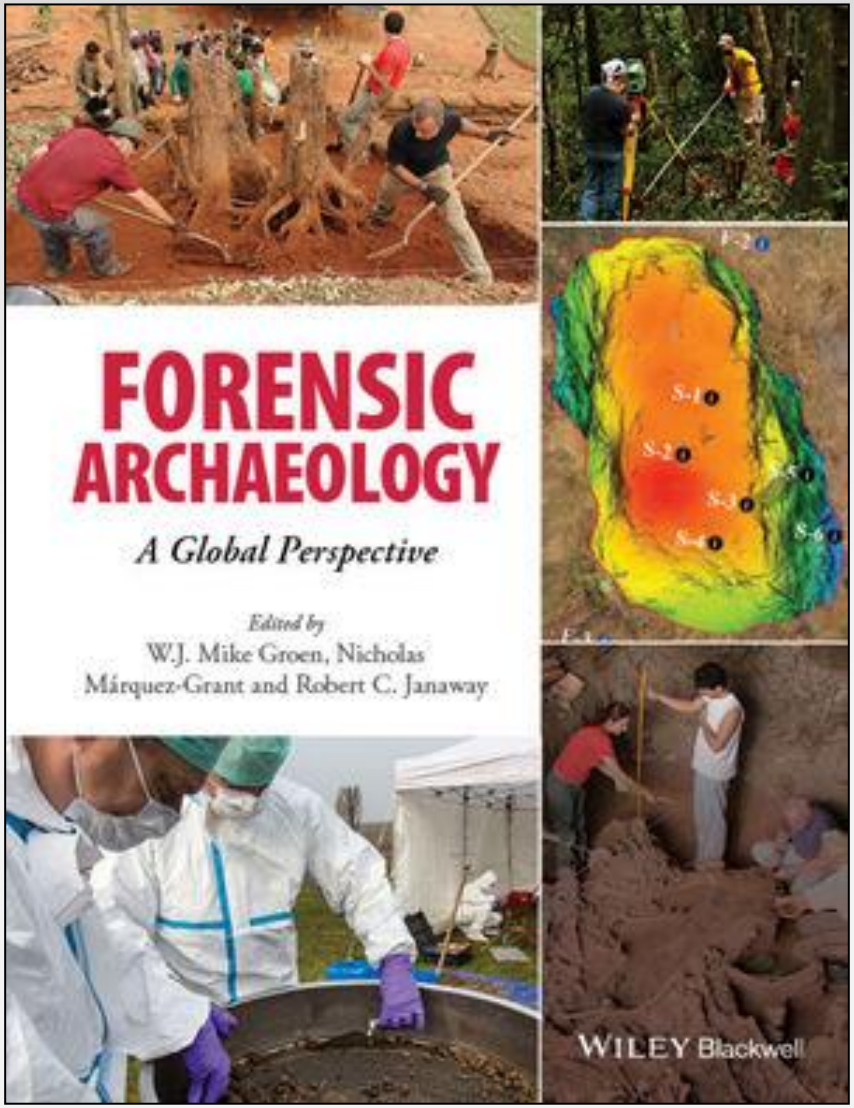


Stable isotopes: geographic origins, age

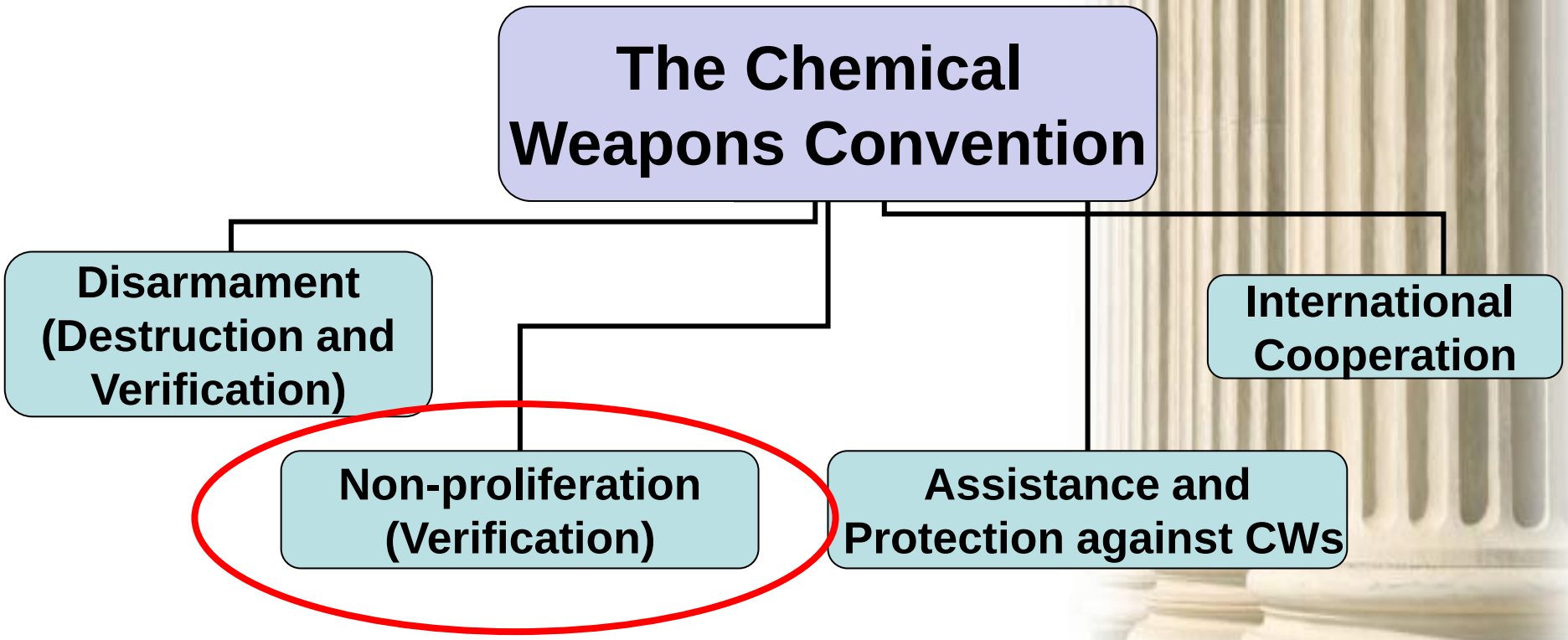
Impurities:
manufacturing processes
process/handling conditions
precursor batches

Chemical Fingerprinting

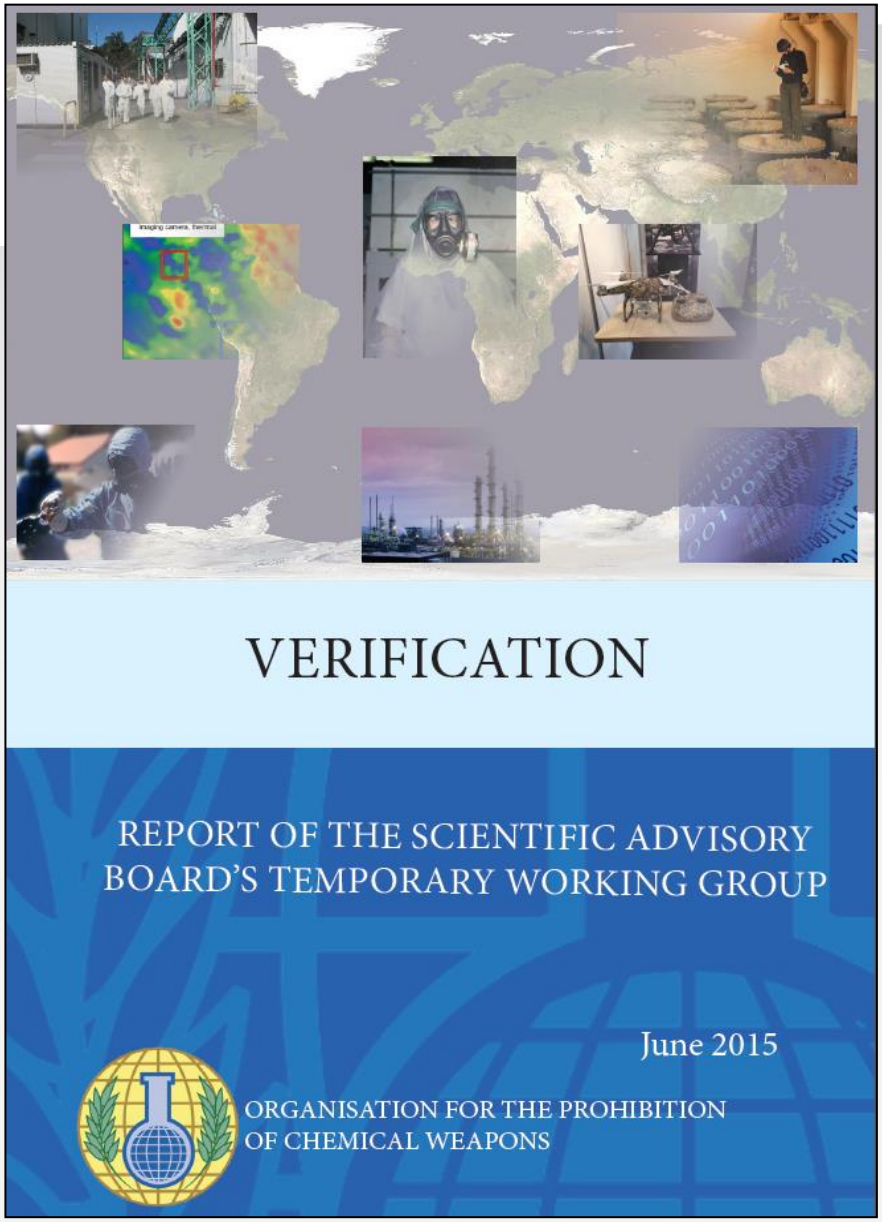
Chemical Fingerprinting



Treaty Implementation



Treaty Implementation



ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Working together for a world free of chemical weapons

Recommendations from the OPCW Scientific Advisory Board Temporary Working Group on Verification

Recommendation 1

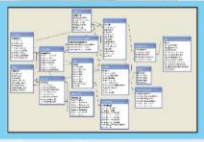
The Secretariat should consider adopting a comprehensive, more analytical approach to verification utilising all available and verifiable information.

Recommendation 2

The Secretariat should acquire the capability to use open-source information on a routine basis.

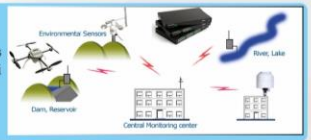
Recommendation 3

The Secretariat should put in place an information management structure that can provide the support required for the verification process.



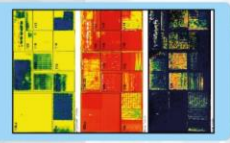
Recommendation 4

Remote/automated monitoring technologies should be added to the list of approved inspecti on equipment.



Recommendation 5

The Secretariat should look into the option of using satellite imagery for the planning of non-routine missions, in particular for IAU and CI.



Recommendation 6

The Secretariat should visit the National Authorities to obtain assurance on the accuracy and completeness of declarations. The outcome of such visits may impact on the inspection frequency.

Recommendation 7

The Secretariat must commission an independent review of all activities pertaining to the missions carried out in the Syrian Arab Republic.

Recommendation 8

The list of declarable OCPFs submitted by States Parties should include all facilities which fall under the definition/requirement of paragraph 1 of Part IX of the Verification Annex, regardless of the purity level of a DOC or DOC mixtures produced.

Recommendation 9

Not all facilities that fall under Part IX of the Verification Annex should be considered of the same relevance to the object and purpose of the Convention. The TWG recommends a practical approach for enhancing the utilisation of verification resources for OCPF declaration and on-site inspection processes.

Recommendation 10

The verification thresholds for OCPFs producing highly relevant chemicals, and the possibility of revision of the product group codes, should be addressed by the SAB as well as the industry cluster.

Recommendation 11

The OPCW should increase the staff of the OPCW Laboratory to cope with various aspects of IAU, biomedical samples, trace environmental analysis, toxins, and on-site analysis. Establishing a network of DLs for biomedical sample analysis should be a high priority.

Recommendation 12

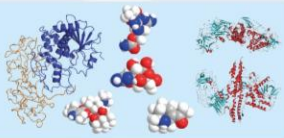
Lessons on chemical sampling and analysis from the OPCW's support to the 2013 United Nations Mission to Investigate the Use of Chemical Weapons in the Syrian Arab Republic, and all subsequent OPCW activities in relation to the Syrian Arab Republic must be identified and implemented.

Recommendation 13

PTs should incorporate a broader range of chemicals, and at a wider range of concentrations, to prepare laboratories for IAU-type scenarios.

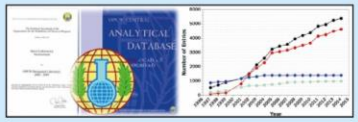
Recommendation 14

The Secretariat should expedite toxin identification exercises.



Recommendation 15

Continuous additions to the OPCW Central Analytical Database (OCAD) are recommended to allow the OPCW to meet all its mandated inspection aims, including IAU.

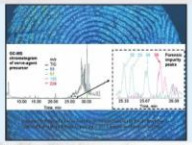


Recommendation 16

Developments in analytical instrument portability, miniaturisation and disposable biosensors should be periodically reviewed by the Secretariat and the SAB for potential applicability to on-site analysis.

Recommendation 17

The Secretariat should monitor developments in attribution analysis/chemical forensics.



Recommendation 18

The Secretariat should augment its capability to monitor and forecast developments in science and technology of relevance to the Convention and its verification regime.

https://www.opcw.org/special-sections/science-technology/science-technology-monitor/

Report available at: https://www.opcw.org/fileadmin/OPCW/SAB/en/Final_Report_of_SAB_TWG_on_Verification_-_as_presented_to_SAB.pdf

Recommendations from the OPCW Scientific Advisory Board Temporary Working Group on Verification

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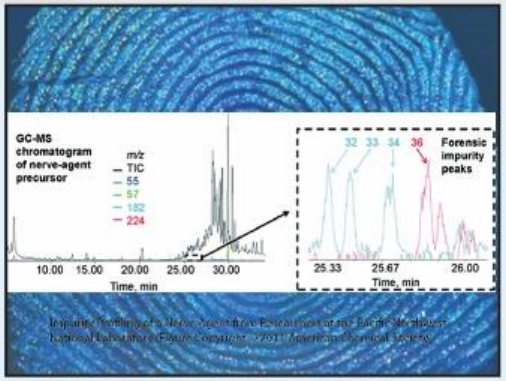

ORGANISATION FOR THE PROHIBITION OF CHEMICAL WEAPONS

Working together for a world free of chemical weapons

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VOLUME 2 NUMBER 7

The OPCW Science & Technology Monitor

A sampling of Science & Technology Relevant to the Chemical Weapons Convention

1 June 2015

In This Issue

Featured content

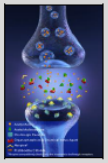
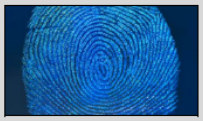


Image from DuoDote®

Medical countermeasures at work in a synapse.



Fingerprinting chemicals.

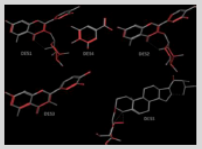


Image from PLoS One. 2013 Nov. 8(11)

Drug discovery research in OPCW Supported Research Projects

Welcome

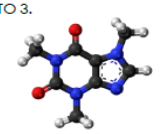
Welcome to the *OPCW Science and Technology Monitor*, an occasional bulletin to provide updates on developments in science and technology across a broad spectrum of topics relevant to the CWC. Past issues are available from the Science and Technology section of the OPCW website.

Thanks to all of you who have taken our survey. For those who have not yet responded, the survey is still open (click here). There are only six questions, all easier than the puzzle (we promise) and all responses are anonymous. Your feedback is highly appreciated!

Today marks the 25th anniversary of the signing of the 1990 Chemical Weapons Accord by the United States of America and the Soviet Union. This agreement, which pre-dated the CWC, marks one of many steps taken in the journey toward a world free of chemical weapons. Steps taken in chemical disarmament have been supported by the science of chemistry itself; a scientific field that provides opportunities for international collaborations and brings forth new developments with peaceful economic and technological benefits. As we move into the future, we look forward to a wealth of new discoveries from this evolving scientific field.

The S&T Puzzle

We once again congratulate our colleagues at the CTBTO, whose entry correctly recognized four of the top five spoken words of the Director-General in the eight statements delivered from 22 January to 29 April 2015 (in case you were wondering, they missed "States"). The prize for best visualisation of the words of the Director-General, however, goes unclaimed as no submissions (except our own, below) were received. Puzzle statistics now stand at: VER 4, OSP 2, OCS 1, INS 1 and CTBTO 3.



$C_8H_{10}N_4O_2$
Molecular Weight: 194.19 g/mol

For this edition of the puzzle, we look at the multiple uses of a cup of coffee. Can you tell us the identity and LD_{50} (that's right, the median lethal dose) of the most abundant chemical in the cup; the molarity (M) of caffeine (molecule above); and the LD_{50} of coffee itself? To keep this simple, assume this coffee is made with Arabica beans and brewed by a certified procedure (for

EC-80/DG.7 (28 August 2015)

Action to implement the recommendations made by the SAB in its report on Verification

https://www.opcw.org/fileadmin/OPCW/SAB/en/ec80dg07_e_.pdf

Recommendation from the SAB	Implementation	Expected outcomes/results
Recommendation 17: The Secretariat should monitor developments in chemical forensics.	• Secretariat: Continue to monitor developments in chemical forensics, together with Designated Laboratories. Explore collaboration with the industry and States Parties to develop methodology tailored to the needs of the OPCW. Develop the capability of the OPCW Laboratory for chemical forensics. • Scientific Advisory Board: Assess development in an expert workshop in 2016 and in the Board's report to the Fourth Review Conference.	• Effective investigations of alleged use and other non-routine situations. • Adaptation of the verification regime in line with scientific and technological developments.

- SAB Workshop planned for June 2016 at Verifin

Science for Diplomats
Chemical Forensics

Paula Vanninen

VERIFIN, Finnish Institute for Verification of the Chemical Weapons Convention
Department of Chemistry
University of Helsinki

VERIFIN
HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI

INCIDENT INVESTIGATION

WHAT – WHERE – WHO ?


INCIDENT OCCURS

FIRST REPONSE

AUM SHINRIKYO

Page 2 THE TECH

March 21, 199

WORLD & NATION

Boston's Red-Light District Flickers

THE WASHINGTON POST BOSTON

It is known officially as the Lower Washington Street Adult Entertainment District, but everyone calls it the Combat Zone.

It is the place where the commercial sex industry finds its public, and where Boston — a city once synonymous with sexual prudery — has carried out a successful containment strategy by creating one of the few formal red-light districts in North America.

Now the red light is flickering, about to be extinguished by a convergence of trends here. The story of the Combat Zone's brief heyday, long decline, and imminent fall is an instructive tale of sex, money, violence and urban development.

[illegible] acquired its name before it became zoned for sex. Initial- [illegible] tailor shops, and troops shipped [illegible] area was [illegible] ment center, the honky-tonk businesses [illegible]

During the late 1980s, the Zone's fate was sealed, according to Robert Campbell, the architecture critic for *The Boston Globe* and a student of urban development.

Rushdie Asks France for Help In Ending Iranian Death Threat

LOS ANGELES TIMES PARIS

Salman Rushdie — the author whom Iran six years ago marked for death for his book *The Satanic Verses* — met France's highest politicians on Monday, winning assurances they would lead a European effort to persuade Iran to declare a "cease-fire" on him.

"I think we are at the beginning of a very serious step," Rushdie said after meeting with Prime Minister Edouard Balladur, Foreign Minister Alain Juppe and other top French officials.

"This is a situation that can be resolved, but what is needed is the will," the British writer told a well-guarded news conference at the French National Assembly. "And this visit has been an important step in creating the will to remove the deadlock."

After meeting with Rushdie, Juppe, the French foreign minister, said pressure on Iran had failed so far in Rushdie's case. But he declared that France was prepared to bring the issue up again next month among European foreign ministers, which Juppe will chair.

"We are ready to take new initiatives in this direction," he said. He added that "new pressures" might be necessary, if Iran did not comply, though he declined to say whether those pressures might include sanctions or diplomatic isolation.

Suspect Captured in Fatal Tokyo Subway Gas Attack

By T.R. Reid
THE WASHINGTON POST TOKYO

Police reportedly had one suspect under guard Tuesday as they searched for a well-organized terrorist gang believed to be responsible for the release of poison gas on the Tokyo subway Monday, which left [illegible] injured and [illegible] fatal — and coordinating [illegible] ery around the city probably required a careful team effort, a police spokesman said.

No one claimed responsibility for the attack, which one official called "a case virtually unparalleled in the history of crime in this country." Police said they were reviewing several other recent cases in which noxious fumes were released — including an incident last June in which seven people died from inhaling what appeared to be the same substance released in the subways on Monday.

The Tokyo Shimbun newspaper reported Tuesday that passengers at the Kodenmacho station in downtown Tokyo spotted and chased a man who had left a vial of vaporous liquid on the train shortly after 8 a.m. The suspect was overcome by the fumes and could not get away. He is now under guard in a hospital, the newspaper said, but was too ill to be questioned Monday.

The poison gas attack was a shock in a city that prides itself on civility, courtesy and the lowest crime rate of any big city on Earth. [illegible] memories of the Army and other terrorist groups resorted to occasional violence in pursuit of various political aims.

There was little sign of panic in Tokyo following Monday morning's attacks. The thousands of people who came gasping and retching out of the subways — many temporarily blinded by the stinging gas — lined up and waited quietly for [illegible] or transport to [illegible] hospital treatment [illegible] International Hospital downtown, beds lined the lobby and corridors as nurses washed the eyes of victims and gave them oxygen. Most victims left the hospital under their own power after a few hours. Police said 603 persons were hospitalized overnight.

Service was restored on all but one of the city's 12 subway lines by Monday afternoon, and officials said trains were as packed as usual during the evening rush hour. "Look, I've got to get home," said a woman on the Ginza subway line Monday night. "And it's probably worse if you go up (on the street) and take the bus."

Since the first day of spring is a national holiday in Japan, Tuesday morning was calm and quiet on the subways, with all lines running and all stations open.

In contrast to the delays and confusion that marked the government's response to the disastrous Kobe earthquake in January, rescue and relief efforts Monday seemed to be timely and adequate. Subway lines were shut within minutes after the affected stations.

U.S. government sources in Washington expressed some skepticism that the substance used in the attack was actually sarin. They said they understood that Japanese police had not completed testing needed to prove what chemical was used and that the data collected so far indicate the substance instead may have been a mixture of agricultural chem- [illegible] and other hazardous pesticide- [illegible] relatively [illegible] ing to chemists and other experts.

Other than the report that a suspect was under guard, police said almost nothing about their investigation, but other media reports indicated that there were several witnesses who saw unusual actions on the subways Monday morning.

At Nakameguro station, southwest of the city center on the Hibiya subway line, witnesses told police, a man about 40 years old jumped on the train just before 8 a.m. When he got off at Ebisu, the next stop, he left behind on the floor a plastic lunch box wrapped in newspaper. Within eight minutes, or three more stops, a sharp odor coming from the package forced everybody off the train.

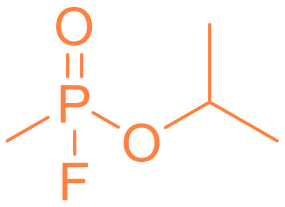
At a train on the Marunouchi line, a wad of wet newspaper on the floor began giving off noxious fumes. A similar wad of papers was found inside a plastic trash bag on a different train.

Government and private experts said these reports suggested that the perpetrators may have brought sealed bottles of sarin onto the trains, poured the clear, lethal liquid onto newspaper, then left the train.

[illegible] Security Tigh [illegible] —Rider Seen as Suspect

Synthesis route

- Starting materials
- Impurities




SYRIAN ARAB
REPUBLIC
2013


INTERVIEWS AND
BIOMEDICAL SAMPLING


ENVIRONMENTAL
SAMPLING


CHAIN OF
CUSTODY!

OPCW Fact Finding Missions

- Number of FFM?
- Collection of evidence
  - Sampling
  - Interviews
  - Photos, video
- On-site detectors, on-site analysis
- OPCW designated laboratory network
  - Chain-of custody
  - Environmental samples
  - Biomedical samples

Workshop: Chemical Forensics

Capabilities across the field and potential applications in the CWC Implementation

- Chemical weapons
  - An OPCW perspective
- Law enforcement
  - illegal drug attribution analysis
- Biomedical samples
  - post-mortem analysis
- Route of synthesis and other attribution analysis
- Chemical forensics in other fields: Art, Archeology
- Discussions
- Report

Workshop: Chemical Forensics

Capabilities across the field and potential applications in the CWC Implementation

- Questions
  - How can chemical forensics be combined with investigative chemical analysis?
  - Limitations and required reference materials?
  - Methodologies with potential for use in CW applications?
  - Normal vs. highly toxic samples?

Workshop: Chemical Forensics: Capabilities across the field and potential applications in the CWC Implementation

- SAB and experts
- Helsinki, Finland
- June 2016 (Dates TBC)
- Preparation for the SAB report for the Review Congress in 2017

Next
2016?
2017?